2015
Colorado Springs Undergraduate Research Forum
(CSURF)

April 4, 2015
Colorado College
The Colorado Springs Undergraduate Research Forum (CSURF) is a collaborative venture designed to highlight the accomplishments of undergraduates from Colorado College, the United States Air Force Academy and University of Colorado Colorado Springs. In its twelfth year, the conference has grown to more than 450 participants and continues to reflect the commitment and dedication of our faculty and staff to our students from all disciplines -- the arts, humanities, engineering, natural, and social sciences. The event gives undergraduate students from all three institutions the opportunity to present their research and creative work in a formal academic setting and receive feedback from scholars and peers. The CSURF also helps students to polish the skills involved in formal presentations, job interviews, or continuing education through graduate/professional study. Rotating between campuses, each year brings new students, research and opportunities for expression and collaboration. Thank you for joining us at Colorado College for our 2015 conference. The University of Colorado Colorado Springs is the host for the 2016 research forum (date TBD). Find out more about the CSURF at www.uccs.edu/csurf.

The following 2015 CSURF Committee Members would like to thank you for your interest and participation in the CSURF

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Keynote Speaker
Noon- 1:00
Gates Common Room

Professor Anne Hyde
History Department, Colorado College

From the Lucky Sweatshirt to the Blogosphere: Adventures in Writing and Researching History

Professor Anne Hyde will talk about her research life as a historian, beginning with an undergraduate project that led to graduate school, then teaching and a series of prize-winning books. Her work in the history of the American West enables her to work as a public intellectual, engaging with students, classroom teachers, professional re-enactors, writers, bloggers and a few trolls.
The Rebirth of Education…or a Modern Renaissance

C2c John Stanley
Faculty Advisor: Lt Col Rouven Steeves
United States Air Force Academy

The purpose of this paper is to revive the conversation on the importance of a liberal education (or, as it is also often referenced, a classical education). This conversation has a rich history that dates back more than 2,500 years, showing a remarkable continuity. This marked consistency has much to do with the fact that people saw such an education as being the only way of nurturing virtuous citizens, which are undeniably the lynchpin to maintaining a vibrant and ordered republic. Therefore, this paper will draw heavily upon this conversation and those pivotal figures who have expounded upon the merits of a liberal education in order to breathe new life into the conversation regarding the need for a foundation in a liberal education, rooted in the Great Books tradition. Specifically, it will focus on delineating what we mean by a liberal education and what such an education will accomplish. It will explain historical understanding of classical education by illuminating its iteration and reiteration during the course of its history since the mid-5th C B.C. In no small part its longevity stands as a testimony of its importance with respect to nurturing a foundation that would lead to virtuous citizens. Whatever its failings, it was seen as the only way of providing citizens with the ability to see the good, the true and the beautiful, which alone made virtue a real possibility and which alone could sustain a republican form of government. By understanding what a liberal education entails, we realize we still need it in our modern age. In sum, this paper offers a plea to revive a conversation that has been ongoing for the last two and a half millennia.

Coleridge’s Shifting Subjects in Dejection: An Ode

C2C Nolan J. Mayhew
Faculty Advisor: Dr. Richard Johnston
United States Air Force Academy

When examining the works of Samuel T. Coleridge or any British Romanticist, it is impossible to separate their literary works from their biographical narratives. More than any other writer in the Romantic period, Coleridge’s individual circumstance and mental state influenced his works. Coleridge’s highest stretch of productivity was between 1795 and 1802, where he composed his Conversation poems in addition to The Rime of the Ancient Mariner, Christabel and Kublai Khan. Coleridge’s newfound psychology and moral framework strongly shaped this period of his life and work, namely his championing of subjective
experience trumping an external imposition of moral truth. Despite a newfound philosophy and framework for living, he could not reconcile a subjectivist approach to living and writing with his relationship with Sara Hutchinson, an unrequited love. Another facet of Coleridge’s personal life pulling him away from a subjective experience philosophy was his desire to seen as the center of the British literary and intellectual universe, a space occupied by his close friend, William Wordsworth. His “Letter to Mary Hutchison” encapsulates Coleridge’s inability to reconcile his philosophical pursuits with his personal and professional longings. Upon editing, he develops the letter into “Dejection: An Ode.” Ultimately, this paper examines the inconsistencies between the two works, and uses those inconsistencies to illuminate Coleridge’s ultimate contradiction regarding his subjective experience philosophy and his desires.

The Marathon: An Examination of Beauty and Sublimity

C3C Leah Young
Faculty Advisor: Dr. Richard Johnston
United States Air Force Academy

This research explores the relationship between beauty and sublimity within the context of a marathon. In this paper, I argue that a marathon is neither entirely sublime nor beautiful, but an extraordinary combination of both. Where is the allure in a distance race? Why do thousands of runners willingly subject themselves to its grueling demands? The answer lies deep within the formidable miles of a distance race, where the exhausted mental state is able to experience a unique construction of beauty and sublimity. In this paper, I examine the element of beauty through a discussion of Elaine Scarry’s “On Beauty and Being Just.” Scarry discusses the exchange of power between the beautiful thing and the perceiver that brings about a sense of passion. This concept of beauty perfectly illuminates the marathon experience. I examine the element of sublimity with a discussion of Percy Bysshe Shelley’s “Mount Blanc.” As Shelley describes his encounter with the Swiss Alps, he defines a sublime experience as something achieved through a submission to terror, which eventually leads to a heightened state of being. By collapsing the distinction between two categories of aesthetic experience, this paper uncovers a surprising parallel between artistic and athletic endeavors.

Disconnect of Intent: The Disparity between Teacher Intention and Student Interpretation Concerning Page Requirements in College Writing

Christopher Varano
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs.

Writing is a critical part of teaching in nearly every discipline, and many papers have some type of page requirement. Faculty blend learning goals into the creation of their writing assignments and design writing assignments so that they are efficient and effective in their pedagogical aims. For teachers, it seems, the reasons for the length of papers are clear. Student reactions to the length of assignments are a less discussed topic. “This Was an Easy Assignment” by Jennie Nelson studies a group of teachers and students to determine the teacher’s motives, and the students’ reactions to different writing assignments. Her research makes clear that students operate within the parameters of the assignment with the primary goal of completing it. Nelson shows that they pay little mind to the purpose of the assignment. This finding,
along with the disparate amount of research conducted between teachers’ reasons for -- and students’ reaction to -- assignment length, shines a light on an interesting question: Why is the message of the purpose of writing being lost on the students? Do assignment parameters affect student invention? In what ways? Why do teachers see page requirements as functions of content, but students see them as the end goal?

Finding the answers to these questions is the motivation for my research. I interviewed three college level professors and surveyed over fifty college students. The research includes their opinions about page requirements, the purported reasons for those requirements, and the students’ reaction to those requirements. The goal is to determine two main points: Is there actually a gap between student and teacher understanding of the efficacy of page requirements? Is there a solution to bridging that understanding between teacher and student? This study will serve as a starting point to get more students thinking about, and more teachers explaining the reasons for, the length of writing assignments.

**Werner Campus Center 213**  
**Mathematics and Modeling**

The Accuracy and Stability of Störmer-Cowell Methods

**C2C Justin Ng**  
Faculty Advisor: Dr. Michelle Ghrist  
United States Air Force Academy

Störmer and Cowell Methods are multistep methods used to numerically solve second-order initial value problems where the first derivative does not appear explicitly, i.e. \( y'' = f(x,y) \). The methods are combined to create a predictor-corrector method. I will discuss the derivation and implementation of these methods as well as preliminary results on analyzing their accuracy and stability.

