The 2017 Undergraduate Research and Scholarship Symposium

At this evening’s symposium, we will recognize and honor undergraduate research, scholarship, and creative works. The symposium is a celebration of the University of Denver as a place where students and faculty become partners in the co-production of knowledge. The symposium is sponsored by the Undergraduate Research Center, the Center for Community Engagement and Service Learning, and University Advancement.

In addition to poster presentations, three exemplary students will present their projects through featured oral presentations. Additionally, students had the opportunity to enter their projects into a competition. Prizes will be awarded in 1st, 2nd, and 3rd place in each of the following four categories: 1) most innovative project, 2) best oral presentation, 3) project with the most impact (such as in the community, contributions to knowledge, or application to the field), and 4) best overall.

The schedule for the evening is as follows:

3:00pm  Project competition commences  
         *Main & Mezzanine Levels*

4:00pm  Symposium opens to the public  
         *Main & Mezzanine Levels*

4:15pm  Opening remarks by Chancellor Rebecca Chopp  
         *Stairway Balcony*

4:30pm  Featured student presentation by Mikaela Guggino, Land of Enchantment  
         *Center Theater*

4:55pm  Featured student presentation by Sofya Norman, The Ubiquitin Protein Modifier Is Attached to Human Immunodeficiency Virus-1 (HIV-1) Particles  
         *Center Theater*

5:20pm  Featured student presentation by Walid Hedidar, Education and the Power of Culture in the Arab World  
         *Center Theater*

5:45pm  Awards presentation  
         *Stairway Balcony*

6:00pm  Symposium concludes
The 2017 Undergraduate Research and Scholarship Symposium

The presentations tonight come from across academic fields including projects funded and supported by the Undergraduate Research Center and the Center for Community Engagement and Service Learning. Many of the projects are capstones or theses.

Poster presentations will be held on both the main and mezzanine levels of the Cable Center. On the next two pages you will find a diagram depicting the layout of poster presentations. The location of each student’s poster can be found in the program below the student’s abstract. Abstracts are arranged alphabetically by the lead presenter’s last name.

In the index at the back of the program, you will find each poster listed by their project affiliation. The project affiliations represented here tonight include:

**Partners in Scholarship (PinS)**—This program provides a unique opportunity for students to collaborate and receive funding for a project with a faculty member.

**Summer Research**—Similar to PinS, this program provides greater funding levels for deeper research over the summer.

**Honors Thesis**—DU’s Honors program offers a broad liberal education rooted in the arts and sciences, acts as a clearinghouse for research, internship/service opportunities and provides funding for thesis work or culminating projects.

**Center for Community Engagement & Service Learning**—Students are supported through numerous community-engaged programs including Public Achievement, Puksta Scholars, DU Service & Change and more.

**Capstone/Thesis**—Student research performed within coursework or other academic requirements at DU.

**Other**—Other noteworthy research projects taking place throughout the DU community.

*The Undergraduate Research Center is devoted to enhancing the undergraduate experience by facilitating students’ investigations that make original intellectual or creative contributions within and across disciplines.*

*The Center for Community Engagement & Service Learning’s mission is to educate, engage, and equip the campus community to accomplish tangible, public work that improves the lives of people in our communities.*
Three exemplary student projects have been selected to be featured as oral presentations. Please join us in the Center Theater for these special projects at the following times:

4:30pm - Mikaela Guggino | Studio Art
4:55pm - Sofya Norman | Molecular Biology
5:20pm - Walid Hedidar | Anthropology & International Studies

Land of Enchantment
Mikaela Guggino | Major(s): Studio Art

In today’s society, many museums face the threat of closure as technology continues to discourage museum outings, but as globalization spreads, the museum experience is one of the best ways to preserve, share, and witness diverse cultures. Land of Enchantment is a hand-bound book that seeks to share culture in a new and exciting manner that brings relevance to the artist’s work and craftsmanship in this age of digitalization and social media. The book features hand-colored intaglio prints made using copper plates and a ferric acid bath.

With the support of the University of Denver’s PinS Grant, the artist researched 18th century printmaking techniques and New Mexican culture to create a book that encompasses both the visual and written arts into a mystery case that needs the viewers’ help to be solved.

Faculty Advisor: Catherine Chauvin, School of Art & Art History, Division of Arts, Humanities & Social Sciences
Keyword(s): Printmaking; Bookbinding; Culture | Location: C8
The Ubiquitin Protein Modifier Is Attached to Human Immunodeficiency Virus-1 (HIV-1) Particles

Sofya Norman  |  Major(s): Molecular Biology

HIV-1 has caused over 34 million deaths since its first appearance and continues to impact populations around the world despite the development of antiviral drugs. One viral polypeptide, Gag, is the sole driver for creating a HIV-1 virus particle. Gag shapes a HIV-1 particle by budding out of the cell membrane of an infected cell. Ubiquitin (Ub) is a host cell factor which modifies protein functions in the cell. My research explores the role of the Ub in potentiating HIV-1 Gag budding. I have successfully visualized HIV-1 particles and demonstrated the presence of Ub at virus budding sites. The results from these experiments are promising, showing colocalization with Gag buds and Ub, and exclusion of Ub from Gag bud sites when co-expressed with an enzyme that enzymatically removes Ub from proteins. These results directly demonstrate Ub conjugation to HIV-1 Gag and further exploration of the role of Ub in potentiating HIV-1 budding could lead to new avenues for antiviral therapy.

Faculty Advisor: Schuyler van Engelenburg, Biological Sciences, Division of Natural Sciences & Mathematics

Keyword(s): HIV; Ubiquitin  |  Location: E9

Education and the Power of Culture in the Arab World

Walid Hedidar  |  Major(s): Anthropology, International Studies

Tunisia’s transition into democracy and the active involvement of its people in the social and political climates are two important catalysts for change that, unfortunately, did not alter the flaws of the Tunisian education system. Almost exactly identical to the one established during colonial times, the Tunisian education system is founded upon robotic memorization and the favoring of quantity over quality. This study reveals the strong link that exists between culture, education, and change in the Arab world. By analyzing and showcasing the results from interviews, discussions, and behavior analysis activities conducted with over 50 teachers and 16 high school students in Tunisia, this ethnographic study reveals the role that culture plays in influencing how teachers, students, administrators, and parents perceive education and behave in regards to it. These results offer a new lens from which education reform should be looked at: one where culture is at core and is no longer ignored.

Faculty Advisor: David Riche, University Writing Program, Writing Faculty

Keyword(s): Education; Culture; Arab World  |  Location: C12
Project Presentations

To find a poster presentation location, please use the map on pages 4 and 5.

**Aging and Glutathione Antioxidant Status as Major Determinants of Injury and Recovery from Traumatic Brain Injury**

Alexandra Adams  I  Major(s): Biological Sciences

TBI is defined as an injury to the brain caused by physical trauma resulting from, but not limited to, incidents involving motor vehicles, sporting events, falls, blast injuries, and physical assaults. In addition to short term cognitive, physical or emotional sequelae, TBI can have lasting effects and may cause or accelerate other disorders that significantly reduce quality of life (e.g., Alzheimer's disease, Parkinson's disease, chronic traumatic encephalopathy, psychiatric and psychological disorders). Certain high-risk groups include athletes, military personnel, and older adults. In particular, older adults display a significantly diminished capacity to recover from the debilitating cognitive, physical, and emotional effects of TBI in comparison to young adults. Among multiple factors that cause the neuronal cell death and inflammatory processes which ultimately produce the debilitating cognitive and physical effects of TBI, oxidative stress is thought to play a key role. The focus of this proposal is to determine if reduced levels of glutathione (GSH), a critical endogenous antioxidant, is a major contributing factor to the poorer recovery of older adults from TBI.

Faculty Advisor: Daniel Linseman, Biological Sciences, Division of Natural Sciences & Mathematics

Keyword(s): TBI; Glutathione; Neuroinflammation  I  Location: A1

**Measuring the Spin Diffusion Length of Platinum**

Shane Allen  I  Major(s): Physics

Binary, the language of computers, consists only of ones and zeros. Physically speaking, these digits are rather a choice of one of two states, such as on or off, full or empty, up or down, etc. Most modern electronics rely on Flash memory to store their data. However, we are rapidly approaching the maximum density for this type of storage, and large electronics manufacturers are investigating other designs. Another technology known as MRAM stores data in cells which are either magnetically polarized up or down (instead of today's Flash cells which are either empty or full of electrons). This technology has the potential to surpass all other forms of data storage available on the market. My project used the operating principles which MRAM relies on to accurately measure the spin diffusion length of Platinum. This technique's additional precision revealed that Platinum will likely be useful in MRAM's further development.

Faculty Advisor: Xin Fan, Physics & Astronomy, Division of Natural Sciences & Mathematics

Keyword(s): Spintronics; Condensed Matter Physics; Magnetics  I  Location: A2

**Islamophobia Through an Education Context**

Aaqil Anwar  I  Major(s): Finance

This project aims to analyze Islamophobia and how it can be tackled through an educational context. The core idea behind the research associated with this project is attempting to understand how education can be combined with awareness about the religion of Islam in order to tackle the social stigmas associated with the religion. Approximately 1 billion people in the world are Muslim, which roughly equates to 1 in 7 human beings. Through the use of curriculums designed to teach people about what it means to be a Muslim along with community events such as open houses, this project aims to tackle the sense of Islamophobia that has become so ripe in the United States following 9/11 and the Iraq and Afghanistan wars. Through the use of community building to break down barriers, Islamophobia can effectively be tackled and awareness of Islam can be spread.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs

Keyword(s): Islam; Islamophobia; Prejudice  I  Location: A3
Mending Relationships between the African-American and Law Enforcement
James Artis | Major(s): Hospitality Management, International Business

My abstract is a combination of all the research I’ve collected over the past year on how blacks are being mistreated in America by law enforcement. This includes entities such as the police, Department of Correction and the judicial system. Being an African-American myself, I understand the hardship and struggle the blacks goes though on a day to day basis. With this project, I intend to shed light on some of the misconceptions that law enforcement have about blacks, show my community the importance of having conversations with different governing bodies and that they have the power to implement change and rewrite the black narrative. Through a black male initiative program called brotherhood I’ve been able to talk to high school students about the American Justice System and explain to them why in a lot of ways it is unjust and how it can affect them. While educating them about that I also plan on having them talk to different individuals in law enforcement just so the people on that side get a sense of who these kids are and they’re not all criminals just students like another trying to navigate their way through life.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Other
Keyword(s): Copacetic; One; Bridge | Location: A4

Positive Emotion and Anxiety in Fear Conditioning
Kathryn Bach | Major(s): Psychology

Anxiety, even at the subclinical level, is associated with a reduced quality of life and impaired daily functioning. Fear and anxiety are thought to be grounded in a defense motivational circuit, which has been extensively studied using the classical fear conditioning paradigm. Research provides evidence that positive emotion is a successful tool for regulating stress. However, minimal research has investigated whether the advantageous effects of positive emotion are equally beneficial for individuals with higher levels of anxiety in comparison to individuals with lower levels of anxiety in the context of fear conditioning (during extinction and retention). Seventy-three participants underwent fear conditioning using an electric stimulation as the US and four colored shapes as C’s. To manipulate positive emotion during extinction and retention, shapes were superimposed on either positive (beaches, mountains) or neutral (rooftops, alleys) background photos. Galvanic skin response (GSR) was collected to index fear responses during acquisition, extinction and retention. Analyses indicate an association between anxiety levels and overall skin conductance values during extinction.

Faculty Advisor: Kateri McRae, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Fear Conditioning; Anxiety; Positive Emotion | Location: A5

Effectiveness of Foot Orthoses in Controlling the Posture of the Medial Longitudinal Arch Angle: A Pilot Study
Elizabeth Bachman | Major(s): Mechanical Engineering
Amira Otmame

The midfoot plays a crucial role in supporting the body, and people who have pronated (flat) feet are at a high risk for the development of orthopedic disorders. Orthotics are often recommended for people with pronated feet. The longitudinal arch angle (LAA) is used to measure midfoot posture and orthotic effectiveness. Prior studies have required the shoe to be altered to use experimental motion capture techniques. The objective of this study was to determine the effectiveness of an orthotic in changing the posture of the midfoot during gait. Three subjects (six total pronated feet) performed standard gait trials barefoot, shod, and shod with an orthotic. The LAA was calculated throughout the stance period using x-ray video taken with a high-speed stereo radiography system. The orthotic increased the LAA during the ends of mid stance and loading response. This supports the hypothesis that footwear with orthoses can effectively control the position of the midfoot during walking, supporting orthotics as a treatment option for people with pronated feet.

Faculty Advisor: Bradley Davidson, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Biomechanics; Foot Posture; Orthotic | Location: A6
Project Presentations

Why Should Restaurants Source Food Locally?
Malia Bacig  |  Major(s): Hospitality Management

Restaurants are increasingly featuring locally-sourced food in their marketing materials and menu design. However, since procuring local foods is more expensive and challenging for restaurants, does it provide a positive return on investment? This study examines whether a restaurant’s locally-sourced food usage can create a halo effect, positively influencing its consumers’ perceptions of the restaurant’s attributes. Using an experimental design, research participants evaluated a restaurant as more environmentally-friendly, healthier/more nutritious, more conveniently located, and more likely to use natural/organic ingredients simply because it sourced some food locally. Additionally, a moderating effect was found for restaurant patrons’ food-related lifestyles. Individuals concerned about: (1) the healthiness of the food they eat; (2) the joy they get from eating and socializing over food with other people; and (3) the value of the brands and products they purchase, were more strongly influenced by the halo effect. These results indicate that restaurants may benefit unintentionally from the positive glow created from the halo effect of sourcing food locally.