**A Three-Species Model with Predator-Prey, Competition and Mutualistic Interactions**

**Minqi Liu**  
Faculty Advisor: Andrea Bruder  
Colorado College

Brown, Bruder and Kummel’s research project on the predator-prey interaction of aphids and ladybugs on yucca plants inspired my project. An important feature of this study system is that it contains ants as a third species. Therefore, this ecological system is composed of a predator-prey relationship between the ladybugs and aphids, a competitive relationship between the ladybugs and ants, and a mutualistic relationship between the aphids and ants.

Most existing mathematical models study one type of interaction, or they focus on three species and study a tri-trophic food chain. We develop and analyze a new mathematical model that includes the predator-prey interaction as well as the competitive and mutualistic aspects of the system. The Rosenzweig-MacArthur model describes the predator-prey interaction, assuming logistic growth of the predator. To build a
mathematical model for the competitive and mutualistic relationships, we use a modified Lotka-Volterra model and include terms representing competition and mutualism. Since the three-species model is substantially harder to analyze, we first study the three submodels, i.e. the predator-prey, competition and mutualism model. Then we use the submodel results to explore the three-species model and the significance of its parameter values. With the help of Mathematica and MATLAB, we construct phase planes and time series plots, find the equilibria of the systems, determine the stability of each equilibrium and conduct a bifurcation analysis.

St. Paul’s Cathedral:
The Scientific Vision and Architectural Genius of Sir Christopher Wren

Davis Tutt
Faculty Advisor: Ruth Kolarik
Colorado College

Sir Christopher Wren is the most significant architect in England’s history because of his keen scientific perspective, diligence in rebuilding London following the Great Fire of 1666, and ability to visualize London, as it would be centuries after his death. His most well known work, St. Paul’s Cathedral, is a direct representation of the empirical mindset espoused by the philosophers and thinkers of Great Britain throughout the Restoration in the 17th century. While extensively considering the aesthetic components and historical impact of his work, art historians have long undervalued the way in which Wren’s early life in science enhanced his legacy. To analyze Wren’s existence only in the context of his architectural creations is to dismiss a large portion of his genius, as he based the whole of his artistic endeavor on the studies and experimentation of his time spent as a natural philosopher. Although Sir Christopher Wren never relinquished his scientific interests, during the second half of his life he applied the doctrine of the New Science, as proposed by the Royal Society, to the implementation of architecture. This approach allowed Wren to erect St. Paul’s Cathedral and crown it with a revolutionary dome that had no precedent, implementing techniques never before used. I will present research and photography gained from rare access to the St. Paul’s Cathedral Library and the Royal Society Archives.

Worner Campus Center 216
Non-profits and Leadership

Indy Give! Campaign Analysis

C1C MacKenzie Paul, C1C Christiana Fairman, C1C Joseph Hays
Faculty Advisors: Dr. Jim Lowe, Maj Jesse Pietz, Capt John Miller
United States Air Force Academy

Since 2010, the Colorado Springs Independent Give! Campaign has provided training, consultation and an opportunity to garner funds for various nonprofits in the Pikes Peak Region. Give! is familiar with general managerial aspects of nonprofits, and they track simple summary statistics. However, they seek to understand donation patterns and trends in order to better instruct nonprofits with how to interpret this information and implement policies to become more successful. In order to assist Give! we target specific
topics such as shared donors, donor zip code analysis, donor gender/age comparisons, etc. We develop a model to mass produce descriptive analysis booklets or "snapshots" for all 75 nonprofits involved in the 2014-2015 Give! Campaign. We show how to guide campaign policies with a deeper understanding of the underlying patterns and trends highlighted by our snapshot.

AlloSource Tissue Storage Optimization

**C1C John Hamm, C1C Andrew Reese, C1C Taylor Vonasek**
Faculty Advisors: Maj Jesse Pietz, Capt Taylor Leonard
United States Air Force Academy

AlloSource, a nonprofit bone and tissue bank in Centennial, Colorado, offers more than 200 types of bone and tissue grafts for life-saving and life-enhancing medical procedures. Any opportunity to improve their operations comes with the immediate impact of saving lives. The current process for placing these grafts into their storage freezers consists of inspecting them for available space, this leads to inaccuracy and inefficiency. We address this problem by first developing a tool that tracks organization and utilization of freezers, and then incorporating a product storage algorithm that minimizes wasted freezer space and maximizes employee productivity. We demonstrate that our tool allows AlloSource improve inventory control accuracy by eliminating the need to inspect freezers during product placement.

Engaging Cadets on Leadership: Student Stories from a Pedagogical Revolution

**C2C Christy Cooper, C2C Stone Frankford, C2C Melaine Valentin**
Faculty Advisor: Dr. Steven M. Samuels
United States Air Force Academy

Interestingly, many cadets at the Air Force Academy despise leadership classes. An institution designed to develop military leaders has disengaged and disinterested their officer candidates from learning and practicing leadership. The Behavioral Sciences and Leadership Department, well aware of this problem, established a revolutionary program that sought to improve leadership lessons. Instead of taking a class for one semester with random cadets during an academic period, the experimental course covers a full year, taught to a single squadron cohort in the squadrons. The overall goal was to positively affect overall cadet attitude toward the learning and practice of leadership, and to foster an environment where teamwork and cohesion is encouraged. We examining the stories cadets are telling about the course to determine if the course is effective. Using teams from three of the five squadrons in the program, this research actively sought out experiences from all cadets, not just those who were supportive of the experiment or comfortable volunteering their opinions.

The squadrons participating in the experimental leadership class each have their own unique identities and atmospheres. Ranging from outspoken and opinionated to quiet and thoughtful, they represent the different squadron environments experienced across the wing. We matched each of these squadrons with a similar squadron that was not involved with the experimental class to act as a control. In the matched squadron, juniors took the regular leadership course in either the fall or the spring semester. We selected eight juniors from each of the trial squadrons and its matched control and we asked questions regarding class cohesion, attitudes and application of leadership. We compared and analyzed the responses of experimental and
control squadrons. Results indicated successes and failures of the experimental program, with advice for how to continue for the following year.

**Cornerstone Arts Center 301**
**Engineering**

Development of the USAFA Small Unmanned Aircraft Systems (SUAS) Test and Evaluation Course

**C1C Warren Saunders**
Faculty Advisors: Maj R. Adam Gorrell, Dr. Kurt Heppard
United States Air Force Academy

The United States Air Force increasingly relies on Small Unmanned Aircraft Systems (SUAS) to accomplish its mission. As these systems have become more common and as SUAS capabilities have become more numerous, the United States Air Force Academy (USAFA) has envisioned and designed programs to increase cadet competencies in this important mission area. This project develops an operational test plan for an emerging SUAS program at USAFA. The background of SUAS programs will be presented and then the technical and organizational aspects of a test plan will be discussed. An example of the SUAS will be on static display.