Faculty Advisor: Cheri Young, Hospitality Management, Daniels College of Business
Keyword(s): Locally-sourced Food; Green Restaurants; Consumer Behavior  |  Location: A7

Regression-Based Approach to Hip Moment Prediction During the Stance Period of Gait
Nicole Batroney  |  Major(s): Mechanical Engineering
Brecca Gaffney, Craig Simons

Joint moments are used in biomechanics to approximate joint demand and provide valuable insight to movement patterns, helpful for diagnosis and rehabilitation of many pathologies. Joint moment calculations require inverse dynamics, which rely on expensive equipment, time, and an instrumented gait lab. As a result, peak joint moments, which are highly sensitive to atypical movement, are not used in a clinical setting. The objective of this project was to predict hip moment from a subset of inverse dynamics components with a linear regression model. We based the model on strong correlations in the stance period between the moment due to the vertical knee reaction force and the hip moment. A cross-validation method was applied with data from 9 of 11 subjects to predict hip moment for the 2 remaining subjects. Prediction accuracy was assessed and found to agree with standard uncertainty in inverse dynamics. This model may be used to quantify moments using simplified, inexpensive equipment.

Faculty Advisor: Bradley Davidson, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Biomechanics; Moment Prediction; Regression  |  Location: A8

The Role of Enemy-Mediated Competition in Determining the Fitness of a Generalist Herbivore
Ryan Beshai  |  Major(s): Ecology and Biodiversity
Elizabeth Barnes

The influence of indirect competition on insect communities is poorly understood, especially for dietary generalists. We studied how the fitness of a generalist herbivore, fall webworm (Hyphantria cunea), is affected by the presence of another generalist, western tent caterpillar (Malacosoma californicum). Both species create structures on their host trees, and it has been observed that predators reside in abandoned tent caterpillar tents. We therefore hypothesized that fall webworm larvae placed nearby tent caterpillar tents would suffer from increased predation. We compared larval survival and fitness for webworm larvae reared on trees with and without abandoned tents. We found that in the presence of an abandoned tent, webworm larvae disappeared more rapidly at one field site, but we did not find any difference in overall survival at the end of our experiment. Our results suggest that tent caterpillars may indirectly affect webworm survival, but more research is necessary.

Faculty Advisor: Shannon Murphy, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Competition; Herbivore; Indirect  |  Location: A9
Project Presentations

Into the Light
Ciera Blehm | Major(s): Business Analytics, Socio-Legal Studies
Olivia Storz
Into the Light was a community initiative that looked at the issue of sexual assault and evaluated the current practices that are used. Into the Light removed the stereotypes and statistics because it is evident that the only way to change campus culture around sexual assault is to make it approachable for everyone. The events aim is to allow individuals to recognize that we all play a role in solving the issue of sexual assault.
Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Sexual Assault Prevention; Community Event; College Campus | Location: A10

Internet Regulation Norms in China and Southeast Asia: A Comparative Case Study
Kayla Blomquist | Major(s): International Studies, Public Policy
My motivation for this project comes from the summer that I spent interning for the U.S. Department of State in Southwest China. There, I became suddenly aware of how the internet is shaping our lives. In a region where individual user rights on the Internet are increasingly limited, I wanted to find clues as to why this is a trend. China is the most extreme case of internet control; is it serving as an example for similar regimes? I approached the problem by examining mechanisms of policy norm diffusion and tested for whether each played a role in shaping my test cases’ Internet policies. I found that while China’s Internet regulation practices did not directly cause similar policies in Southeast Asian states, the example it set has begun to set a new norm, through the policy diffusion mechanism of “learning.” China’s example of “Internet sovereignty” could potentially become a new, alternative Internet governance norm for non-democratic states.
Faculty Advisor: Keith Gehring, International Studies, Josef Korbel School of International Studies
Keyword(s): Internet; Policy; Asia | Location: A11

The Marketing of Concussions in Football and the Subsequent Effects on Consumer & Player Sentiment
Sam Bloomfield | Major(s): Marketing
Although there is a great deal of concussion research conducted from a medical perspective, there has been very little publicized research focusing on this issue from a marketing perspective. Due to this gap in the literature, this research aims to investigate the relationship between the NFL, its players, and its consumers, specifically how the NFL has used marketing initiatives to impact consumer and player sentiment. In order to better understand this problem, this research focuses on ideal marketing tactics and the strength of the masculine American culture in the NFL, as well as primary consumer sentiment. The results illustrated that consumer sentiment towards the NFL is rarely affected by marketing surrounding concussions, as it was found that the NFL has created a loyal fan base that views the league positively regardless of the success of its initiatives, so long as it makes an effort to fix the problem and fill the “information vacuum.” This research is very relevant for the NFL’s marketing team, and these findings will allow the NFL to understand how its marketing impacts consumer and player sentiment, and how it should shape its future concussion marketing campaigns.
Faculty Advisor: Don Bacon, Marketing, Daniels College of Business
Keyword(s): Concussions in Football; Marketing; Consumer Sentiment | Location: A12
Project Presentations

Humanizing the Hound: British Soldiers and Their Canine Companions in World War One
Katie Bokenkamp | Major(s): Italian, History
For this thesis, I was drawn to the period of the First World War in order to delve deeper into the general history of humans and canines. I wanted to answer the question of what role dogs played in the lives of British soldiers in WWI, and I approached this by analyzing the first-hand writings of soldiers, such as diaries, personal papers, and trench journals (publications written by soldiers). To complete a large portion of this research, I traveled to the Imperial War Museum in London over Winter Break. I found that British soldiers in WWI looked to the dogs around them (war, camp, and mascot dogs) in order to regain the humanity they lost through witnessing and participating in such horrific violence. These findings add a layer of complexity to the British soldier and add to the burgeoning field of historical animal studies by situating dogs in human history.
Faculty Advisor: Carol Helstosky, History, Division of Arts, Humanities & Social Sciences
Keyword(s): Dogs; Soldiers; War | Location: B2

A Just Fashion: Dante as Arbiter Between Beauty and the Law (Una Moda Giusta: Dante come l’arbitro tra la legge e la bellezza)
Katie Bokenkamp | Major(s): Italian, History
The motivation for this thesis was to situate the poetry of Dante Alighieri (b. 1265- d. 1321) within the context of history. The question I strove to answer was how the medieval sumptuary laws regulating women’s clothing in Florence influenced Dante in La Vita Nuova (1295) and La Commedia (1314, 1315, 1321). To answer this question, I examined the aforementioned works, papal decrees, and sumptuary laws regulating women’s clothing during the life span of Dante. I found that the sumptuary laws influenced Dante’s perception of beauty, leading him to present the most pious and beautiful women as adhering to the legislation of the period, and those who are sinful as violating them. These findings provide another layer of complexity to both the Poet and his renowned poetry. This thesis displays that Dante was a man of his time and illustrates how then-current events influenced him as a writer and individual. (This thesis is written entirely in Italian.)
Faculty Advisor: Rachel Walsh, Languages & Literatures, Division of Arts, Humanities & Social Sciences
Keyword(s): Dante; Clothing; Women | Location: B1

Education and Awareness on Sexual Assault and Domestic Violence
Andrea Bonilla | Major(s): Psychology, Criminology
Sexual assaults and domestic violence might not be an issue that you directly can relate to, but if we take a step back and take the time to educate ourselves on this, we would realize that gender violence is something that effects so many people around us. The likelihood of your friend, your neighbor, your classmate, or a family member being affected by gender violence is very high. But if it didn’t happen to you, how would you know what this is? This is why I chose to do work on educating others about sexual assaults and domestic violence, specifically geared towards high school students. This should be an open discussion in high school classes so that our students are well educated on this matter. This is an important tool to have because as we spread awareness, we are educating others on the resources that are out there and giving them a better guidance to what to do if this ever happened to their friends, family members, or even themselves. we also get rid of what is so famously known as Rape Culture, which normalizes rape and pushes away survivors from getting the help they need.
Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Sexual Assault; Domestic Violence; Education | Location: A13
Perceptions Across Gender: Male and Female Infidelity and Experiences in Mixed-Gender Relationships

Alisa Braun | Major(s): Psychology
Troy Fangmeier

Although studies once demonstrated that men were more unfaithful in committed relationships than women, more recent findings indicate both genders cheat at similar rates (Finchman & May, 2017). Less is known about how perceptions of the likelihood of infidelity may influence relationship functioning. We aimed to examine more nuanced links between infidelity experiences and gendered perceptions. Participants (N=1294) in this study were drawn from a longitudinal study of romantic relationship development (Rhoades, Stanley, & Markman, 2010) who were in a mixed-gender relationship. The sample was 63% female and 37% male. Results showed that 18% of this sample had sexual relations with someone other than their current partner, yet 36% of participants believed their partners had cheated. Significantly more women than men said that their partners have or probably have been unfaithful \( \chi^2(3, N=128)=16.335, p=.001 \).

Additional analyses will be presented exploring between infidelity perceptions. These findings suggest that both experiences and perceptions may be important for understanding infidelity. Results will be discussed with respect to gender dynamics in relationship faithfulness.

Faculty Advisor: Galena Rhoades, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Gender; Relationships; Perception | Location: B3

Finite-Dimensional Quantum Metric Spaces

Samantha Brooker | Major(s): Mathematics, Computer Science

The study of quantum metric spaces, motivated by questions in quantum physics, is a relatively young area of mathematical research. In a recent paper, K. Aguilar and F. Latréomolière re showed that certain algebraic structures called AF algebras can be endowed with a quantum metric, allowing them to prove that these algebras can be approximated by finite-dimensional quantum metric spaces, in terms of a distance called the quantum Gromov-Hausdorff propinquity. Our work focused on one class of examples of these finite-dimensional quantum metric spaces, and we were able to show that one can, from the same underlying algebra, form several different quantum metric spaces that are demonstrably distinct in terms of the quantum propinquity. When dealing with so many layers of abstraction, it is often difficult to characterize a non-trivial example without having several years of training in a very narrow field. We were able to explore an example that requires little more to understand than a background in elementary linear algebra, and we hope that our work will serve as a first step to in establishing lower bounds on the propinquity between these finite-dimensional quantum metric spaces.

Faculty Advisor: Frederic Latréomolière, Mathematics, Division of Natural Sciences & Mathematics
Keyword(s): Mathematics; Quantum | Location: B4

Teaching LGBT Culture and History

Larcy Brooks | Major(s): English, Spanish

Resources and support systems for LGBT youth discovering their identities often have minimal efficacy because they focus on acceptance, rather than embracing with excitement, these newfound identities. I believe that the latter can be achieved through learning about the resilience, the creativity, the sacrifice, and the hard work that defines our community through time, so I have spent the last two years developing and beginning the work of implementing a curriculum to be used by middle through college level Gay Straight Alliances that teaches about the history, culture, and creative production of the LGBT community. This kind of perspective on education is not easily accepted and can be difficult to integrate directly with academic institutions, where the need for these resources is most dire. Through this, my work has an additional and unexpected result, which is experience in the work of implementing controversial educational programs into public school settings. I hope that sharing my curriculum and its message, as well as my findings in beginning to reach out to community partners, can be useful for those wanting to do similar community based work for any marginalized group.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): LGBT; History: Activism | Location: B5
Project Presentations

Assessment of Glenoid Anatomy and Bone Quality Using a Statistical A Shape and Intensity Model
William Burton | Major(s): Mechanical Engineering

Loosening of the glenoid prosthetic component in total shoulder arthroplasty (TSA) remains one of the most prevalent causes for revision surgery. Knowledge of the shape variability and underlying bone quality distributions of the scapula is crucial to ensuring effective fixation of the glenoid component and optimizing implant design and sizing. Accordingly, the objective of this study was to develop an SSIM in order to explore the morphological and material property variability of the scapula throughout a population. This was achieved by developing material mapped finite element (FE) models of a population of 50 scapulae based on CT data. The population was registered in order to achieve nodal correspondence and a linear algebra technique called principal component analysis (PCA) was applied to the population in order describe the most significant modes of variation in both morphology and material properties throughout the population. PC modes were visualized by perturbing the mean scapula by plus and minus 2 standard deviations of the modes. Mode 1 of the SSIM accounted for 41% of variability in the population and described uniform scaling of the geometry and Young’s modulus.

Faculty Advisor: Peter Laz, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Glenoid; Biomechanics; Principal Component Analysis | Location: B6

Collective Governance of Common Pool Resources
Chandler Carlson | Major(s): Finance
Daniel Myers, Benjamin McClellan

The provocation of this research stems from a question concerning the effects of governance regarding access to common pool resources, namely water. The manner in which public goods and rights are governed globally is a pertinent question regarding the planet’s increasing strain on environmental and social systems due to the threat that increasing poverty, resource depletion, population growth and political instability have posed to water access via rural communities. Mzuzu, Malawi as an economically challenged and resource-ridden city, became the subject for this research given perceived resource supply and a world-ranking of 173 of 188 most underdeveloped countries (World Bank). This study examines prevailing systems of governance regarding water access for rural communities by way of semi-structured interviews amongst government officials, community officials, non-profit developers and rural inhabitants. This research reveals that communal governance of water sources exists via water point committees and is adaptive and unique to specific groups, yet structurally continuous and commonplace for all communities. The greater implications of these findings require further research.

Faculty Advisor: Robert Uttaro, International Studies, Daniels College of Business, Joseph Korbel School of International Studies
Keyword(s): Governance; Water Resources; Sustainability | Location: B7

Public Achievement’s Impact in George Washington High School
Grace Carson | Major(s): Journalism Studies, Political Science
Katherine Zapata, Ismaat Klaibou, Bristi Basu

Public Achievement is a program through the Center for Community Engagement and Service Learning (CCESL) that seeks to empower students to make the change they want to see in their own community. We believe that by empowering students to want to make these changes, they will continue to participate in community organizing and civil engagement in their own lives. By empowering each student individually, we will help to make communities better by giving students the resources they need to make the changes themselves. In George Washington High School, there are four coaches that help each Freshman advisory class implement a project in their school/community. There are six advisory classes that are working on projects. The current projects are: Mental Health Awareness and Positivity (two classes), Student Voice, Consent Education, Bullying, Racism. Not only does this give students a chance to engage in their own community and learn about community organizing and social justice issues, but students also feel confident in themselves and their ability to make change. Inspiring these students encourages them to make a difference in their own community, which makes the world better.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Community; Community Organizing; Empowerment | Location: B8
Partial Credit For Machine Learning Systems: Using Prior Information in Deep Neural Networks

David Chan  |  Major(s): Computer Science, Mathematics

Computational visual object recognition (VOR) is the task of assigning semantic information to digital images. The complexity of such a task is readily belied by how simple it appears to human observers (we see a picture of an apple and immediately know it is an "apple"). Indeed, such systems are ever-present in our current day-to-day lives from traffic cameras to self-driving vehicles. Today, Training computer systems for VOR consists almost exclusively of comparing the "true" label of an image to the predicted image, and updating the system based on if the system is "right" or "wrong". It is then natural to ask: "is training the system to exactly approximate the true label necessarily the best option?" When humans learn, it is often not "all or nothing" - partial credit is assigned when a human guess close to the correct label, but is not entirely correct. In this work we present a system which assigns partial credit during learning based on a "similarity" metric learned from the data. By doing this, we show empirical gains of up to 17% on classical VOR problems, constituting a massive increase in recognition accuracy.

Faculty Advisor: Dr. Pooran Singh Negi and Dr. Mohammed M. Mahoor, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science

Keyword(s): Machine Learning; Neural Networks; Object Recognition  |  Location: B9

A Game within the Games: The Berlin Olympics and Nazi Propagation on the World Stage

Devin Dalager  |  Major(s): Sociology, History

In this project, I grappled with the question of how the Nazi regime used the Berlin Olympics as an extension of their propaganda push. The inspiration for this project was the anecdotal stories I had heard of Jesse Owens and other athletes during these Games. I wanted to understand how the Nazi regime influenced these Games. A regime with this level of power, who also dominated the media, had to influence the Games. In my research, I found this influence to be true in practically every aspect of the Games. The implications of this is that the Olympics in 1936 serve as a key midpoint between the Nazi takeover in 1933 and the Nazi attack on Poland in 1939.

Faculty Advisor: Carol Helstosky, History, Division of Arts, Humanities & Social Sciences

Keyword(s): Propaganda; Berlin Olympics  |  Location: B10

Twinkle Twinkle Little Supernova, How I Wonder About Your Early Geometry and Hydrogen Clumps

Sophia DeKlotz  |  Major(s): Molecular Biology

Supernovae are the explosive deaths of the Universe’s most massive stars. By studying these spectacular events, astronomers can draw important conclusions about the lives and deaths of other stars and the composition of the Universe. My project focuses on studying the geometry and composition of a particular supernova remnant called SN2012au. Early data analysis on SN 2012au has shown that it has abnormal geometry and composition, which my research has attempted to characterize and explain. My research utilizes a technique called spectropolarimetry, which combines spectroscopic and polarimetric data obtained from the light of the supernova. By plotting spectropolarimetric data obtained from SN2012au, I have been able to isolate two clumps of matter, one that represents ionized hydrogen and another that indicates ionized helium. This result is interesting because SN 2012au belongs to a class of supernovae, called type Ia, that do not normally contain hydrogen gas. This clump warrants further investigation, but they could be due to hydrogen rich circumstellar material or even SN 2012au falling into a hybrid class of supernova.

Faculty Advisor: Jennifer Hoffman, Physics & Astronomy, Division of Natural Sciences & Mathematics

Keyword(s): Computational Astronomy; Supernovae; Geometry  |  Location: B11
Project Presentations

HPA/HPI Axis: Analyzing the Co-evolution of the Melanocortin-2 Receptor (MC2R) and the Accessory Protein MRAP1 from Cartilaginous Fishes to Mammals
Megan Deyarmond | Major(s): Biological Sciences
We evaluated the properties of a newly discovered accessory protein, elephant shark (es) MRAP1, on the ligand sensitivity of the esMC2R. The MC2 receptor plays a critical role in the elephant shark stress response mechanism (Hypothalamus/Pituitary/Interrenal Axis). Corexpression of esMC2R with esMRAP1 increased sensitivity for ACTH(1-24) 10 fold. Immunocytochemical analysis indicated that esMC2R and esMRAP1 are co-localized on the surface of co-transfected cells. These results indicate that the interaction between MRAP1 and MC2R arose early in the evolution of the jawed vertebrates.
Faculty Advisor: Robert Dores, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Elephant Shark; Accessory Protein; Immunocytochemical Analysis | Location: B12

Developing a Process to Detect a Protein of Ragweed Pollen
Anna Dondero | Major(s): Biochemistry
Emma Biesiada
Sensitization to common airborne allergens has become more prevalent in urban areas over the last several years. Airborne pollen proteins have been reported as being a leading molecular trigger for allergic responses. Pollutants from vehicular emissions, such as nitrogen oxide and nitrogen dioxide can react with the amino acids on airborne pollen proteins, causing them to become nitrated. In a typical response to allergies, enzymes of the human body are allocated to nitrate incoming foreign proteins in order to mark them for destruction. The purpose of this particular project is to develop a laboratory technique to detect specific nitrated proteins in the atmosphere that originate from Ragweed pollen. The immunoassay technique uses antibodies that specifically recognize proteins of interest in order to determine their concentration in a sample. Antibodies bound to proteins of interest change color in solution, and the amount of color change allows for protein quantification by comparing the results to a calibration curve of known concentrations. Results show the procedure is difficult to optimize, but a calibration curve can be generated to detect concentrations of nitrated protein.
Faculty Advisor: Alex Huffman, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): ELISA; Nitrated Protein; Ragweed Pollen | Location: B13

An Ecosystem Service Valuation of the National Parks
Sophia Duncan | Major(s): Geography, Economics
Ecosystem service valuation is the process of assigning a dollar value to the services our environment provides for us naturally. From carbon sequestration to nutrient cycling to cultural significance, green spaces are worth far more to our well-being than their real estate values would imply. In a period of political and environmental uncertainty, it is critical to accurately value our natural capital to secure its protection and conservation, especially for public lands like the National Parks. Using remotely sensed land cover data, a benefits transfer analysis was performed on the National Parks within the contiguous United States, and found them to provide $70 billion per year in ecosystem services. Given the National Park Service’s annual budget is a mere $3 billion, we are grossly underfunding our Parks in terms of return on investment. To support “America’s best idea” in the future, funding should be determined by this more holistic approach to their value so the National Park Service can address a backlog of maintenance while preserving new lands.
Faculty Advisor: Paul Sutton, Geography & the Environment, Division of Natural Sciences & Mathematics
Keyword(s): Ecological economics; GIS; National Parks | Location: B14
Organizing for the Novice: Public Achievement and High School Changemakers
Ashley Edinger | Major(s): Socio-Legal Studies, Political Science
Sami Helgeson
The societal narrative tells us that high school students are so distanced from reality that they don’t know what’s going on in the world around them. They do things simply because everyone’s doing it, or so they can get out of class or doing work. However, high school students are very aware of how the conditions in their communities affect them. Our community based initiative though Public Achievement aims to elevate the voices of these students and empower them to become the future and present changemakers of their communities. We employ a community organizing curriculum weekly with students from Rangeview High School and coach them through relationship building, issue identification, issue research, project implementation, and reflection and celebration. Students identify a social justice issue and pursue a public work initiative to benefit their community. The process of designing and implementing these initiatives begins to change the narrative to reflect reality.
Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Community Organizing; Public Achievement; Social Justice | Location: B15

Getting it Together, Keeping it Together: Romantic Relationship Formation and Later Outcomes
Troy Fangmeier | Major(s): English, Political Science
Alisa Braun
Limited research has investigated how romantic relationship formation may be related to later relationship quality. The current study aimed to address this gap by examining how relationship formation pathways predict relationship outcomes. Data were drawn from a longitudinal study that followed adults for 11 waves of surveys. During the study, participants provided responses to the question, "How did you begin dating [your partner]?" These responses were coded into two groups: "traditional" and "non-traditional." Traditional formation was characterized by clear, increasing involvement over time. Non-traditional formation was characterized by rapid intimacy, third party involvement, or extraordinary circumstances. Analyses used these coded responses to predict later relationship outcomes. Results indicated relationships with non-traditional beginnings had higher levels of joint investments, more negative communication, and marginal findings for higher psychological aggression. Other outcomes tested were not significantly related to relationship formation. These results may have implications for future research and interventions designed to promote healthy relationships.
Faculty Advisor: Galena Rhoades, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Couples; Relationships | Location: B16

Six1-Eya2 Transcription Complex and Eya2 Phosphatase Activity in the Proliferation and Survival of High Grade Serous Ovarian Cancer
Connor Farnham | Major(s): Biological Sciences, Biochemistry
The present study investigated the protein interaction of Six1 and Eya2 as a maladapted transcription complex in high grade serous ovarian cancer (HGSOC). This cancer was specifically examined due to its prevalence (accounting for approximately 70% of ovarian cancer cases) and particular lethality, with the majority being diagnosed in Stage 3 or beyond and an associated 15% five year survival rate. Generation of in-vitro genetic models of HGSOC with high levels of Six1 and either Eya2 knockdown or over-expression allowed analysis of the potential roles of interaction between the two. Findings provided genetic proof of principle that disruption of the Six1/Eya2 interaction weakens the proliferation and survival within an HGSOC model. These results suggest that the Six1/Eya2 interaction plays significant roles in the proliferation, survival and metastasis of the cancer, offering a potential target for clinical efforts. Continued research will include in vivo mouse models, as well as testing of small molecule inhibitor drug targeting the implicated proteins as potential novel treatments, with the ultimate goal of clinical application.
Faculty Advisor: Taylor Hatz, Pharmacology, University of Colorado Anschutz Medical Campus
Keyword(s): Ovarian Cancer; Six1; Eya2 | Location: C1
Project Presentations

Generating Bessel Beam Laser Modes with Modulated Gratings
Julia Farrell | Major(s): Computer Science, Mathematics

It was thought that all light waves must diffract, but in 1986 Durin of the University of Rochester noticed some solutions to the wave equation did not depend on the direction of propagation, suggesting the possibility for a non-diffractive light beam. Today we call this a Bessel beam. In talks with my research advisor Dr. Mark Siemens, we noticed an issue with generating Bessel beams with the common, somewhat trivial approach of an axicon. Instead, we thought to use a diffraction grating that can be adjusted to account for the amplitude of the input beam. Diffraction gratings work effectively like any other optic, in that you pass a beam of light through and the light bends into a pattern as dictated by the grating. After many attempts, I was able to generate Bessel beams with gratings I creating in Mathematica with my knowledge of the Bessel function and orbital angular momentum (OAM). Although our beam did diffract, it was able to propagate without divergence for several meters. Overall our experiment was fairly successful, and we enjoyed playing with giving these beams varying levels of OAM as well.

Faculty Advisor: Mark Siemens, Physics & Astronomy, Division of Natural Sciences & Mathematics
Keyword(s): Orbital Angular Momentum; Physics; Science | Location: C2

Seeing Gaze and Emotion Across Time
Laurel Gaediert | Major(s): Psychology, Italian

Seeing a person’s direction of gaze is not just a matter of examining pupil rotation - it depends on analyzing and integrating pupils in the context of head rotation. This emergent process occurs not only when face parts are seen simultaneously, but also when they are seen sequentially in time. Gaze, however, is often seen on faces of varied emotion, and emotion is known to extend the perception of time. Does seeing emotion thus influence the perception of gaze across time? A computerized face perception task was created to test and record gaze direction judgments from 57 observers about emotional head and eye rotations. Data indicate that integration of pupil and head rotation persists even amidst changes in emotion. While the presence of emotional cues did not significantly prolong or strengthen this integration, the integration persisted across delays of up to 2 seconds, furthering the notion that gaze perception is both emergent and quite dynamic despite changes in features.

Faculty Advisor: Timothy Sweeny, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Face Perception; Gaze Direction; Emotion | Location: C3

Reflections of Psychological Identity in the Work of Luigi Pirandello
Laurel Gaediert | Major(s): Psychology, Italian

Luigi Pirandello is a renowned Italian literary figure, who ultimately won the 1934 Nobel Prize in literature. He is extremely well known for his theatrical works as well as his novels and short stories. These works demonstrate not only profound literary expertise, but also deep psychological insight into the formation of one’s personal identity and the construction of evolving social dynamics. Few prior literary analyses have examined the psychological nature of his work, especially across the different modalities of his writing. Through research conducted in Denver and at the Institute of Pirandellian Studies in Rome, Italy, this study documented the specific influences of psychological theories in a number of Pirandello’s works and how they are stylistically portrayed. This literary inquiry concentrated on the specific use of psychologically relevant symbolism (of eyes and of mirrors) to help strengthen Pirandello’s various constructions of individual and social psychological identities.

Faculty Advisor: Angelo Castagnino, Languages & Literatures, Division of Arts, Humanities & Social Sciences
Keyword(s): Luigi Pirandello; Italian Literature; Psychology | Location: C4
A Volatile Mood: Changing Emotions and Their Impact on Regulation

Daniel Garcia  | Major(s): Psychology

We all experience emotions differently; one may maintain relatively consistent moods across the course of a day, whereas another may fluctuate between mood extremes in a few hours. This variability in mood states can be measured as "mood volatility", and has been shown to be a valid predictor of manic and hypomanic episodes, bringing on connections to Bipolar Disorder (Miller et al., 2011; Kwapiel et al., 2000). In an effort to understand the experiences of high mood volatility individuals, this study aims to compare high and low mood volatility groups in their practices of regulating emotions. Therefore, we compiled survey data collected at Burning Man Festival in 2015 (N=3211, 41.8% Female, mean age=40.16), using the mood volatility sub-scale, and the items from the Emotion Regulation Questionnaire (ERQ). It was found the low mood volatility individuals used regulation significantly more than high mood volatility individuals overall. The data suggest that high mood volatility individuals hardly use any regulation at all, raising questions of causality for frequent mood swings. Understanding these individuals’ experiences could have implications for future mood disorder research.