Last Glacial Maximum in the Culebra Peak Area of the Colorado Sangre De Cristo –
Results of Paleoglacial Numerical Modeling

**Erica Evans**
Faculty Advisor: Eric Leonard
Colorado College

The Culebra Peak area of the southern Colorado Sangre de Cristo Range was extensively glaciated at the time of the Last Glacial Maximum (LGM), about 20,000 years ago. This project makes use of a 2-D coupled glacier energy/mass balance and flow model (Plummer and Phillips, 2003) to investigate the climatic conditions that could have sustained glaciers in the range at their LGM extents. Modern climate input to the model came from several sources including PRISM climate grids, and SNOTEL and meteorological station data. The mass balance component of the model calculated annual snow accumulation and potential ice ablation across a 60m topographic grid of the study area, using a combination of these modern climate data and instructions on how to alter climate to try to simulate LGM conditions. The mass balance model output was then fed into the ice flow model to grow the glacier that would have developed in response to that climate input. Models were run iteratively until a good fit was found between the modeled glaciers and the actual mapped LGM ice extent. Model results indicate that, assuming no change from modern precipitation, a 5.3°C temperature depression compared to the present would have been necessary to sustain the paleoglaciers. A halving or double of LGM precipitation compared to the modern would have necessitated -8.1 and -4.3°C temperature depressions respectively. This work was undertaken as part of a larger study that is making use of mapped glacial extents to characterize LGM climate along the crest of the Rocky Mountains from northern Montana to south-central New Mexico. Global climate models have suggested that during LGM the Pacific Northwest and northern Rockies were much drier than today but
that, at least in the winter, precipitation was strongly enhanced in the Southwest and southern Rockies. Results from modeling in the Cuelebra Range, along with results of other modeling completed to date, corroborate these predicted patterns in LGM precipitation.

Precision Air Drop

**C1C Max Johnson, C1C Kyle Morse**
Faculty Advisor: Lt Col Tim Pettit
United States Air Force Academy

Air drops are used by the United States military to bring emergency supplies to troops on the ground or even to civilians in other countries in need of supplies. There are several methods to precision air drops, the most accurate being the JPADS unit, which is a $20,000 controlled parachute. Our mission is to utilize an unmanned/uncontrolled bundle by using the Computed Air Release Point (CARP) given by the Consolidated Airdrop Tool (CAT), which we believe we can optimize by gathering not only drop altitude winds and ground winds, but also winds at various altitudes to give a more accurate release point.

Kinetic Energy Transfer of Near-Earth Objects for Interplanetary Manned Missions (KETNEO-FIMM)

**C1C Winston Sanks**
Faculty Advisor: Lt Col Scott Putnam
United States Air Force Academy

This report outlines the rationale, procedures, technical feasibility, risk assessment and cost-benefit analysis of utilizing a Near-Earth Object, 101955 Bennu (provisional designation 1999 RQ36 - the target of the OSIRIS-REx mission), as a source of energy to minimize the propulsion requirements of an interplanetary spacecraft. The planet Mars is the target body in this study and the outbound Trans-Mars injection in the years between 2175 and 2199 will be analyzed (within this timeframe Bennu’s orbit is predicted to approach Earth within two Earth radii on at least 80 occasions). The Mars orbit insertion burn, Trans-Earth injection burn, and Earth orbit insertion burn are assumed to be achieved with propulsive maneuvers outlined in standard manned interplanetary mission architectures. To accomplish this mission, two methods of transferring kinetic energy are examined: direct capture and release of the asteroid by a spacecraft using a Kevlar net and an inertial reel, and indirect capture by establishing a station on the asteroid to manufacture compressed material from the carbonaceous regolith in order to fire a mass stream to be captured by the spacecraft. This mission architecture analysis takes into account the associated safety risks of perturbations within Bennu’s orbit (which could result in inaccurate rendezvous location predictions), the implications of altering the orbit of 101955 Bennu after transferring a portion of its energy (since there is a possibility of collision with Earth in the late 22nd century if the asteroid is slowed too significantly), g-limit restrictions of the spacecraft and its occupants during an acceleration by the asteroid, and the possibility of a collision between Bennu and the spacecraft. In addition, the cost-benefit considerations of this mission architecture are weighed. This examination concludes that a direct capture Net and Reel system aboard the spacecraft is not a viable capture method due to an insufficient maximum ∆V available through a best-case perfectly elastic collision (capture) with the asteroid, as well as a prohibitive weight penalty aboard the spacecraft due to the Net and Reel system. However, this report finds
that the method of establishing a station on Bennu with the capability to separate mass from the asteroid and fire it at a spacecraft is a plausible (if costly) means of transferring a significant ΔV. A KETNEO-FIMM Asteroid Station mission architecture could also be used in subsequent interplanetary missions providing cost-sharing over many decades for future interplanetary missions.

Cornerstone Arts Center 302
Lasers and Genetics

Zar Regulates Gene Expression in Eggs and Embryos

Kenneth Valles
Faculty Advisor: Amanda Charlesworth (University of Colorado Denver)
University of Colorado Colorado Springs

A Xenopus laevis (African Clawed Toad) egg embarks on its journey to adulthood by rapidly dividing after fertilization. There is very little time available to utilize the genes from both the mother and father, so the embryo uses genetic messages previously placed by the mother as instructions to make new material for the developing animal. Zar is a protein that controls when the genetic messages for specific genes are decoded and new material is synthesized. Currently, only two messages are known to be controlled by Zar, Wee1 and Mos, but we think there are more. Zar binds to messages at a specific sequence site called the TCS. We looked for TCS sites in other messages and found them in FZR1 and Oct-4, which have important roles in stem cells and development. To test if Zar binds these messages we shone UV light onto crushed eggs, creating a strong chemical bond between Zar and the adjacent molecules. Because we found Wee1, Mos, FZR1, and OCT-4 alongside Zar, we conclude that Zar binds to these new genetic messages in eggs.

Neural Networks, Genetic Algorithms and the Blood-Brain Barrier

Lodewijk Brand
Faculty Advisor: Matthew Whitehead
Colorado College

Certain kinds of drugs, like those that treat African sleeping-sickness and other brain related diseases, need to be able to pass through the blood brain barrier (BBB) to treat the patient. A medicinal synthetic chemist cannot simply look at the structure of a molecule to determine whether or not it will pass through the BBB. Instead, the chemist relies on expensive programming packages, or animal testing, to determine whether or not a drug will reliably get into the brain. This project focuses on creating a web-based application that will reliably predict whether or not a drug would pass through the BBB. The foundation for this application is an artificial neural network. In addition to neural networks, genetic algorithms are hypothesized to help improve the speed at which artificial neural networks learn. The methods used to create the hybrid genetic-neural network behind the application employ basic theoretical concepts from neuroscience, mathematics, computer science, and biology.
USAFA’s Department of Civil and Environmental Engineering aims to establish a static testing capability to enhance cadet education in the civil engineering program through demonstrations and laboratory work. Beyond enhancing cadet education, the department intends to lay the foundation for future cadet and faculty research in the structural technical area of civil engineering. This poster details an effort to design, integrate, and operationalize new and existing components for a static testing system. Major system components, i.e. what is generally required for a static testing system, are described, including basic laboratory infrastructure, test frame, force generation system, sensors and data acquisition system. The poster’s Conclusions and Lessons Learned outline test frame design considerations as well as limitations and relative cost of the main system components. Recommendations for future work include preliminary ideas for developing demonstrations and laboratory exercises for structural engineering classes and increasing capability through enhancements and additional components.