Faculty Advisor: Kateri McRae, Psychology, Division of Arts, Humanities & Social Sciences

Keyword(s): Affect; Emotion; Regulation  | Location: C5

Structure in the Disk of Epsilon Aurigae

Justus Gibson  | Major(s): Physics

One of the more mysterious stars in the night sky is epsilon aurigae, a binary star, which experiences two-year long eclipses every 27.1 years. This uncommonly long 27-year orbital period and extended eclipse, caused by an orbiting disk, make epsilon aurigae one of the most difficult star systems to understand. In order to answer questions about the nature of the disk and to offer a more complete system description, we used the high-resolution spectrometer on the ARC 3.5-meter telescope at the Apache Point Observatory to collect 125 spectra covering the most recent eclipse from 2009-2011. Our data analysis has revealed sub-structure in the disk including a mass transfer stream as well as information about the disk shape. With these additions to the understanding of epsilon aurigae, more targeted observations in the future could finally solve longstanding questions about this complex system and open the door to new exciting questions.

Faculty Advisor: Robet Stencel, Physics & Astronomy, Division of Natural Sciences & Mathematics

Keyword(s): Binary Star; Mass Transfer; Epsilon Aurigae  | Location: C6

Curiosity Cured the Cat: Can Curiosity Decrease Risk for Alzheimer’s Disease?

Allison Grossberg  | Major(s): Biological Sciences, Psychology

For centuries, curiosity has been heralded as one of the most important human drives and simultaneously disparaged as dangerous (e.g. the phrase "curiosity killed the cat"). This research aims to understand the positive benefits of increasing curious thought and behavior, specifically within populations who are at risk for developing Alzheimer’s disease (AD). Patients with AD or those who are at risk of developing the disease who participate in intellectually stimulating activities are at a decreased risk for developing the disease, and onset has been shown to manifest itself more slowly. Thus, cognitive activity may serve as a buffer against the mental decline seen in the early stages of Alzheimer’s. This research investigates which type of cognitive activity - intrinsic curiosity or basic intellectual stimulation - is most effective in combating the cognitive decline exhibited by individuals who are risk for developing neurodegenerative disorders and who are in the early stages of Alzheimer’s disease and dementia. Ultimately, this information will be used to help scientists and clinicians to implement more effective interventions designed to decrease risk factors for Alzheimer’s.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs

Keyword(s): Curiosity; Alzheimer’s Disease; Dementia  | Location: C7
Project Presentations

Land of Enchantment
Mikaela Guggino | Major(s): Studio Art

In today’s society, many museums face the threat of closure as technology continues to discourage museum outings, but as globalization spreads, the museum experience is one of the best ways to preserve, share, and witness diverse cultures. Land of Enchantment is a hand-bound book that seeks to share culture in a new and exciting manner that brings relevance to the artist’s work and craftsmanship in this age of digitalization and social media. The book features hand-colored intaglio prints made using copper plates and a ferric acid bath. With the support of the University of Denver’s PinS Grant, the artist researched 18th century printmaking techniques and New Mexican culture to create a book that encompasses both the visual and written arts into a mystery case that needs the viewers’ help to be solved.

Faculty Advisor: Catherine Chauvin, School of Art & Art History, Division of Arts, Humanities & Social Sciences
Keyword(s): Printmaking; Bookbinding; Culture | Location: C8

Writing Center Work as a Social and Collaborative Act of Reflection
Madeline Halseth | Major(s): English

Reflection is widely recognized in the field of composition studies as a tool for transfer of knowledge and metacognition. Writing center consultations have an implicit element of reflection that I believe, if made explicit, would aid consultants and students alike in consultations with the goal of encouraging students to transfer knowledge and writing skills to various rhetorical situations. In this presentation, I will review reflection as it is understood as a tool for metacognition and the transfer of knowledge, offer my own insight into how reflection may fit into consultations based on my experience as a peer tutor, then offer models of how to incorporate reflection into writing center consultations. These models focus on encouraging peer tutors to question students. In this line of questioning, there is an element of reflection that aids students’ metacognition as they begin to understand themselves as writers and to develop their own identity as a writer. These models are informed by Kathleen Blake Yancey’s groundbreaking book, Reflection in the Writing Classroom, as well as Kara Taczak’s research on reflection as a tool for transfer.

Faculty Advisor: Juli Parrish, English, Division of Arts, Humanities & Social Sciences
Keyword(s): Reflection; Metacognition; Writing | Location: C9

The Role of Negative Emotionality and Supportive Parenting in Stress Reactive Cortisol Among High-Risk Toddlers
Estee Hamo | Major(s): Psychology

Early childhood stress, and in particular low socioeconomic status, has been associated with negative health outcomes in later life including depression, heart disease, and premature death (Middlebrooks et al., 2008). Furthermore, physiological responses to stress, such as cortisol reactivity, may become dysregulated when exposed to chronic stress. Previous research has found that children who display more negative emotionality have a higher risk of elevated cortisol in response to arousing stimuli (Ursache et al., 2013). Some research suggests that supportive maternal behavior is associated with better cortisol recovery in children exposed to everyday stressors (Albers et al., 2008). The aim of the current study is to examine the role of supportive parenting in high-risk toddlers who display more negative emotionality. We hypothesized that children with higher internalizing scores would show elevated cortisol during a stressful task and that maternal support would moderate this effect. The results show that negative emotionality predicts elevated cortisol in children from low-income families. However, maternal support may serve as a buffer against the negative effects of stress.

Faculty Advisor: Sarah Watamura, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Child Development; Cortisol; Poverty | Location: C10
Acetals as Versatile Substrates for the Synthesis of Bioactive Compounds
Matheus Hanson | Major(s): Environmental Chemistry

Synthetic methods for Bronsted acid catalyzed enantioselective carbon-carbon bond forming reactions remains in its infancy. Such methods enable access to compounds useful in medicine and material science. Deficiencies currently exist surrounding certain acidic ranges, including sulfur based mono-protic acids. These coupling reactions were targeted by looking at the reactivity of acetal based functional groups using various sulfonic acids as the catalysts. The second opportunity for expansion in this field would be the simplification of sulfonic acid synthesis using a light catalyzed Newman-Kwart rearrangement. Particularly looking at the feasibility of synthesizing sulfonic acids on large aromatic and chiral scaffolds such as 1,1-Bi-2-Naphthol (BINOL). Results showed the coupling of acetal groups is possible using sulfonic acids. Also the use of ultra-violet light to catalyze the Newman-Kwarts rearrangement on a BINOL based O-thiocabamate group was successful, and from there to the sulfonic acid is being investigated. A greener technique for the rearrangement on a BINOL backbone was confirmed with the potential to create the sulfonic acid and other interesting new Bronsted acids.

Faculty Advisor: Bryan Cowen, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Organic Synthesis; Bronsted Acid Catalysis; Enantioselective | Location: C11

Education and the Power of Culture in the Arab World
Walid Hedidar | Major(s): Anthropology, International Studies

Tunisia’s transition into democracy and the active involvement of its people in the social and political climates are two important catalysts for change that, unfortunately, did not alter the flaws of the Tunisian education system. Almost exactly identical to the one established during colonial times, the Tunisian education system is founded upon robotic memorization and the favoring of quantity over quality. This study reveals the strong link that exists between culture, education, and change in the Arab world. By analyzing and showcasing the results from interviews, discussions, and behavior analysis activities conducted with over 50 teachers and 16 high school students in Tunisia, this ethnographic study reveals the role that culture plays in influencing how teachers, students, administrators, and parents perceive education and behave in regards to it. These results offer a new lens from which education reform should be looked at: one where culture is at core and is no longer ignored.

Faculty Advisor: David Riche, University Writing Program, Writing Faculty
Keyword(s): Education; Culture; Arab World | Location: C12

Characteristics of Maternal Anxiety in the Early and Late Postpartum Period
Madison Herrud | Major(s): Psychology, Gender and Women’s Studies

Postpartum anxiety is experienced by approximately 15% of mothers, however, it has garnered less attention than postpartum depression. A small literature has explored characteristics of postpartum maternal anxiety, however, there is a gap in research exploring early and late postpartum anxiety symptoms to better define what postpartum anxiety is and if there are differences based on the timing of the symptoms. The aim of the current study is to understand differences in the symptoms of later postpartum anxiety versus early postpartum anxiety. Two independent t tests will be performed to evaluate whether there are differences in severity maternal anxiety and parenting specific anxiety symptoms for early (before 3 months) vs. late postpartum (after 5 months) groups. Findings from this study may inform future interventions for postpartum anxiety and provide more awareness to an understudied but important postpartum mental health issue.

Faculty Advisor: Elysia Davis, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Maternal Mental Health; Anxiety; Postpartum | Location: C13
Project Presentations

Attempting to Sensitize Cells Further to Existing Chemotherapeutic Agents for Brain Cancer
Ruth Hollenback | Major(s): Molecular Biology, Chemistry

Temozolomide is the most common chemotherapeutic for glioblastoma multiforme (an invasive form of brain cancer), but it only works to delay mortality rather than improving quality of life, as tumor cells often evolve machinery to repair themselves over time. A protein called Cdc42 has been proven to help neurons live because of its role in cell migration and proliferation, specifically in the treatment of neurodegenerative diseases. It, therefore, probably also has implications in brain tumor cell growth. Over the next year, I will test inhibitors of Cdc42 activity on a human glioblastoma cell line in an attempt to further sensitize them to temozolomide, ultimately to show that this protein is a primary reason for temozolomide’s success in killing cancer cells. This will in turn create new avenues for further cancer and cell biology research because of the identification of the specific molecular pathway that this therapy, temozolomide, takes to stop tumor growth.

Faculty Advisor: Daniel Linseman, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Cancer; Glioblastoma Multiforme; Temozolomide; Quality of Life | Location: C14

The Effect of Conspecific Density on Honey Bee Recruitment
Eva Sofia Horna Lowell | Major(s): Ecology and Biodiversity, Spanish

Honey bees (Apis mellifera) are social insects and are known to use a variety of signals to communicate and coordinate effective recruitment to a profitable resource patch. Once foraging honey bees arrive at a flower patch, they use the presence of conspecific foragers as cues for flower quality and quantity, which can have a positive effect on a hive’s foraging efficiency. While other studies mostly studied the effect that a single forager on a flower had on recruitment by other bees, we tested the effect that a large range of initial foragers on a flower had on recruitment by other bees to a single flower. In conjunction with a non-majors undergraduate class, we tested whether the number of conspecifics on individual flowers influences which flower foragers choose to land on once they arrive at a flower patch. We found that incoming foragers land more frequently on flowers that are already occupied by high numbers of conspecifics. We propose that the presence of conspecifics suggests low risk of attack by predators and that the flower is a profitable food source.

Faculty Advisor: Shannon Murphy, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Recruitment; Honey Bee; Foraging | Location: C15

Tibiofemoral Kinematics of Healthy Older Adults during Dynamic Seiza-Style Kneeling: A Pilot Study
Melissa Jackels | Major(s): Biological Sciences
Kendra Reiley

The purpose of this study was to determine the six DOF tibiofemoral (TF) kinematics of older healthy adults during a seiza-style kneeling activity. The ultimate goal is to develop subject-specific virtual patient models driven by healthy in vivo kinematics for demanding activities to aid design of next generation knee implants. Quantifying TF kinematics of healthy knees is critical to understanding variations of knee motion in patients with knee pathology and quantifying the result of treatments, including total knee arthroplasty (TKA). Many activities of daily living require deep knee flexion, and no previous studies have accurately evaluated the six DOF TF kinematics of normal knees. High-speed stereo radiography (HSSR) was used to capture x-ray images of the knee joint in two-planes during the activity, allowing for sub-mm 3D measurements to be captured, transformed into models, and tracked through the motion. Maximum flexion angles were found for all subjects, as well as anterior-posterior translations, varus-valgus rotation, and internal-external rotation. These findings provide baseline data of healthy knee motion that may be used to develop new implant designs.

Faculty Advisor: ??, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Kinematics; Knee; Healthy | Location: C16
Project Presentations

Predator Exposure of Three-spine Stickleback Parents Influencing Offspring Mating Decisions
Clara Jenck  |  Major(s): Biological Sciences
Whitley Lehto

Parental effects are contributions from the parental environment that shape offspring development, allowing offspring to respond not only to the environment they experience but also to the environment experienced by their parents. Parental experience with predators is linked to how offspring respond to stressors and to changes in many behaviors. This study examines how parental effects resulting from experiences with predators affect the mating choices of offspring and whether they have an underlying molecular, epigenetic basis. Three-spine sticklebacks (Gasterosteus aculeatus) provide a model system to test the impacts and consequences of maternal and paternal effects on mate choice because both parents make significant contributions to offspring development. Variations in epigenetic states among daughters from natural crosses exposed to distinct conditions of predation risk are characterized and the molecular mechanisms for these behavioral changes are revealed. Investigating whether parental effects, such as the effects of predator exposure, influence the mating choices of the parents’ adult offspring reveals that parents can prepare their offspring for the mating environment.

Faculty Advisor: Robin Tinghitella, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Parental Effects; Mate Choice; Epigenetics  |  Location: C17

Variation in Egg Stress Hormones in Three-spine Stickleback Female Offspring Induced by Predator-Exposed Parents
Clara Jenck  |  Major(s): Biological Sciences
Whitley Lehto

In the three-spine stickleback (Gasterosteus aculeatus), both parents make important contributions to offspring development at different stages. Many offspring traits are influenced through non-genetic contributions to phenotypes when parents experience predator stress while producing offspring; parental experience with predators is linked to how offspring respond to stressors and to changes in many behaviors. Increased concentrations of glucocorticoids (GCs) “stress hormones” and differences in parental care received could explain the variation in offspring traits. Female exposure to predator stress during egg formation and male exposure while caring for eggs produces parental effects, increasing female offspring circulating GCs. As a result, parental effects influence the level of GCs female offspring deposit in their own eggs. Differences in egg cortisol of female offspring due to predator-induced parental effects show that these effects are long-lasting and parents deliver indirect messages about predators to the next generation via eggs, influencing the development, growth, and behavior of offspring to prepare them for potential stressors in their future environment.

Faculty Advisor: Robin Tinghitella, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Parental Effects; Stress Hormones; Cortisol  |  Location: C18

Towards a Measure of the Galactic Bar Using Gaia and RAVE Surveys
Jaclyn Jensen  |  Major(s): Physics, French

The Galactic bar is an extensively studied structure in the center of the Milky Way; however, the parameters of this object are still disputed. Current assumptions for its length are between 3.5 and 5 kpc, while the associated pattern speed ranges between 40 and 65 km s⁻¹ kpc⁻¹. If the bar exhibits a large enough pattern speed, a resonance is produced, as is common in many other spiral barred galaxies. This project utilizes the Hercules stream, a co-moving group of stars that appears to be directly influenced by this resonance, as an indirect method to analyze the Galactic bar’s velocity. This is possible with the cross-matching of two high precision astronomical catalogs: the newly released TGAS DR1 catalog alongside RAVE DR5. We can eliminate longer bar models by examining the saddle point produced in Galactic velocity distributions of the Hercules stream, which we have found to follow a relation of 1.89 times the circular frequency of the Sun. Studying the structure of our Galaxy not only provides better parameters for dynamic modeling, but also yields improved methods for future theories involving our evolution and how our solar system developed.

Faculty Advisor: Robert Stencel, Physics & Astronomy, Division of Natural Sciences & Mathematics
Keyword(s): Galaxy; Kinematics and Dynamics; Disc; Structure  |  Location: D1
Project Presentations

An Investigation of the Role of Shared Group Threat in Shaping Latino Vote Choice in the 2016 Presidential Election
Scarlett Jimenez  | Major(s): Political Science, Public Policy, French

Hispanic and Latino voters are an underrepresented and understudied group in Political Science begging further research. This study seeks to begin to fill that gap and better understand the various factors driving Latino vote choice in the 2016 Presidential election. This study is a mixed-method analysis of 38 post-election interviews of eligible Latino voters across 4 U.S. states: Arizona, California, Colorado and Florida. Specifically, the interviews explored the link between panethnic Latino identification and the perception that a shared group threat was posed by the potential election outcomes. The early results of the study suggest that income level is the most influential variable predicting the perception of a discrimination threat. There also appears to be an opposite effect at play, economic threat, which seems to be driven most by English fluency and which discourages Latinos from making vote choices based on a shared group identity. The implications of this research are far reaching in terms of influencing future voter mobilization efforts and developing a more nuanced understanding of the Latino electorate as a whole.

Faculty Advisor: Seth Masket, Political Science, Division of Arts, Humanities & Social Sciences
Keyword(s): 2016 Presidential Election; Latino; Political Science  | Location: D2

Peat Humification Analysis and Loss On Ignition at Kannah Creek Fen, Grand Mesa, Colorado
Taylor Johaneman  | Major(s): Environmental Science

Understanding the relationship between climate change and regional moisture budgets is integral to determining the effects of global climate change. The impact of climate change can be assessed through research on past climate using peat cores. In the past, research on the dynamics of peatlands have only focused on high-latitude peatlands and tropical peatlands; very little research has focused on mid-latitude peatlands. We will be working to uncover past climate conditions using peat humification analysis and loss on ignition methods. Peat cores will be extracted from Grand Mesa, Colorado. We hypothesize that as summer temperatures increase, the water table in peatlands will change. Furthermore, an increase in summer temperatures will cause an increase in evaporation, thus having an effect on soil moisture. Continuing research on peat cores in Grand Mesa will bridge the gap in existing knowledge of the effects of climate change on peatland dynamics and carbon sequestration.

Faculty Advisor: Donald Sullivan, Geography & the Environment, Division of Natural Sciences & Mathematics
Keyword(s): Peat Analysis; Climate Change; Soil Moisture  | Location: D3

Developing a Fluorescent Probe for the Study of Creatine
Ben Johnson  | Major(s): Biochemistry, Molecular Biology

The interconversion of creatine to creatine phosphate by creatine kinase represents the characteristic phosphagen/phosphagen kinase system in vertebrates and allows for the appropriate function of their metabolism through buffering the concentrations of ATP within cells. The role of creatine under various stress and/or disease states is not fully understood and currently no method exists for the determination of creatine concentrations within the cell. We sought to develop a small molecule fluorescent probe to react with creatine in vivo by taking advantage of betaketodene functionality and the electronic conjugation of a substituted naphthalene probe scaffold. We found poor reactivity of the betaketo, and seek to improve its reactivity by adding additional electron withdrawing functional groups to the terminal end of the betaketo. We also continue to investigate vinylogous amide functionality on a naphthalene probe scaffold and by adding functional groups to react with creatine on a fluorescein probe scaffold as possible solutions to problematic reactivity.

Faculty Advisor: Ben Johnson, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Creatine; Fluorescent Probe; Organic Chemistry  | Location: D4
Biomechanics of Babywearing
Alexandra Kahney  |  Major(s): Biological Sciences, Spanish

Babywearing, the practice of carrying an infant in a carrier worn on the body, has been shown to have a variety of benefits for the child. Interestingly, there has been little research done to investigate the impacts of this practice on mothers. The purpose of this study was to investigate the impacts of two carrying methods on a woman’s body, focusing on how each method impacted upper limb muscle activity and discomfort, along with postural sway, during prolonged standing. Subjects stood for 15-minute intervals on motion-sensitive plates that recorded postural sway while they carried infant mannequins in-arms and in-carriers and while unloaded. Activity of subjects’ arm and shoulder muscles was recorded via EMG. Surveys were used to monitor discomfort. It was found that carrying infants in-arms led to significantly higher arm and shoulder muscle activity and self-reported arm pain compared to carrying infants in-carriers. For in-arms carrying, postural sway and stance asymmetries were significantly increased compared to in-carrier carrying. These findings can inform mothers on the optimal method of infant carrying to minimize fatigue, discomfort, and risk of injury.

Faculty Advisor: Erin Mannen, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Babywearing; Posture; Fatigue  |  Location: D5

Doing Gender while Doing Secularism: Pathways and Obstacles to Inclusion in Secular Communities
Kristen Kennedy  |  Major(s): Sociology, International Studies

Although there is generous research concerning gender and religiosity, there lacks research focusing on gender and secularism. The growing secular movement is primarily composed of white, educated men. Why is the secular movement more attractive to men and less attractive to women? Like gender, secularism is a constructed experience. Understanding the complexities concerning how one “does” gender and secularism sheds light on the different pathways and obstacles to inclusion in secular communities. This is an ethnographic study of a secular community in the western region of the United States. Due to possessing a marginalized masculinity, the white, heterosexual male community members performed hyper-masculinity through rationality during discussion group sessions. The women interviewed in this study often noted the lack of inclusion within these discussion groups, as well as the lack of daycare resources provided by the community. Social justice based events often had a very diverse turnout within this community, as opposed to the discussion group sessions. Adding a social justice platform to secular communities will likely increase the diversity within the secular movement.

Faculty Advisor: Lisa Martinez, Sociology and Criminology, Division of Arts, Humanities & Social Sciences
Keyword(s): Gender; Secularism; Masculinity  |  Location: D6

Empowering Muslim Women
Ismaat Klaibou  |  Major(s): International Studies, Spanish

Growing up in the Muslim community, it is very often difficult to discern between what is faith and proper practice of faith and what is simply the implementation of archaic cultural ideas into the roles that different people have in the community. It is extremely important to me to be able to make that very clear distinction and open the doors for Muslim Women to seek empowerment through each other and their strengths, while fostering their desired level of faith. Muslim women are powerful and fierce and ready to take on the world, but there isn’t always space for us to do so. I will work with Muslim women to find where their needs are lacking and help establish a space to express those concerns. The final research brought to light many of the gaps in the community support that need addressing. There is work to be done.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Muslim; Women; Empowerment  |  Location: D7
Project Presentations

Analyzing the Potential Synergistic Effects of Multiple Nutraceuticals on Neuroprotection

Lilia Koza  |  Major(s): Biological Sciences

This experiment determined the ability of nutraceuticals, antioxidants which are derived from food, to protect against neuronal apoptosis. Apoptosis is commonly due to mitochondrial damage caused by nitrosative and oxidative stressors derived from reactive oxygen and nitrogen species. Due to these stressors, the mitochondria release proteins which lead to programmed cell death. Apoptosis is characteristic of many neurodegenerative diseases, specifically Amyotrophic Lateral Sclerosis, the focus of this research. Protocatechuic acid, epigallocatechin gallate, caffeic acid, and rosmarinic acid, were tested for their ability to prevent apoptosis in primary rat cerebellar granule neurons. These nutraceuticals have been shown to protect against apoptosis individually at higher concentrations. Therefore, a synergistic effect of the combined nutraceuticals was explored. Nitrosative stress and excitotoxicity were induced with sodium nitroprusside and glutamate and glycine, respectively. The combined nutraceuticals exhibited significant neuroprotection against apoptosis at lower concentrations than those required for protection individually, ultimately confirming a synergistic effect.

Faculty Advisor: Daniel Lineman, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Nutraceuticals; Neuronal Apoptosis; Neurodegeneration | Location: D8

Fluorescence and Sizing Properties of Individual Particles Associated with Dust and Non-Dust Events, Contrasting Cyprus and Barbados

Christine Krentz  |  Major(s): Chemistry, Biological Sciences
Nicole Savage

Bioaerosols can be defined as the suspension of biological particulate matter in the atmosphere. There are various biological particle types including whole and fragmented microorganisms, biopolymers, and reproductive entities. They can serve as nuclei for cloud droplets and ice crystals in the atmosphere, and thus have an effect on cloud formation and precipitation. Particle concentrations were measured for two 2016 field campaigns in Cyprus and Barbados during dust and non-dust periods. Barbados and Cyprus are areas of interest for monitoring long distance aerosol transport events. Bioaerosol detection was accomplished utilizing a Wideband Integrated Bioaerosol Sensor (WIBS), licensed by Droplet Measurement Technologies, Boulder, CO. This instrument utilizes single particle fluorescence spectroscopy to detect and characterize biological particles. The WIBS operated at each site for 4-8 weeks. Initial fluorescence and sizing properties of individual particles observed by the WIBS from each site will be reported. A comparison of fluorescent properties between Cyprus and Barbados air masses will also be presented.

Faculty Advisor: Alex Huffman, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Bioaerosols; Cyprus; Barbados | Location: D9

Does Quality of Maternal Care at 6 Months Predict Infant Emotional Regulation at 1 Year?

Sarah Levin  |  Major(s): Biological Sciences, Psychology

Emotion regulation, a component of temperament, is predictive of psychopathology later in life. One factor that might influence infant temperament is maternal sensitivity, which describes the extent to which a mother is emotionally available and responds appropriately to her child. The purpose of the present study is to assess whether maternal sensitivity at 6 months postpartum is related to infant emotion regulation at one year. Participants include 163 mother-infant pairs enrolled during pregnancy. Sensitivity was measured 6 months postpartum during a 10-minute mother/child play period. Infant temperament was assessed at 12 months postpartum using the standardized Laboratory Temperament Assessment Battery.

Faculty Advisor: Elysia Davis, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Maternal Sensitivity; Infant Temperament; Emotion Regulation | Location: D10
Phase III Trial of Sonepcizumab Versus Standard of Care Pazopanib in Von Hippel-Lindau Metastatic Clear Cell Renal Cell Carcinoma

Nicholas Lewis | Major(s): Biological Sciences

This project was intended as a research proposal for an innovative clear cell renal cell carcinoma (ccRCC) treatment therapy for patients with the Von Hippel-Lindau (VHL) mutation. For many patients with ccRCC the standard of care, Pazopanib, is an ineffective treatment therapy in treating tumor growth and angiogenesis. Our approach focused on utilizing Sonepcizumab, a monoclonal antibody, as an alternative treatment to the standard of care. Sonepcizumab has shown promising results in phase I and II trials that could help increase progression free survival in patients with ccRCC and is potentially less volatile for the patient since Sonepcizumab is a monoclonal antibody instead of a small molecule. Since this is only a clinical trial proposal, there are no results yet gathered. The greater implication of this research proposal would provide an alternative treatment for patients with a very rare mutation, that would be targeted specifically for this kind of mutation with less side effects.

Faculty Advisor: Karoly Szuhai, Molecular Cell Biology, Leids Universitair Medisch Centrum
Keyword(s): Clear Cell Carcinoma; Clinical Trial | Location: D11

Syntheses of Quinoline Analogs for the Inhibition of Class IIa Aldolases

Lauren Lustig | Major(s): Chemistry

Mycobacterium tuberculosis is a widespread bacterial pathogen which may cause tuberculosis disease (TB). TB is a human-spread infection characterized by damaging tissue nodules which inflame the lungs, internal organs, and bones. M. tuberculosis strains are rapidly evolving resistance to common antibiotic treatments. Modified organic drug compounds are necessary for future treatments. One promising target for future drugs is the bacteria’s class II fructose bisphosphate aldolase. This enzyme cleaves fructose 1,6-67bisphosphate in an essential step of the glycolysis cycle. Recent research has found that quinoline-like compounds (such as 8-hydroxyquinoline-2-carboxylic acid [HCA]) have the ability to deform the aldolase’s active site and effectively starve the bacteria of energy. Thus, compounds which build off the HCA scaffold may provide an invaluable new drug treatment for TB. Here we have attempted to alter the scaffold by modifying C2 substituents through various methods, including modified Fischer-Indole, Bischler-Mohlau and Castro syntheses. Several analogs to HCA have been successfully created and may be used for future biochemical research.