Effects of Sustained Attention on Perceived Mental Workload

C1C Jason Amick, C1C Derrick Pee
Faculty Advisors: Dr. Victor Finomore & Lt Col Chris McClernon
United States Air Force Academy

Many everyday tasks, from monitoring control displays to driving, require sustained periods of attention for the user to detect infrequent but potentially disastrous events. A ubiquitous finding in these supervisory type situations is a significant decline in signal detection over time. The United States Air Force employs operators whose job consists of monitoring displays for sustained periods. Although the task of monitoring displays for sustained periods of time is relatively simple, it places a heavy workload demand on the operator performing the task. In this paper, we present an investigation of the effects of perceived time on the operator’s perceived stress and mental workload. We hypothesize that participants who are told that a vigilance task will last twice as long as the actual time it takes (time flies condition) will experience lower perceived workload during the course of a 12-minute vigil than participants who are told the task will take half the time (time drags condition) or the actual time (control). Additionally, we hypothesize that the stress state levels and mental workload levels of the time flies condition will be lower than that of the time drags condition. Our results aligned with the hypothesis that the time flies condition increased performance and decreased workload and stress levels when compared to the time drags condition. These results can be integrated into various military tasks requiring prolonged attention, such as air traffic control, missile
detection and radar observations in order to improve operator’s performance and reduce their level of workload thus positively affecting mission success.

Development of Multimodality Display System for Air Force Battlefield Airmen

C1C Jason Amick, C1C Courtney Bishop, C1C Curtis Lackey, C1C Emilee Ledford, C1C Hunter Moody, C1C Jon Steinmetz, C1C Daniel Thomas, C1C Alex Warner
Faculty Advisor: Dr. Victor Finomore
United States Air Force Academy

The United States Air Force employs Battlefield Airmen to accomplish specific objectives over a broad spectrum of environments and scenarios. Battlefield Airmen are required to maintain high levels of situation awareness at all times on the battlefield in order to detect and mitigate potentially disastrous events and to successfully complete their objectives. Operators in the field used advanced wearable technology aid these in completing the mission. However, a major issue with the introduction of this technology is the overreliance of visual displays. Battlefield Airmen must now divide their visual attention between an environment that poses many threats and their wearable displays that assist them in their objectives (i.e. waypoint navigation, detection of friend or foe, text messages, map and video displays, etc.). The goal of this project is to create an integrated multimodality (visual, auditory, vibrotactile) system to effectively offload the need for visual attention and to increase the situation awareness of navigation task that compares the completion time of a navigation course while using visual, audio, and vibrotactile navigational cues. A see-through augmented reality helmet mount display was also evaluated using the Attentional Layer Testbed (ALT). The ALT measures the visual attention allocation during a threat detection task. The results from this study provide support to an integrated multimodality display system that improves the combat effectiveness and reduces the workload of Battlefield Airmen.

C1C Kelsey Applegate
Faculty Advisor: LtCol Christopher McClernon
United States Air Force Academy

Stress Exposure Training (SET) is a systematic training regimen that improves task performance under stress. While many stressful military operations rely on team performance, no research currently explores the benefits to conducting SET as a team. This study examines the efficacy of team stress training by presenting SET to dyads that then perform a collaborative, stressful split-task driving simulation. The researchers randomly assigned participants to team SET, individual SET or no SET conditions. Researchers compared groups using heart rate data, subjective stress evaluations, and performance measures. Given these parameters, we found SET to improve performance on a driving task. In addition, we also found team SET to be more beneficial than individual SET.
Understanding PTSD: Contemporary Study of Brain Injury Effects and Treatment

C1C Daniel Barbera, C2C Ryann Anderson  
Faculty Advisor: Dr. Brent Talbot  
United States Air Force Academy

Post-Traumatic Stress Disorder (PTSD) and traumatic brain injury (TBI) are increasingly endemic in modern soldiers and veterans. The study of these mental and moral injuries is exploding with new research that can help the soldier, clinician, and civilian understand and combat PTSD and TBI. The study includes literature-based research aimed to educate about the causes and effects of PTSD and TBI. Prevention techniques are a possible method to decrease the effects that trauma has on the brain. Psychology of killing and combat has complex methods of contaminating the brain. Lt Col Dave Grossman discusses a fear response to violence in soldiers, and how the response affects the physiological processes involved with killing another human being. He details the physical effects that violent stresses produce on humans in a combat environment. Post-trauma, proper handling of all spectrums of injuries by treatment facilitators is essential to managing trauma victims. Dr. Frederick Foote’s Epidaurus project is approaching veteran post-trauma treatment with holistic medicine focusing on literature and art. By increasing public knowledge on this growing issue in society, our hope is that all members, soldier, clinician, and civilian will be able to contribute to a culture that properly understands, manages, and treats the growing issues PTSD and TBI have on soldiers and veterans.

Implications of Handwriting Analysis in Relation to Self-Perception and History of Handwriting Instruction

Casidy Baur  
Faculty Advisor: Michelle Neely  
University of Colorado Colorado Springs

Many studies, such as those done in the past by researchers E.J. Eyesnck, Gisli Gudjonsson, Rebecca Warner and David Sugarman, have been conducted that show certain characteristics of a person’s handwriting that can be used to identify aspects of their personality. What has been missing from past research is the aspect of self-perception when it comes to reaching a conclusion on personality from handwriting analysis along with how instruction of handwriting influences these results. The study conducted uses research tools previously discovered to analyze personality through handwriting. The study relates the results of handwriting analysis to self-perception of personality and the history of participant’s handwriting education, in order to compare the results of what handwriting analysis says about a person and how their past instruction in handwriting impacts the results of a handwriting analysis.

In the study, a classic handwriting analysis will be done on samples provided by participants. The samples that each participant will transcribe are of the same wording and will be written in the same amount of allotted space. The analysis of the sample will focus on the same characteristics of handwriting in all participants, relating to aspects such as letter size, slant, and pressure of writing, among other handwriting traits that are shown to relate to specific personality traits. Along with the sample, participants will provide a description of how they perceive their own personality, as well as an account of how teachers instructed them when learning handwriting. An assessment of the outcomes from the handwriting analysis and the participant’s self-perception will be related to the way their history of learning to write could have affected the results. Through this comparison, implications can be drawn about what a person’s handwriting
indicates about them, as well as how accurate handwriting analysis is in contrast to how they see
themselves and how educational history affects these results. This study contributes a new aspect to the
previous work done on handwriting analysis and personality by introducing self-perception and instructional
history as components to determining the accuracy of a handwriting analysis.

The Fine Line in Peer Review

**Jenette Belgrave, Dawn Lanum, Allison Tucker**
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

Peer review is something that every college student experiences during their academic career. Some
students love doing peer reviews and others get an extreme case of anxiety when the time comes to have
another student look at their paper. Judgment is scary but is it valuable? Raoul Mulder conducted a study
of peer review with third year undergraduate students to find out their perception of the peer review process
before and after. He also looked at the correlation of participating in peer review versus the grades.
Mulder’s findings support peer review, but some students may be skeptical with the value of peer review.
There is a fine line between the work that college students do to get by in college and work that they learn
from their college experience. Students make a choice when they complete an assignment. If they value
the assignment then having others improve it seems wise. Do students really take into account what the
other students have said regarding their paper? Alternatively, do students even take the peer-review class
time to actually review their peers’ work? We took the time to find some answers to these questions. We
started from the top of the pyramid and worked our way down to actual college students. The professors
are the ones who assign or don’t assign a peer review. Some make time for peer review on every paper
and others don’t find it necessary to add to their curriculum. The professors that do find peer review
valuable can add a worksheet to guide the students through a peer review. Does this make that type of
peer review more valuable than just letting the students make their own guide of how to conduct a peer
review? All of this information leads to the final question. Why do students value or not value peer review?
Each student has their own opinion of what goes on during their college experience. We just want to know
if the anxiety is worth it to have another student look over your paper and make changes to better suit their
needs.

Narrowband High Harmonic Generation from a CW Laser

**C2C Jackson Bell, C2C Steven Sauer**
Faculty Mentor: Dr Jerry Sell
United States Air Force Academy

Current sources of extreme ultraviolet light are limited to broadband ultrafast pulses or incoherent x-ray
sources. A coherent, tunable and narrowband source of extreme ultraviolet light would have many
applications, such as photo-lithography to make ultra-miniature circuits. This is possible due to the fact that
a laser’s spot size is limited to half of its wavelength. An extreme ultraviolet laser can have a wavelength
down to the single nanometer range, significantly smaller than other lasers. This laser could also be used in
high frequency atomic or nuclear clocks. We will demonstrate our progress in generating extreme ultraviolet
light with a very narrow line-width from a continuous wave laser using high harmonic generation. While high
harmonic generation usually requires intense ultrafast pulses, the lower intensity of a continuous wave laser can be compensated for by using light very near the resonance frequency of the gas used in high harmonic generation. The input continuous wave laser will have a very narrow line-width which should result in a shorter wavelength output with a similarly narrow line-width.

N-terminal EF-Hand Calcium Binding Proteins (NECABs) throughout Development of the Nervous System

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Calcium ion (Ca\(^{2+}\)) gradients in the brain affect neurotransmitter release, neuronal gene expression and neurogenesis (Burnashev, & Rozov, 2005; Maric, Maric, & Barker, 2000; West et al., 2001). Consequently, Ca\(^{2+}\) concentrations inside and outside of cells must be maintained within tight margins both in the adult nervous system and throughout its development via Ca\(^{2+}\) sequestration mechanisms, such as Ca\(^{2+}\) binding proteins. In the present study, N-terminal EF-hand calcium binding proteins (NECAB) 1 and 2’s expression, visualized using immunofluorescence, were found in primarily immature neurons in neocortex, thalamus, and striatum, among other structures, throughout the developing nervous system. NECAB2’s expression pattern began early and was more extensive than NECAB1’s. Subsequently, a transgenic NECAB2 knockout mouse model (NECAB2KO) was used to see if NECAB2 maintenance of Ca\(^{2+}\) homeostasis shaped development of the nervous system with a focus on corticogenesis. However, further experimentation upon NECAB2KO mouse model is necessary to elucidate its overarching phenotype.

Composers and Their Musical Effects on the Brain

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Throughout the years, researchers have done extensive investigations exploring how music truly affects the brain. Some say that listening to music is therapeutic, teaches us language and can even increase brain activity. “Researchers believe that musical training actually creates new pathways in the brain,” (Bales 1998). The opinions differ from person to person however, some say that classical music is what really stimulates the growth in spatial reasoning pathways, and some say that it is any kind of musical background in a person's childhood. This project looks into the research behind famous composers and digs deeper by asking questions about known musicians that may not be considered the “Bach” counterpart of their time, however they still are able to connect with their listeners. Are people like Meredith Monk or Sara Bareilles, who compose their own music, still able to reach the inner workings of our brains and affect our pathways in the same way that classical composers are able to? And why has western classical music been the main focus of research, creating an obvious bias against other countless musical genres?
The Effects of Display Parallax on Performance in a Tracking Task

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Parallax occurs when there is a displacement in the apparent position of an object. The parallax projects the object along two different lines of sight, and the displacement is measured by the angle of inclination between those two lines. As an object gets closer to an individual, the parallax gets larger. Therefore, the distance between the two objects can be determined by the size of the parallax. Determining the effects of parallax is especially critical in tasks that require the operator to be accurate, particularly in a dynamic setting where the target duplicates and shifts apart as the operator moves closer. This experiment attempts to solve the distances at which the parallax effect will cause degraded performance. There should be a particular distance between the two objects at which performance caused by parallax is the worst, and as the two objects approach this distance, either by moving closer or further apart, performance should continually degrade. That specific distance can be determined, as well as acceptable levels of deterioration for different activities. A single test, within-subjects design using approximately 20 participants was used. The independent variable was the degree of visual disparity between the augmented reality and the real world. Subjects were fitted with an HMD and required to perform a dynamic accuracy test consisting of tracking a moving dot projected onto a Smart Board. Distance between the users eyes and an augmented reality camera was manipulated and accuracy in performing the task was recorded. There were three angles, representing respective distances between two objects, at which the performance due to parallax was observed. The largest parallax, representing the closest distance, showed to have the greatest performance. The middle camera angle appeared to cause the worst performance. The smallest parallax created by the camera angles, representing the greatest distance, caused average performance. This relationship between parallax and performance is defined and suggestions for future military weapon system development are provided.

Examining Culturally Diverse Students’ Sense of Belonging and Academic Success at USAFA

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Diversity and inclusion remains at the forefront of our military’s overall commitment to enhance cultural understanding and global environment. As a means to continue to build this momentum, research analyzing and assessing sense of belonging amongst minorities within predominately white environments should be thoroughly and frequently examined. Studying college-aged racial/ethnic minority students at military institutions (predominately Caucasian), could potentially advance research in the area of diversity and inclusion. This study analyzes culturally diverse students (cadets’) sense of belonging at the United States Air Force Academy (USAFA), a predominately white, military institution. Questions derived from the 2015 Diverse Learning Environment [DLE] Core Survey (UCLA) and Goodenow’s Psychological Sense of School Membership (1993) were used to explore, reveal and assess several aspects of USAFA’s environment and overall atmosphere, as well as cadets’ perceptions of experiences of their campus climate. A total of 778 (568 non-minority and 210 minority) cadets were surveyed over a period of 4 days. It
was hypothesized that culturally diverse cadets would 1) have lower levels of sense of belonging; and 2) would identify more negative issues with the racial climate than those who are within the non-minority population. Data showed that 77.3 percent of African-Americans believed they had to work harder to be perceived as a good cadet; 25 percent of African-Americans reported to have been singled out in class due to race/ethnicity; and most forms of harassment or bias experienced by this population were channeled through verbal comments. Therefore, culturally diverse cadets, specifically African Americans felt lower levels of sense of belonging and inclusion at USAFA. Findings aim to provide knowledge of culturally diverse cadets’ perceptions of campus climate, sense of belonging, and to further explore and address strategies for recruitment, retention, and support for members of these populations.

Pilot Performance in the Advanced Cockpit: A Human Factors Optimization of Unmanned Aerial Vehicle Data Entry Methods

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The intent of this study is to improve the data entry performance of UAV operators in modern Ground Control Stations (GCS). The study will evaluate the performance of participants in data entry with various alternative keyboards using a multitude of measures to monitor error rates, time to complete task, participant observations, and ability to complete the operational scenario. Objective performance will be measured in a simulated GCS using a key logger with various keyboard inputs as well as timed measures in an AF_MATB test. Usability analysis in the form of subjective questionnaires administered after the test procedure will be recorded to identify perceived mental workload and interface ability with the various input devices. Data collected currently suggests that the number keypad causes fewer errors and reduces workload saturation as compared to the standard keyboard and touchscreen modalities of data entry. The final intent behind this study is to determine the ideal method of data entry among these three options. This ideal method would allow UAV operators to maximize precision in entering data while simultaneously considering an adequate amount of workload capacity for the operator to maintain a normal operations tempo.