Faculty Advisor: Bryan Cowen, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Tuberculosis; Organic Chemistry; Quinoline Analogs | Location: D12

Collective Governance of Forest Resources in Northern Malawi

Ben McClellan | Major(s): Environmental Science, International Studies

Collective goods, including forest resources, remain a pivotal provision in the lives of those residing in rural Malawi. Fuelwood production, especially charcoal generation, coupled with tobacco production threatens the sustainability of forest resource harvests even in the relatively forested areas surrounding Mzuzu. The institution of the Forestry Act of 1997 in Malawi returned much of the control over forest resources to local communities, following global trends allowing for local communities to realize the incentive of maintaining their forest resources; however, conditions of necessity often push aside incentives and legislation. This study looks at the intersection of incentives, legislation, and performativity regarding forest resources. 47 semi structured interviews with government officials, forestry department workers, and members of six communities lead to finding that erratic government support and reliance upon forest resources for fuel creates variety in governance outcomes. While the results suggested success in decentralizing forest governance, the range of forest resource access between communities begs the question what other support can communities receive?

Faculty Advisor: Robert Uttaro, International Studies, Josef Korbel School of International Studies
Keyword(s): Governance; Forest; Malawi | Location: D13
Project Presentations

Road to Distinction
Daniela Medina Caro  |  Major(s): Accounting

As an undocumented student, I struggled finding support in high school to achieve higher education. The program "Road to Distinction" is focused on instilling self-esteem and skills needed to be successful after high school. This program emphasizes skills such as self-care, resume building, scholarship search as well as speaking skills.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Undocumented; Higher Education; Women Empowerment  |  Location: E1

Map-2 Blockage of Tau Fibril Elongation
Brendan Monogue  |  Major(s): Biochemistry

Microtubule-associated protein Tau (Tau) is a human brain protein that forms long fibrillar aggregates in cases of Alzheimer’s disease. For this reason, finding a mechanism of preventing the growth of these aggregates could be of substantial medical value. Previous work in the lab of Dr. Martin Margittai has shown that a related protein, Microtubule-associated protein 2 (MAP-2) can impede the growth of Tau filaments. However, the details and mechanism of this process had yet to be explored in depth. Through a combination of assays that demonstrate the growth of Tau fibrils, it was determined that this blockage is not dependent on the protein isoforms. In addition, it was shown that Tau inhibition was not due to sequestration of the cofactor required for Tau fibril growth. Most significantly, the data suggest that the monomeric form of MAP-2 associates with a Tau fibril at a rate dependent on the number of free ends, implying that this blockage is caused by direct binding to the end of Tau fibrils. These findings could lead to a more complete understanding of the mechanisms of this blockage, potentially allowing for treatments to be developed.

Faculty Advisor: Martin Margittai, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Alzheimer’s; Tau Fibril; MAP-2  |  Location: E2

Total Hip Arthroplasty Effects on Upper Body Motion
Holly Morrison  |  Major(s): Molecular Biology

Total hip arthroplasty (THA) research has primarily focused on the effects on the lower body joints, while there is relatively little to be found on the effects on the back and upper body. This research is important because hip arthritis is often accompanied by back pathologies such as low back pain and poor posture. The objective of this study was to determine if THA affects the movement of the upper body when climbing stairs. Subjects were asked to perform a "step-up" task while stereo radiography and motion capture data were recorded to give detailed information on hip kinematics as well as the angles of the low back. Comparisons were made between healthy and THA subjects. The stereo radiography results indicated the translation magnitude was 0.80\(\text{mm}\) ±0.43 mm when the limb was loaded during the entire task. On average, THA subjects had a higher low back angular excursion with more variability than healthy subjects (EXT: 5.6±5.6 vs. 2.9±0.9  ; Bending: 3.9±5.0 vs. 2.2±3.2  ; ROT: 3.8±3.6 vs. 2.2±1.0 ). These data indicate that there is a difference in upper body movement between THA and healthy subjects and can contribute to the understanding of multi-joint interactions and problems.

Faculty Advisor: Casey Myers, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Total Hip Arthroplasty; Upper Body  |  Location: E3
Project Presentations

Community Building Through Healthcare
Emina Mujezin | Major(s): Accounting

Since November, the Islamic community in Colorado has received threats and aggressive actions. Also, since then, the general healthcare plans in the US have been threatened. By teaming up with the Colorado Muslim Society, we hope to provide days where all members of the Denver community can stop by any mosque and receive free preventative healthcare checkups and advice from doctors. We also hope that these visitors can come into the mosques and get to know the Muslim community and interact with them - so we may get rid of the fears and concerns associated with Islam and build unity.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Islam; Healthcare; Community Building | Location: E4

Effect of Single-Point Disease Mutations on Tau Aggregation Behavior
Rachel Murphy | Major(s): Molecular Biology

Propagation of tau protein fibrils amongst neurons is a key component of neurodegenerative disease pathology, especially Alzheimer’s Disease. Tau fibrils grow through a template-assisted mechanism in which an established fibril will recruit tau monomer to elongate onto its ends. Research by the Margittai lab established the existence of seeding barriers amongst certain isoforms of tau. This research was extended to three mutants of the h140 isoform found in disease: G303V, P301S, and P301L. It was hypothesized these mutations could alter tau aggregation behavior due to their influence on the conformation of the fibril core. Sedimentation of seeded reactions was used to examine monomer recruitment by mutant fibrils. A seeding barrier was discovered between h123 monomer and mutant fibrils P301S and P301L not present between non-mutant isoforms. These findings provide insight into the mechanistic factors which may affect tau fibril formation, of which is necessary for the proliferation of neurodegenerative disease.

Faculty Advisor: Martin Margittai, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Tau Aggregates; Alzheimer’s | Location: E5

Collective Governance of Public Goods in Malawi-Agricultural Land
Daniel Myers | Major(s): International Studies
Ben McClellan, Chandler Carlson

This project stemmed from an abiding curiosity concerning the effects of the collision between customary and privatized land tenure systems in East Africa. I started with a broad question: how is agricultural land governed in the environs of Mzuzu, Malawi? I conducted 40-odd structured interviews with randomly selected farmers, traditional authorities, and government officials in the Mzuzu area, revealing wide diversity in land tenure practices in six villages surrounding central Mzuzu. This diversity could be found in the land rights of women, the frequency and nature of land disputes, the presence of formal title deeds, the degree to which land was commodified, the power of traditional authorities in apportioning land, methods of dividing land among children, and opinions held on a controversial land reform bill. The findings indicate that land management in Mzuzu is an adaptive process in which customary and proprietary systems are employed to fit the unique needs of specific communities, as well as by individual actors to maximize their own wealth or social standing within said communities.

Faculty Advisor: Robert Uttaro, International Studies, Josef Korbel School of International Studies
Keyword(s): Land Tenure; Resource Governance; Customary Law | Location: E6
Project Presentations

Human Rights for Refugees
Blanche Ndoutou  |  Major(s): Criminology
I came to the United States as a refugee from Cameroon. When we came here, we were given a case manager who did not speak our language so we could only communicate with sigh language. Our case manager was a caring man but because we did not understand each other, we did not have our basic needs met. Refugees are brought to the US and are left to take care of themselves without much help. I want to help make them feel at home by helping them understand how the transportation work, where the grocery store is, where school are for themselves and their children, and how to get a job. In other to approach this problem, I have done as much research as I can on the subject of refugees coming to Denver and what their needs are. I have researched about an organization that I would like to work with to better help refugees in Denver. As a result, I have learned that newcomers mostly need help with the language, daycare, housing necessities, and employment. Therefore, refugees are human beings just like us. They need our help to better adapt to their new homes.
Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Refugees; Adapt; Rights  |  Location: E7

The Effect of CDC42 Inhibitors on Neuronal Survival
Allisen Nguyen  |  Major(s): Biochemistry, Psychology
Noelle Punessen
Neurodegenerative diseases such as Amyotrophic Lateral Sclerosis (ALS), Alzheimer’s, Parkinson’s, and Huntington’s disease are caused by a decline in the nervous system. These illnesses do not have a long-term treatment, and existing treatments only delay disease onset or provide symptom relief. One significant cause of neurodegenerative disease is excessive programmed neuronal death, also known as apoptosis. In this specific study, the goal was to delineate a way to delay or prevent neurodegenerative diseases by studying the Cdc42 pathway, which is closely related to other pathways that play a role in neuronal survival. Based on experiments focused on quantifying apoptosis, it has been determined that Cdc42 is likely implicated in neuronal survival. There is potential for future studies in this field that could find a long-term solution and provide help for individuals suffering from ALS and other neurodegenerative diseases.
Faculty Advisor: Daniel Linseman, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): CDC42; Pathway; Neuronal Survival  |  Location: E8

The Ubiquitin Protein Modifier Is Attached to Human Immunodeficiency Virus-1 (HIV-1) Particles
Sofya Norman  |  Major(s): Molecular Biology
HIV-1 has caused over 34 million deaths since its first appearance and continues to impact populations around the world despite the development of antiviral drugs. One viral polypeptide, Gag, is the sole driver for creating a HIV-1 virus particle. Gag shapes a HIV-1 particle by budding out of the cell membrane of an infected cell. Ubiquitin (Ub) is a host cell factor which modifies protein functions in the cell. My research explores the role of the Ub in potentiating HIV-1 Gag budding. I have successfully visualized HIV-1 particles and demonstrated the presence of Ub at virus budding sites. The results from these experiments are promising, showing colocalization with Gag buds and Ub, and exclusion of Ub from Gag bud sites when co-expressed with an enzyme that enzymatically removes Ub from proteins. These results directly demonstrate Ub conjugation to HIV-1 Gag and further exploration of the role of Ub in potentiating HIV-1 budding could lead to new avenues for antiviral therapy.
Faculty Advisor: Schuyler van Engelenburg, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): HIV; Ubiquitin  |  Location: E9
Project Presentations

Over-Expression of Aldose Reductase in AKR1B1 Gene Shows Evidence of Increased Vasculature Leading to Diabetic Retinopathy in a Mouse Model
Kaylee Oberlies | Major(s): Biological Sciences

Diabetic Retinopathy (DR) is the premier cause of acquired vision loss among diabetic patients and the leading cause of blindness in working-age adults in the United States. Recently, evidence has suggested that pharmacologically inhibiting the expression of the human AKR1B1 gene coding for aldose reductase (AR) in the lens epithelium of diabetics may be effective at arresting angiogenesis and vascular hemorrhage causing visual impairment. In this study, retinal vasculature and ganglion cell layer thickening in 14 wild-type and Par-37 transgenic mice were quantified at 12, 30 and 50 days post-birth. The average number of vessels in all five retinal cell layers was found to be significantly greater in the Par-37 cohort than in the wild-types across all three time intervals. Our results indicate that increased AR production resulting from chronic hyperglycemia in diabetic patients may promote the proliferation of leaky blood vessels in the retina, inducing RGC death and subsequent vision loss. These findings suggest that the targeted inhibition of AR may prove to be a valuable mechanism for the preventative treatment of vascular complications that emerge in DR diagnoses.

Faculty Advisor: Nancy Lorenzon, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Diabetic Retinopathy; Aldose Reductase; Ophthalmology | Location: E10

Minority Association of Pre-Medical Students
Laleobe Olaka | Major(s): Biological Sciences

Take a moment to think about your annual checkup with your physician. Would you say you and your physician have a great bond or would you say you know nothing about your physician at all? Also how comfortable are you with your physician? The answers to these questions may vary for a lot of people, however, for the majority of minorities the answers to these questions are no or not at all. The purpose of the minority association of pre-medical student (MAPS) is to improve the relationship between physicians and their patients by diversifying the field. MAPS was designed to help closing the achievement gap by helping minority students get into medical school and out of medical school. Programs like MAPS will better our communities through providing more diverse physicians who can better relate to their patients and therefore build the necessary bonds required to help the patient in their time of need.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Health; Minority; Community | Location: E11

Solheim Expedition
Jacob Pearlstein | Major(s): Psychology, Studio Art
Kevin Shanken

Climate change is real, and nowhere is it more evident than Icelandic glaciers. With even minor changes in the environment, glacial melt compounds, reaching higher and higher rates in a vicious melt cycle. Glacial retreat causes higher ocean levels and irreversible changes in global weather patterns, and despite the immense consequences, not many people recognize this occurrence. My peer Kevin and I set out to capture the fragility of an ice crystal in contrast of the immense power of an entire glacier, to capture the smallness of humanity next to these Earth systems. Our photographs establish an emotional conduit for people to realize just how powerful a glacier can be, and yet how easily one can disappear. These images serve to teach the reality of global climate change to the general population and to instigate action against the ever-increasing human impact.

Faculty Advisor: Rod Maclnnes, School of Art & Art History, Division of Arts, Humanities & Social Sciences
Keyword(s): Glacier; Photography; Climate | Location: F1
Project Presentations

Does Trisomy 21 Cause a Cilia Defect?
Andrew Pham | Major(s): Biological Sciences, Sociology

While Down syndrome is well understood for its physical implications, there is limited mechanistic knowledge of how trisomy 21 causes these morphological changes. Interestingly, attributes common to Down syndrome overlap with ciliopathy characteristics, a class of diseases caused by aberrant formation or function of cilia. Thus, the purpose of this work is to investigate whether trisomy 21 causes a cilia defect. Previous study in the Pearson lab by DF Galati notes that trisomic cells have shorter and fewer cilia than disomic cells. This defect, however, can be attributed to either the process of cilia assembly or to other factors that affect timing of cilia formation. Here, I show that cell cycle kinetics is not responsible for this abnormal cilia phenotype. Altered cell-to-cell contact similarly cannot explain these malformed cilia. Thus, I propose that trisomy 21 causes an autonomous cilia defect that arises from irregular ciliogenesis due to dysregulation of many cilia genes. By highlighting cellular changes caused by an extra chromosome 21, these findings carry significant future implications as the potential missing link to illustrate how trisomy 21 induces Down syndrome.

Faculty Advisor: Chad Pearson, Cell and Developmental Biology, University of Colorado Anschutz Medical Campus
Keyword(s): Trisomy 21; Cilia; Down Syndrome | Location: F2

Long-term Balance Changes in Patients with History of Concussion
Jenna Powell | Major(s): Biological Sciences, Psychology

Concussion is an especially injurious injury in athletes and is known to result in notable short-term balance dysfunction, though the longer-term effects on postural control are not well studied. Center of pressure (COP) metrics can be utilized to quantify quiet stance balance dysfunction with higher sensitivity than currently available clinical metrics. COP was used here to measure standing balance in athletes with history of concussion (n = 40, 20.1 ±1.5 yrs) and non-concussed athlete controls (n=40, 19.6 ±1.4 yrs). Patients performed standing balance tasks on force platforms. Linear metrics (average velocity, pathlength and 95% confidence ellipse area) and non-linear metrics (multi-scale entropy) of COP were calculated. Initial results show COP velocity was elevated in the concussion group compared to the controls. This may indicate continuing neurologic impairment long after subjective symptoms have resolved and athletes have been cleared to return to play.

Faculty Advisor: Bradley Davidson, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Mild Traumatic Brain Injury; Postural Control; Center of Pressure | Location: F3

Effects of Mental Health Symptoms on Academic Performances of Sexual Assault Victims
Saman Rizvi | Major(s): Psychology, Sociology
Kerry Gagnon

Past research has shown that academic performance in students is negatively impacted by a sexual assault. However, the relationship of trauma-related mental health symptoms (specifically, PTSD and depression) after a sexual assault and academic functioning has yet to be explored. The current study asks whether college students who report an impact on their academic functioning experience greater PTSD and/or depression symptoms relative to students who do not report experiencing an impact. Forty-three college students were asked six different questions targeting different areas of academic functioning (i.e. overall impact, concentration difficulties, negative quality of coursework, dropping classes, taking a leave of absence, and withdrawing from extracurricular activities). Results indicated that students who reported dropping a class and concentration difficulties also had both higher PTSD symptoms and higher depression symptoms. Such findings can assist universities in addressing specific areas of cognitive functioning in their support efforts to keep students in school.

Faculty Advisor: Anne DePrince, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Sexual Assault; Mental Health Symptoms; Academic Performance | Location: F4
Musique Concrète for Laptops and DJ’s
Diego Rodoni  |  Major(s): Recording and Production

While some may argue that modern day music technology has undermined the use of acoustic instruments, new technological tools have created templates for creativity that blend both acoustic and electronic sounds, ultimately paying homage to the music of the past while paving the way for the music of the future. Current technology such as Ableton’s Push controller is the company’s most recent endeavor to integrate instrumentation, sampling, arrangement, sampling, and mixing into a single tool. The Push is a powerful, expressive instrument that gives you hands-on control without needing to look at a computer. Using this controller, I am designing an educational video that showcases the potential for creation of original compositions and productions purely using the device.

Faculty Advisor: Art Bouton, Lamont School of Music, Division of Arts, Humanities & Social Sciences
Keyword(s): Music; Technology; Composition  |  Location: F5

An Investigation: Lake Titicaca Frog Hemoglobin
Rebecca Rosenberg  |  Major(s): Molecular Biology

The world’s largest aquatic frog, Telmatobius coleus, common name Lake Titicaca Frog (LTF), is found exclusively within the Andean mountains in Lake Titicaca, on the Peru-Bolivia border. Novel adaptations have occurred in response to an exclusively aquatic existence at high altitude. Reduced lung capacity is complemented by the loss of requisite surface breathing; instead, characteristic body shakes diffuse oxygen through highly vascularized skin folds. Much like in humans, the hemoglobin molecule transports oxygen, however, the LTF DNA sequence remains unknown. Several primers developed in reference to the distantly related Xenopus tropicalis were used in “PCR-amplification” of the LTF hemoglobin genes. After “Sanger Di-Deoxy” sequencing, PCR fragments were organized into a cohesive unit, and “Primer Walking” will be used to sequence the remaining sections. Advancing the understanding of LTF hemoglobin provides insight into how this protein functions in an extreme environment, expands on earlier studies, and adds insight on the diversity of globin genes across vertebrates (including humans).

Faculty Advisor: Tom Quinn, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Lake Titicaca; Hemoglobin; Telmatobius Coleus  |  Location: G1

The Effect of Forest Fires on Host Plant Quality for Herbivores in the Colorado Front Range
Dexter Rowland  |  Major(s): Ecology and Biodiversity

Fire plays an influential role in vegetation distribution and structure globally (Bowman et. al. 2009). Few studies have investigated how fires affect trophic interactions. How fire severity affects the quality of herbivore host plants has important implications for herbivore-plant dynamics. Our study investigated how forest fires of varying severity affect the quality of wax currant plants as hosts for herbivores. We sampled plants from high-severity, low-severity, and unburned sites within the burn areas for three fires along the Colorado Front Range. We recorded leaf size, water content, toughness, and the relative percent carbon and nitrogen ratio (C:N) of the leaves. We found that fire severity had a significant effect on all metrics, and that wax currant plants from low-severity and unburned sites were higher quality for herbivores than wax currant plants from high-severity sites. Our results show that fire severity affects host plant quality which has ramifications for forest fire management programs.

Faculty Advisor: Shannon Murphy, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Fire; Plant; Herbivore  |  Location: G2
Project Presentations

Unseen, Unheard, and Unspoken: Examining News Media Coverage of Victimized Children

Ani Rshouni | Major(s): Criminology, Psychology
As an avid consumer of different types of media, I have been interested in the types of voices and the politics associated with them that we hear, shaping the framework of public thought. In particular, this project focuses on the voices typically not heard - the younger children and teenagers that have tragically passed. These young boys and girls that are mentioned in the news seem to have different coverage than their offenders, the men and women that took their lives through violent acts. My project aimed to see why that is, and why some children receive more public acknowledgment and coverage than others. In order to do so, I have narrowed down a time frame, covering murders resulting from heinous crimes and mass killings. Between the years 2010-2013, which child gets more coverage? Which crime gets the most coverage? Which underlying themes of these murders predict the amount of coverage? It is important to understand the underlying issues of these murders and why not all children receive the same amount of coverage - after all, they are the future.

Faculty Advisor: Jeffrey Lin, Sociology and Criminology, Division of Arts, Humanities & Social Sciences
Keyword(s): Criminology; News Coverage; Child Homicide | Location: G3

Planting the Seeds of Higher Education

Oscar Saenz | Major(s): Marketing
The importance of higher education is a well known fact, well what if this well known fact wasn’t known to you? Addressing and planting a seed of knowledge in K-5 families and students in title 1 schools is the key to making an impact. Instead of trying to motivate just the students to go to college in the future, let’s start with the parents. Parent support is the main factor in a students decision on careers after high school. By educating parents through seminars and workshops we can show the importance of college education while serving the community.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Education; Community; Development | Location: G4

Neuroprotective Potential Of Betacyanin and Its Catechol Derivative Against Mechanistically Distinct Cell-Death Inducing Agents in Culture Cerebellar Granular Neurons

Todd Savolt | Major(s): Molecular Biology, Biochemistry
Neurodegenerative diseases are characterized by neuronal cell death commonly through oxidative and nitrosative stress mechanisms. For many patients with neurodegenerative diseases there is no effective treatment available to prevent or slow down the death of neurons. This has led to recent studies of nutraceutical antioxidants as potential therapeutic agents to stop cell death in neurodegenerative diseases. Betacyanin is a compound found in Dragon Fruit that previous studies have determined to be a strong antioxidant, which can protect cells from stressors commonly seen in neurodegenerative disorders. The neuroprotective effects of betacyanin in CGNs were examined against a variety of stressors similar to the ones seen in neurodegenerative disorders. It was found that betacyanin was able to effectively protect CGNs from glutamate excitotoxicity as well hydrogen peroxide and 5K apoptotic conditions. Neither betacyanin nor betanidin provided any protection from nitric oxide donors. Secondary mechanisms of protection that betacyanin can offer must be explored before it should be considered as a potential candidate for testing in pre-clinical models of neurodegenerative diseases.

Faculty Advisor: Daniel Linseman, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Betacyanin; Neuroprotection; Neurodegenerative disorders | Location: G5
Making Race and Nation, 2.0: Using Research in Moral Psychology to Analyze Political Strategies and Contexts
Burgandi Schlut | Major(s): Political Science, Socio-Legal Studies
Recent events have highlighted the necessity for a comprehensive approach to race politics. I propose that such an approach requires the use of research in disciplines other than Political Science; moral psychology, social psychology, and historical institutionalism, among other fields, have compelling insights to offer. To articulate this argument, I analyzed a leading framework in moral psychology, known as Moral Foundations Theory, and utilized that framework to qualitatively code the words and rhetoric of United State Presidents. In doing so, I hoped to exhibit the importance of considering disciplines which specialize in research on the individual when discussing the aggregates, an importance which Political Scientists so often seem to overlook.
Faculty Advisor: Elizabeth Sperber, Political Science, Division of Arts, Humanities & Social Sciences
Keyword(s): Moral Psychology; Race Politics | Location: G6

Automating Musculoskeletal Modeling Data Processing Using Python
Wystan Schmidt | Major(s): Computer Science, Mathematics
Holly Morrison
Over the next two decades, the number of total hip replacement surgeries is expected to increase by 174%, which will require improvements in both the procedure and the implants. OpenSim provides a way to generate movement dynamics for dynamic tasks, but the process is time consuming and labor intensive. This project used Python and the OpenSim API to create a programming tool to automate OpenSim movement dynamics data processing. This also made it easy to quickly compare healthy and implanted subjects. The Python programming tool decreased the time taken to generate the movement dynamics from approximately twenty hours per subject to two hours per subject. Across the dynamic tasks, the healthy subjects averaged a range of motion 10 degrees greater than the implanted subjects. We can generate movement dynamics for human subjects much faster, which will allow us to develop a better understanding of the stresses that hip implants will undergo when subjected to everyday physical activities.
Faculty Advisor: Paul Rullkoetter, Mechanical & Materials Engineering, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Biomechanics; OpenSim; Python | Location: M1

An Image Analysis of Protein ORC4 Forming a Three Dimensional Structure Enclosing Polar Body DNA
Darreon Schwartz | Major(s): Physics, Biological Sciences
The purpose of this project was to qualitatively analyze the formation of a 3D protein structure forming around polar body DNA prior to and during polar body extrusion during meiosis in female gametes. Quantitatively, it appeared that a DNA cage was forming around the DNA to be extruded in the polar body, but there was no empirical evidence to support that observation. In this project, the images were uploaded into Matlab, converted into a format in which they could be manipulated, and run through a variety of scripts to statistically prove the presence of a DNA cage around the polar body DNA. The presence of the cage was qualitatively proven through the combination of several techniques, including cross correlation analysis and intensity vs. distance data. The results of the image analysis provided further weight to the qualitative data obtained in the laboratory.
Faculty Advisor: Dinah Loerk, Physics & Astronomy, Division of Natural Sciences & Mathematics
Keyword(s): Image Analysis; Meiosis; Protein Structure | Location: M2
Project Presentations

The Effect of Metals on the Modulation of Tau Fibril Formation

Sophia Simina | Major(s): Biochemistry

With the aging population in the United States on the rise, neurodegenerative diseases will parallel this increasing trend. Tau is a microtubule associated protein, and one of the causes of Alzheimer’s disease is the formation of insoluble tau aggregates within the brain tissue. The presence of metals in the brain tends to be elevated in the pathological state. The research conducted focuses on the role of divalent cations in modulating the formation of tau fibrils. Various metal ions, as well as their concentrations, were used to investigate the presence or absence of a seeding barrier. The presence of the barrier in either the nucleation or elongation phase of growth was also considered. There is believed to be a barrier observed in the condition involving low micromolar concentrations of Cu^{2+}, though more research is being done to investigate the threshold of Cu^{2+} concentration necessary to observe the barrier.

Faculty Advisor: Martin Margittai, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Tau; Metals; Barrier | Location: M3

Cell Motility in Sponges

Shaleigh Smith | Major(s): Molecular Biology

Despite sponges being seemingly simplistic organisms often associated with the everyday cleaning tool, they provide numerous insights into the evolutionary path of life on this planet. This project explored different ways to access and track the internal cellular movements of a sponge in order to study the relationships between genes and proteins. This is the kind of information that can be used to fill in the gaps of evolutionary history. In order to dive into this vast, molecular world this research project strove to insert fluorescently tagged DNA, that carries genetic information, into live sponges in order to track cells via fluorescent light. The method of inserting this DNA was electroporation, using electricity to open cell membranes and allow the influx of the DNA that could then be imaged by microscope and compared to each other. While there were no significant results for tracking specific cell movement, the project resulted in a successful electroporation protocol of sponges. In addition, the project was the start of several promising new ideas for DNA insertion that are currently being tested in the lab such as new DNA sequences and different fluorescent tags.

Faculty Advisor: Scott Nichols, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Sponges; Fluorescence | Location: M4

Effect of Fire Severity on Herbivore Damage of Wax Currant

Timothy Smith | Major(s): Biological Sciences

Multiple climate change models predict an increase in forest fire occurrence and severity in the near future. Forest fire disturbance is known to affect multiple ecological interactions, but there is little evidence for how fire affects herbivore damage and none in mountain systems. We surveyed three separate fires in Pike National Forest to investigate the effects of fire severity on overall herbivore damage as well as damage done specifically by the butterfly species Polygonia gracilis zephyrus on wax currant (Ribes cereum). Wax currant is an important source of food and cover for wildlife in the Colorado Front Range. We found that severity alone and the interaction between fire location and severity have a significant effect on overall herbivore damage. In addition we found that fire severity and plant size significantly affect the amount of P. g. zephyrus damage to plants. Our results show that herbivores in general cause the most damage to wax currant in low severity and unburned sites rather than high severity sites, and damage by the butterfly P. g. zephyrus is found most commonly in unburned sites.