Acinetobacter baylyi is a gram-negative soil dwelling bacterium that has traditionally been studied using light microscopy. However, using atomic force microscopy (AFM), we can explore the morphology of the bacterium over time with superior precision. Combining the morphological data with growth curves, we created an extensive, nanoscale detailing of Acinetobacter baylyi’s growth patterns over the exponential and stationary growth phases. We examined the cell growth by sampling the population every hour for twelve hours. These samples were used to generate growth curves in addition to being plated and dried for AFM imaging. Using Nanoscope Analysis software the cells’ morphology was analyzed.

We have found significant variations in the morphology and morphological diversity of the population that cannot be determined solely by fluctuations in the growth curves. A majority of the population synchronizes, and together undergoes a cyclical process of morphological changes over several hours. The cells
lengthen, display similar surface features, then reduce their length by over half, a process indicative of growth and division. Further investigation may confirm our hypothesis that the observed surface features indicate the position of the chromosomes within the cell.

Evolution of Writing Instruction: Generational Differences in Teaching Writing

**Katherine Bray**
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In collegiate education programs, writing instruction focuses on current practices used in K-12 Language Arts programs. However, there is little mention of how the instructional methodologies and practices have changed during the last several decades. This lack of an understanding of the history of writing instruction can often go unnoticed, but having the knowledge of what instruction used to be and how it has evolved into the current practices can be incredibly helpful for future educators. Berlin’s “Rhetoric and Reality: Writing Instruction in American Colleges,” delves into the timeline of writing instruction based on three defining theories of instruction. Berlin’s research presents the change of instructional theory, but does not comment on how this influences current instruction in writing. Knowing what came before informs our choices and methods in teaching writing to future students because we can better understand the reasoning and trend behind the curriculum we will administer. This study looks at three qualitative interviews with one former and two current teachers in both elementary and high school writing instruction. By comparing, contrasting, and highlighting the changes developed in writing instruction, we can use this history to make educated and effective decisions in the classroom. In decades past, the curriculum focused on the structure and grammatical correctness in students’ writing. In comparison, today’s curriculum focuses on the pre-planning and organization of logical thought and argument in students’ writing. The former practices influenced the current instructional methods, but this difference also brings to light the change in what is considered “good writing.” Through the interviews with these three educators, we can not only see what concepts they focus(ed) on, we can also learn the reasoning behind certain classroom practices and what each teacher found effective or ineffective. All of this can provide future educators with information and examples of the development of writing instruction and the reasoning behind each practice, which can better inform future teachers’ classroom methodologies and practices.

Bidirectional “Ping-Pong” Energy Transfer in a Ir(III) Charge Transfer Complex

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The synthesis and photophysical properties of a new luminescent Ir(III) diimine complex covalently attached to one 4-piperidinyl-1,8-naphthalimide (PNI) chromophore, [Ir(ppy)2(phen-PNI)](PF6)2, is presented. This compound represents a new class of visible light-harvesting Ir(III) chromophores that exhibit greatly enhanced room temperature metal-to-ligand charge transfer (MLCT) emission lifetimes as a result of intervening ligand centered (LC) triplet states present on the pendant naphthalimide chromophore. In the Ir(III) complex, the intense singlet fluorescence of the pendant PNI chromophore is nearly quantitatively quenched and was found to sensitize the MLCT-based photoluminescence. The title
chromophore represents an interesting example of “ping-pong” energy transfer wherein photon excitation first migrates away from the initially prepared 1LC* excited state and then ultimately returns to this moiety as a long-lived excited triplet which disposes of its energy by equilibrating with the photoluminescent Ir(III) MLCT excited state.

Microwave-Assisted Green Synthesis of Silver Nanoparticles for the Assessment of Total Antioxidant Capacity in Fruits

Santiago Bukovsky-Reyes
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Previous studies have used gold nanoparticle formation as a means to assess the antioxidant capacity of fruit extracts. However, the synthesis of silver nanoparticles (AgNPs) in developing an antioxidant assay are unknown. This research presents a microwave-assisted synthesis of AgNPs guided by the principles of green chemistry to assess antioxidant capacity of fruits. Synthesis of AgNPs has been achieved by reducing Ag+ ions from ultrapure AgNO3 using standards solutions of chlorogenic acid (CGA), caffeic acid (CA), and starch. Analysis of AgNPs by UV-visible spectroscopy displayed a direct correlation to CGA, CA, and starch concentration (R2 = 0.9966, 0.9791, 0.9607 respectively). A previously developed microwave-assisted extraction (MAE) procedure for chlorogenic acid was applied to fruits to generate extracts for antioxidant assay by this method. This work has the potential for development of a rapid, sustainable method for surveying the antioxidant capacity of fruits.

Coming to America: Challenges Faced by English Language Learners

Tami Burns
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Attending college in America can be a difficult feat for most. The struggles American students face are difficult to overcome, but imagine coming from country where English is not the first language. In the 2013/2014 school year, 886,052 international students came to America to attend college and that number continues to increase every year (Institute of International Education). The primary source of funding for their educational experience comes from personal or family funds. Other sources include the college or university directly, their home country funding their education or unnamed other sources. In 2013/2014, international students contributed to $27 billion to the US economy (Institute of International Education). Students attend college here for a better education in the hopes of going back to their home country to teach English or simply to provide a better life for themselves in America. International students are immersed in the American culture. They receive a more inclusive education than they would in their home countries. International students face many hardships academically as well as socially. Each students has the hopes of succeeding within the academic realms of the US as well as gain an appreciation for the new culture surrounding them. To understand how international students face the challenges of attending college in a new country, I interviewed four undergraduate students about their experience when they first arrived to America. The interviews were about their experience attending college. The questions focused on their academic experience as well as their social experience as they became immersed into the
American culture. I also interviewed an instructor at the University of Colorado Colorado Springs to discuss what our community can do better to help international students acclimate better to the American culture.

Analysis of Geographical Effects on the Efficiency of Wind Energy near Colorado Springs

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The recent focus on renewable energy has increased the awareness of using wind for energy production. Wind energy provides a pollution free alternative to the use of fossil fuels or other nonrenewable energy sources. This research analyzed the efficiency of wind farms in Colorado Springs, specifically how the geography influences the power output. The three geographical terrains compared were a flat open space, the base of an escarpment, and the top of an escarpment. The preliminary investigation conducted in this research has not been previously accomplished to our knowledge. Areas in Colorado Springs that contained dense vegetation, large infrastructure, or flight restrictions were not considered. The modeled wind farms were standardized to 100 MW for each of the three areas. The advantages and disadvantages of wind energy production due to each of the three geographic locations were discussed along with initial design and actual power output. It was determined that wind energy is a viable power source for Colorado Springs and more detailed studies should be conducted in the future.

The Postmodern Divide in Music

Therese Carmack
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University of Colorado Colorado Springs

John Cage’s three-movement piece “4:33” premiered on August 29, 1952, in Woodstock, New York, at a contemporary piano recital by David Tudor. The score instructs the musician(s) not to play their instrument(s) for the duration of the piece. Cage proposes to encourage the audience to listen to the sounds around them during the performance. This piece has been performed around the world, often to packed venues such as Carnegie Hall and the Sydney Opera House. Philip Glass’s first opera Einstein on the Beach was premiered on July 25th, 1976, at the Avignon Festival in France. This opera was written with no plot in mind, but rather is based around the notion of space through storyboards. The four-hour work includes atmospheric, dissonant interludes, yelps from vocalists, loud counting with minimal accompaniment, engines and logs being dragged on and off stage (often very slowly), and more. This work has also been performed internationally and received widespread acclaim.

In what lies the value of these pieces? In the talent of the artists? In the evaluation of music critics? In the inspirations behind the works? Or solely in the psyches of the audience members? In the past, has anyone asked such questions of pieces such as Beethoven’s Symphony No. 5? Has anyone ever heard Symphony No. 5 and said flippantly, “I could have composed that”? The answer is “no,” and yet such a statement has become a common response to postmodern music.

What is happening in today’s musical landscape (i.e., the last 50 years or so) is something that has never quite happened before. As a result of pieces like Cage’s and Glass’s mentioned above, the very notion of music has become confused and jaded and has led many to accept — however reluctantly — radical, new
definitions of music—definitions wide enough to embrace both Symphony No. 5 and Cage’s silence. The goal of this presentation is to investigate both old and new theories of music, and determine whether or not postmodern music has stepped outside the boundaries of music or simply redefined it. Having briefly described the outer bounds of the various definitions of music (aesthetes from Socrates to Danto will be explored for their theories on aesthetics) and so of this presentation, I will proceed with a closer look at the various elements of these definitions, attempt to determine the basis for their variance, and seek to reach the truth of music to draw near to a possible answer.

Jazz and Latin Drums, Musical Protest and Freedom

John Charland
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University of Colorado at Colorado Springs

Drums and percussion played in Latin music, jazz, gospel and reggae music may sound different but all share unique musical contributions, all having been involved in protests for freedom, from the freedom to make any kind of music, to the expression of humans wanting freedom from oppression. The differing rhythmic styles between the drums and percussion of Latin, jazz, reggae and gospel music have beginnings in similar protest environments, from the freedom to practice religion to the freedom to play jazz as an African American. Some of these styles share rhythms and also contain unique differences. Often all have a basic sense of rhythm accompanied by more complex rhythms and improvisations. The rhythmic styles in these particular genres are each very unique, and come from different parts of the world, but still contain similarities. Above all the involvement of these musical forms are, instead of primarily amusement based, played to also accompany a higher cause and purpose.

Wearable Technology Improves Battlefield Airmen’s Mission

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United States Air Force Academy

The introduction of wearable technology has greatly improved dismounted Battlefield Airmen’s ability to carry out their mission by digitally connecting them to valuable assets. However, in reducing the size and weight of this technology, there has been a tradeoff between the usability of the input/output interfaces especially when on the move in challenging environments. Battlefield Airmen are responsible for accomplishing tasks that require precise coordination and attention to detail while operating in physically demanding and stressful environments. A primary example is during close air support when an operator has to pass targeting information of hostile locations to supporting aircraft while being actively attacked. The size of the display can have a significant impact on usability, accuracy while performing tasks, and speed of accomplishing the mission. In this study, 40 participants will complete a running course while designating targets on either a five- or seven-inch tablet. Performance and completion time on the obstacle course will be measured along with the speed and accuracy of the tablet-targeting task. Target designation accuracy is expected to be higher using the seven-inch display compared to the five-inch; however, running course performance is expected to be better using the five inch display. Subjective usability questions will also be collected and used to inform the integration of touchscreen table devices for Battlefield Airmen.
Operational Resilience

C1C Hayden Clark, C1C Jordan Pierce, C1C Trevor Haydel
Faculty Advisor: Lt Col Timothy Pettit
United States Air Force Academy

Operational resilience is the ability of an organization to avoid disruption in its operating process and recover quickly from any disruptions that may occur. The Air Force is a multi-role organization that thrives on efficiency and effectiveness. This project answers the question of what creates a resilient operation by finding modes of operation that increase effectiveness while eliminating inefficiency. By examining the various modes of operations of CV-22 Osprey and B-1B Bomber organizations, recommendations can include new methods of improving operational resilience throughout the Air Force.

Synthesis of Fluorinated 1,2,3-Triazoles via Copper(I)-Catalyzed Cycloaddition

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1H-1,2,3-Triazoles have only recently come prominently into the synthetic chemistry fold since introduction of the copper(I)-catalyzed cycloaddition, a widely acclaimed “Click Chemistry” method, which was published in 2002. Since then, some synthetic fluorotriazole drugs have been marketed, notably two as fungicides. The 1,2,3-triazoles do not occur naturally and testing has shown that organisms do not degrade the triazole moieties of tested compounds. Fluorinated pharmaceuticals are much sought after due to their increased hydrophobicity beyond that of analogs lacking a fluorine. Fluorine atoms are highly polar and a change from a C-H bond to a C-F bond can cause significant dipole moment and pKa changes from the C-H form. These considerations led us to synthesize a series of fluorinated triazoles using Click Chemistry. We report preparation of a variety of fluorinated 1H-1,2,3-triazole derivatives characterized as 1,4 disubstituted triazole derivatives. Products were synthesized from aromatic azides and alkynes containing various regioisomers containing trifluoromethyl and fluoro substituents. Characterization by GC-MS, 1H NMR, 13C NMR, and IR confirmed successful synthesis of the desired fluorinated triazole products.

Effects of Stereotype Threat in People with a History of Depressive Disorders

Kjersten J. Conway
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The Colorado College

In this empirical study, we studied how stereotype threat affected the task performance, self-esteem, self-efficacy, and help-seeking behavior of people with a history of depression. Participants with or without a history of depression took a test with multiple tasks, and were assigned to either a stereotype threat condition (diagnostic of "mental fog") or a non-threat condition (diagnostic of creativity). We hypothesized that the stereotype-threat group would exhibit executive resource depletion via a Stroop task, slower verbal reasoning task completion, and lower verbal reasoning task accuracy. We did not have a directional hypothesis regarding how stereotype threat might affect help-seeking behavior. Data showed there was no
negative stereotype threat effect on verbal reasoning task performance and speed, or on help seeking behavior. Self-esteem and self-efficacy were not affected by stereotype threat, but showed a main effect whereby participants with a history of depression scored lower on both measures. Surprisingly, for the GRE-type question score, we found suggestive evidence for a stereotype lift effect for participants with depression who were told that the task was diagnostic of creativity. Our findings underscore the need for further research on depression stereotype content.

Bringing Unsexy Back: A Review of Protective Factors against Sexualization and an Argument for Summer Camp

Susannah Conway
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Colorado College

In 2007, the American Psychological Association published a report that presented compelling evidence of widespread cultural sexualization of the female body and the negative effects this has on girls. When girls internalize the sexualizing and objectifying messages they are exposed to every day, they can experience a number of negative emotional, cognitive and even physical consequences. Fortunately, there is a growing body of research on methods to help girls combat the negative effects of sexualization and self-objectification. This paper reviews the existing, though as of yet scant, literature on such methods. Research has shown that media literacy programs, sports participation, body-focused exercise, single-sex environments, and uniforms can all potentially protect girls from the negative effects of sexualization. Despite the evidence, however, these tools are not yet widely implemented or accessible. The paper concludes with a proposal for an all-girls summer camp, argued to provide an ideal venue for implementing effective methods for combating the negative effects of sexualization in girls.