Faculty Advisor: Shannon Murphy, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Herbivore Damage; Fire Severity; Wax Currant | Location: M5
Project Presentations

Vertex-Specific Intercellular Adhesion Dynamics Drive Epithelial Morphogenesis
Celia Smits | Major(s): Molecular Biology, Biochemistry
Tim Vanderleest
Adherens junctions, the adhesive contacts between epithelial cells, must be remodeled during the architectural rearrangements of processes like wound healing and morphogenesis, in order to maintain tissue integrity while transducing physical forces. The regulation and dynamics of intercellular adhesions during these massive tissue re-shaping events, however, remain poorly understood. Here, we characterize a novel mechanism of adherens junction sliding in the process of Drosophila melanogaster germband extension. We show that the transmembrane adherens junction component E-cadherin and the molecular motor Myosin II exhibit previously uncharacterized tricellular vertex specific behaviors. E-cadherin and Myosin II are highly enriched at cell vertices, and undergo oscillatory changes in localization and intensity. We found that vertex-associated E-cadherin behaviors rely on medial Myosin II flows and endocytosis-dependent redistribution of cortical E-cadherin. These results suggest that the regulation of intercellular adhesions at tricellular vertices contributes to the anisotropic force generation that drives cell intercalation during Drosophila embryogenesis.

Faculty Advisor: Todd Blankenship, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Intercellular Adhesions; Morphogenesis; Germband Extension | Location: M6

Optimization of an Optical Zinc Sensor GZnP by High-Throughput Screening
Lea Son | Major(s): Biochemistry
Zinc is a trace element that is critical to normal physiological functions such as the growth, development, and differentiation of all types of life; dysfunction of zinc metabolism is closely associated with many severe neurological diseases, such as Alzheimer’s, Parkinson’s, hypoxia-ischemia, and epilepsy. In order to determine how free zinc affects homeostasis, it must be monitored in cells using sensors. After multiple high-throughput screening assays of sensor variants, I identified and isolated a few optimized sensors with improved brightness and dynamic range, which will ultimately be used for better monitoring zinc signals with higher resolution in live cells under varying conditions.

Faculty Advisor: Yan Qin, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Zinc; Flourescent; Sensor | Location: M7

Creating a National Readership for Harper’s Weekly in a Time of Sectional Crisis
Ashly Stewart | Major(s): English, History
My project asks how one of America’s first national publications, Harper’s Weekly, covered the Sectional Crisis and Civil War from 1857-1865. In the first phase of the project, I seek to understand how a periodical appealed to a heterogeneous, rapidly splintering audience in the face of crisis. In the second phase, I analyze how the periodical’s platform and identity changed once crisis became war. I consult abundant primary source material—including editorials, illustrations, and cartoons—from the periodical itself, as well as secondary literature that places Harper’s Weekly within the context of the mid-nineteenth century and its publication history. I ultimately argue that the periodical’s early national aspirations evolved to be nationalistic goals once the war began. Understanding the roots of American national media sheds light on the struggles our media faces today, especially in terms of bias, narrow audiences, and timeliness.

Faculty Advisor: Susan Schulten, History, Division of Arts, Humanities & Social Sciences
Keyword(s): Periodicals; Civil War; Publication History | Location: M8
Project Presentations

Structural Analysis of the MftB-MftA Binding Site by HDX
Hallie Stolte | Major(s): Biochemistry
Faculty Advisor: John Latham, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): n/a | Location: M9

Access to Higher Education for Asian Americans
Brendan Teck | Major(s): Emergent Digital Practices, Strategic Communication
The purpose of this project is to analyze barriers of access to higher education for Asian American Pacific Islanders (AAPIs). Historically, higher education and pop culture has undermined the need to understand AAPI students due to stereotypes of AAPIs as model minorities who achieve great academic success. These stereotypes cloud the ethnic diversity within the AAPI group and perpetuate the idea that AAPI students succeed at higher rates than other racial groups and are not in need of additional support, rendering their experiences invisible.
Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Higher Education; Access; Asian American | Location: M10

Towards the Structural Determination of a Natural Product from M. Tuberculosis
Mason Tuttle | Major(s): Biochemistry
Faculty Advisor: John Latham, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Modification; Post-translational | Location: M11

Dysregulated Cortisol in High Risk Infants Predicts Poor Sleep Quality
Haley Umans | Major(s): Psychology, Biological Sciences
In early development, constant stress responses due to the result of difficult family environments or traumatic events, cortisol levels can be chronically elevated causing general wellness problems (e.g. susceptibility to illness, anxiety, etc.). One explanation why cortisol causes these problems may be due to the role of diurnal cortisol regulation in sleep. This study examined how dysregulated diurnal cortisol in a high risk population may be predictive of infant quality of sleep. We hypothesized that higher levels of salivary cortisol, demographic risk score, and a greater number of parental adverse childhood experiences would predict lower sleep percentage calculated with actigraphy in infants. Final analyses explained that minority status, number of parental adverse childhood experiences, and cortisol at noon and bedtime were predictive of child’s quality of sleep. The results imply that sleep may play a role in the mechanism that causes negative health outcomes in infants with often stress responses.
Faculty Advisor: Sarah Watamura, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Cortisol; Sleep; Infant | Location: M12
Higher Bedtime and Flatter Diurnal Cortisol for Infants with Higher Risk
Haley Umans  | Major(s): Psychology, Biological Sciences
The dysregulation of cortisol has detrimental developmental implications. Cortisol is a biological marker that is related to levels of environmental stress. Cortisol levels fluctuate throughout the day as part of a homeostatic process of the body. An environmental factor that could affect the dysregulation of the cortisol may be due to adverse life experiences of the parent. While the effect of adverse childhood experiences is well studied on the person with the experiences, little research has examined what impact this may have on the person’s offspring. This sample is derived from a toxic stress study of a high risk population that examines families with a child enrolled in Early Head Start. The research found that there was an effect of demographic risk and mother’s adverse childhood experiences on the cortisol regulation of the child in various forms. These results suggest the prevalence inter-generational effects of risk and early life stress.
Faculty Advisor: Sarah Watamura, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Cortisol; Infant; Risk  | Location: M13

Crosstalk between p53 and Myc: Investigating Gene Interactions in Cancer
Kylie Van Hoesen  | Major(s): Biological Sciences
Cancer is the second leading cause of death in the United States, and its complexity continues to challenge scientists. Cancer occurs due to the accumulation of genetic mutations. The tumor suppressor gene p53 is the most frequently mutated gene in human cancers. However, the expansive signaling network of p53 is not fully understood. To better understand the role of p53 signaling, we studied the interactions of p53 with an oncogene Myc, which is known to increase the progression of cancer. Prior analysis predicted a correlation of p53 activity with the downregulation of Myc. We investigated the levels of Myc activity following p53 induction as well as the cellular response to p53 in the absence of Myc. We found that without Myc, the apoptotic response was decreased following p53 activation. By understanding the p53 genetic network, the goal is to create more specific and effective therapeutic methods against cancer.
Faculty Advisor: Nancy Lorenzon, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Cancer; Tumor Suppressor; Oncogene  | Location: M14

Income Discrepancy and Commitment in Romantic Relationships
Patrick Vandenberg  | Major(s): Psychology
Kayla Knopp
Research shows that financial investments and constraints can affect commitment in romantic relationships, but it is unclear how this process works in couples with discrepant income. This issue might be further complicated by changing norms in gender roles in mixed-gender relationships. We hypothesized that income discrepancy would be associated with greater constraint and lower relationship quality. Participants (N=1012) were from the first wave of a longitudinal study on relationship development and answered questions about their economic well-being and romantic relationship functioning. Results showed that participants who made less money than their partner reported more financial constraint in their relationship than participants who made roughly the same amount of money as their partner. Income discrepancy did not significantly predict any other aspect of relationship commitment or quality that we examined. Further, gender did not moderate any of these findings, suggesting that this process works similarly for men and women. These findings can help us better understand the roles of financial independence in people’s decision-making about romantic relationships.
Faculty Advisor: Galena Rhoades, Psychology, Division of Arts, Humanities & Social Sciences
Keyword(s): Income Discrepancy; Commitment; Romantic Relationships  | Location: M15
Project Presentations

Immigration and Education
Chhorda Vuth | Major(s): Biological Sciences
My motivation for this project is that I grew up in Cambodia, and moving to the U.S. was really challenging for me. The culture and language difference was the most challenging experience that I overcame. I was not exposed to enough resources to help me adapt to the culture and to integrate myself into the new community. I found it really frustrating to go to school because of the language barrier and the lack of the American culture. At the time, I wished I had a mentor to help me through the process. The problem that I found is that immigrant students do not receive enough support in and outside of school to help them with their education and their integration into their new communities. I am still doing research to learn more about the issues and the gaps that make it challenging for immigrant students. My goal by the end of my four years at DU and as a Puksta scholar is to create a mentorship program to help immigrant learn English faster and ease them into their new community.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): Immigrants; Education; Students | Location: M16

Effectiveness of Marine Bioparticles as Ice Nuclei
Rachel Wegener | Major(s): Physics, Environmental Science
Clouds play a vital role in climate as regulators of the radiative balance of the earth, transporters of trace gasses, and facilitators of the hydrologic cycle. In order for clouds to form they need nuclei upon which water can condense and, in the mixed-phase clouds predominant at the mid-latitudes, also to freeze. While there are ample particles in the atmosphere that are potential nuclei, some particles nucleate better based on shape and hygroscopicity. In order to better understand the formation and presence of clouds in the atmosphere, this study has assessed the ice nucleation abilities of particulates collected off Reunion Island, an island situated off the east coast of the African continent exposed to the open ocean. As a result, this study focused on the nucleation abilities of particles of oceanic origin as well as particles undergoing long range atmospheric transport.

Faculty Advisor: Alex Huffman, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Ice Nucleation Particles; Bioparticles | Location: M17

Developing an Educational Hebrew Game
Kendall Weistroffer | Major(s): Computer Science
Both traditional games and video games have been used to further skills taught in the classroom setting and reinforce their importance and usage in daily life. It has been suggested by previous research that in order to effectively teach a foreign language, games that are used in this setting must provide students with realistic scenarios that challenge students to draw upon prior knowledge of the language and apply newly taught vocabulary. For this reason, the game sentence completion game — "Complete" — was created at University of Denver’s Daniel Felix School for Computer Science in conjunction with Professor Sari Haviv of the University of Denver’s Department for Judaic Studies in order to provide Hebrew language students at University of Denver with an effective and different way to practice their most recent Hebrew vocabulary and grammar skills. In this manner, students are presented with an additional study tool that can be used in order to prepare for tests and quizzes, and increase the methods that Hebrew learners and educators can use to present and reinforce relevant material.

Faculty Advisor: Chris Gauthier-Dickey, Computer Science, Daniel Felix Ritchie School of Engineering and Computer Science
Keyword(s): Hebrew; Video Game; Education | Location: M18
Project Presentations

Do Gar Melanocortin Receptor Interact with the Accessory Proteins, MRAP1 and MRAP2?

Emily Waveron | Major(s): Biological Sciences

The objectives of this study were to determine whether ligand sensitivity for either ACTH or Î±-MSH was affected when gar (g) melanocortin receptors were co-expressed with either accessory protein gMRAP1 or gMRAP2. The results indicated that gMC2R requires co-expression with gMRAP1 for the receptor to be activated by hACTH(1-24), and no activation occurs with co-expression with gMRAP2. Increases in sensitivity to hACTH(1-24) when gMC4R or gMC5R were co-expressed with MRAP1 was observed, though not with gMC1R or gMC3R. Only co-expression between gMC3R or gMC4R with gMRAP2 demonstrated changes in sensitivity to NDP-MSH. Since the gar lineage appeared early in the radiation of the bony fishes, it appears that interactions emerged between some gMCRs and gMRAP1, but minimally with gMRAP2. Hence, observations that gMRAP2 affects the functionality of at least gMC4R in mammals indicates that those interactions evolved long after the bony fish lineage diverged from the lineage of bony vertebrates.

Faculty Advisor: Robert Dores, Biological Sciences, Division of Natural Sciences & Mathematics
Keyword(s): Gar; Melanocortin Receptors; MRAPs | Location: M19

The Use and Behavior of Allyl Samarium Bromide as an Alternative Grignard Reagent with a One-pot Derivatization of N-substituted Oxindole and Isatin

Michael Wright | Major(s): Chemistry

Carbon-carbon bond formation is one of the most useful reaction types in organic chemistry. A common reagent class used for carbon-carbon bond formation are Grignard reagents. Allyl samarium bromide is an alternative reagent that can act as both a nucleophilic reagent and a single electron transfer reagent in the reaction of substituted isatin and oxindole. The reaction can be temperature controlled to yield partial or full reduction of the carbonyl providing diverse products. Addition of an allyl group is of interest due to its ability to be functionalized in several different ways.

Faculty Advisor: Bryan Cowen, Chemistry & Biochemistry, Division of Natural Sciences & Mathematics
Keyword(s): Allyl Samarium Bromide; Organic Chemistry; Grignard Reagent | Location: M20

Community Organizing in Denver Public High Schools

Katherine Zapata | Major(s): International Studies, Computer Science
Monsi Vasquez, Alyssa Bekerman

Students from the University of Denver’s Center of Community Engagement and Service Learning have coached 3 South High School classes for an academic year as part of the Public Achievement Program. Throughout the year, coaches trained students on community organizing and helped them identify social justice issues that are prominent in their communities. Through conducting service learning projects, the students were able to take on an active role in their communities and make a difference.

Faculty Advisor: Ryan Hanschen, Center for Community Engagement & Service Learning, Undergraduate Academic Programs
Keyword(s): DU Public Achievement; Social Justice; Community Organization | Location: M21
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## Other Student Research

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