Investigating a Tryptophan-less Green Fluorescent Protein for Biosensing of Explosives

C2C Shannon Daily
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Fluorescent proteins (FPs) have potential use as biosensors to detect various explosives and toxic agents. FPs can show sensitivity to their environment through the combined effect of UV excitation and relaxation by the Forster Resonance Energy Transfer (FRET). Previous work has demonstrated the ability of nitroaromatics and nitroamines to quench the excitation of tryptophan (W) residues. However, W side chains primarily are located within the β-barrel structure of the chromophore decreasing their accessibility to collisional quenching. This study seeks to determine if the more numerous tyrosine (Y) residues on the exterior of FP can show similar intensity by using W-less FP to examine the potential intensity of the Y-to-chromosphore FRET. W-less FP will also be used to determine the sensitivity of Y to its external environment in detecting TNT for use as a biosensor.
Energy Minimization of Magnetic Domain Walls in Nanometer-Sized Strips

Miriam DeJong
Faculty Advisor: Dr. Karen Livesy
University of Colorado Colorado Springs

Magnetic recording is of fundamental importance in data storage devices such as hard disk drives and there is a push in the scientific community and electronics industry to increase the efficiency of these devices. The magnetic materials used in recording are very small, on the scale of nanometers, and designed to maximize the amount of data that can be stored in small electronic components. It has been experimentally shown that different dimensions of magnetic materials used in recording result in different energy requirements for device operation since the shape of a magnet affects the energy of the magnet. One practical way to increase the efficiency of these materials is by finding the specific material dimensions where this operation energy is minimized. The goal of this research project is to explicitly find those dimensions, and more generally, find an analytic expression that will generate those necessary dimensions for different magnetic alloys. Results of this research can be implemented in the manufacturing of electronic devices to reduce energy consumption.

Language Development and the Acquisition of Self-Regulation Mechanisms: An Exploration of Language Disorders and Externalizing Behaviors

Leslie Dinkin
Faculty Advisor: Sarah Hautzinger
Colorado College

I spent four weeks in a small coastal town in Oregon where I explored tensions between the fishing, the marine science, and the tourist communities in the form of a narrative ethnography. Through interviews, meals and storytelling, I learned about the people in Newport and the unique culture the ocean as a unifying factor fosters. This small town is home to a large harbor filled with sea lions and salmon trollers, many saltwater taffy shops that were closed during my visit because of the off season and the National Oceanic and Atmospheric Administration which moved to Newport from Seattle in 2009 as well as the Oregon State University Marine Science Center. My study focused mainly on the fishermen who were surprised by my interest in listening to them. In my ethnography, I map changes made in the fishing industry, pressured by both the tourists and the marine science community, through the fishermen’s stories and reminiscence. I also map my journey through Newport as a tourist and novice fisher in my attempts to establish relationships with the fishermen and marine biologists.

DNA Extraction from Herbarium Specimens of Varying Ages

C1C Emma E. Dridge
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United States Air Force Academy

The objective of this project was to determine the age range for archived plant specimens to extract and amplify genomic DNA. I will extract DNA from various preserved specimens in the Herbarium in the
Department of Biology at the U.S. Air Force Academy, and determine the yield. Then, I will subject this DNA to Real-Time PCR to determine whether there is sufficient yield to successfully amplify the housekeeping gene, GAPDH.

Echelle Spectroscopy Studies of the Star Tau Bootis

**C2C Anita Dunsmore, C1C Rebecca Esselstein, C1C Adam Samlowski, Ms. Stephanie Panoncillo**
Faculty Advisors: Lt Col Steven Novotny, Lt Col Daniel Polsgrove, Dr. Devin Della-Rose
United States Air Force Academy

Since Spring 2014, we have conducted radial velocity studies of the star Tau Bootis using a high-resolution echelle spectrograph attached to the 61-cm Cassegrain telescope at the U.S. Air Force Academy Observatory. This presentation summarizes our work to: (1) collect, process and calibrate spectral data; (2) use a variety of mathematical tools to compute the cross-correlation function between two spectra, thus deriving the corresponding radial velocity shift; (3) estimate the orbital parameters for the planet Tau Bootis b, and compare our findings to previous research.

A Fledgling Nation Crippled: The Articles of Confederation’s and the War of 1812

**C2C Christopher M Dylewski**
Faculty Advisor: Maj Ryan Menath
United States Air Force Academy

In 1781 a group of revolutionaries founded the United States under a fundamentally flawed document—the Articles of Confederation. As a direct, albeit strange, result, the United States would declare war on Great Britain in 1812. The declaration of war partially resulted from, in an example of the absurdity of international relations, the United States’ inability to demand respect in the international community. The American Founding Fathers, desperate to avoid creating a despotic government, eschewed a strong federal government. The resulting Articles thus outlined a federal government too weak to deal with the international community on solid footing. The economy would go essentially unsupported, sectional politics would abound, and the inflammatory sense of personal and national pride already imbibed by the American people would be challenged. The pitiable American presidents Jefferson and Madison could do little but attempt to tamp the brushfires of sectional politics and attempt to counter European sanctions with wild stratagems. Their devices were commonly the subject of accusations of over-stepping the proscribed role of the American chief executive, and inspired little cooperation by international powers. Even though the AoC were eradicated by the Constitution in 1788, Jefferson and Madison’s struggles with the eradicated Articles were indicative of the overall trend: the Articles of Confederation handicapped the American government, and history has proven them one of the chief causes of the War of 1812.
Representations of Word Meaning in Dyslexic and Non-Dyslexic Individuals

Samantha Ellner
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Dyslexia is traditionally defined as a discrepancy between reading achievement and intellectual potential (Tunmer & Greaney, 2010). Previous research suggests that dyslexic individuals show impairments in the visual processing of words (Stein & Walsh, 1997) and the mapping of sounds to symbols (Ziegler, Pech-Georgel, Dufau, & Grainger, 2010). Although these findings highlight deficits in the online processing of words, few studies have examined dyslexic individuals' underlying representations of word meaning. In the present research, we investigated whether such representations differ from those of non-dyslexic individuals due to differences in reading experience.

We recruited 15 self-identified dyslexic participants and 15 non-dyslexic participants matched for age, gender, and location of residence. Following previous research (Bradley & Lang, 1999), we asked participants to rate 86 words on the dimensions of valence, arousal, and dominance. Half of the words contained the letter combinations “ie” or “ei” (e.g., ceiling), often regarded as confusable (Cahen, Craun, & Johnson, 1971). The other half were roughly matched in meaning, but were less confusable (e.g., roof).

In a repeated-measures ANOVA on the rating data by item, there was a main effect of participant group (dyslexic vs. non-dyslexic) for all three dimensions (valence: F(1, 42) = 24.85, p < .001, η2 = .37; arousal: F(1, 42) = 20.67, p < .001, η2 = .33; dominance: F(1, 42) = 4.22, p < .05, η2 = .09). Dyslexic participants rated words significantly higher than non-dyslexic participants. There was no main effect of confusability, nor was there an interaction between participant group and confusability (all ps > .5). Thus, regardless of confusability and dimension, dyslexic participants consistently rated words higher.

These findings indicate that dyslexic individuals interpret word meanings as greater in magnitude on a variety of dimensions, irrespective of how confusable the words are to spell. Although no effect of confusability was observed, we hypothesize that dyslexic individuals may nonetheless experience confusable and non-confusable words differently. The explicit nature of the word-rating task may have encouraged dyslexic participants to adopt a compensatory strategy, assigning equally high ratings regardless of confusability. Future research will investigate whether dyslexic individuals’ implicit representations of word meaning differ from their explicit judgments.

Variation of Flow Properties During a Vessel Discharge

Aida Ferro Ardanuy
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University of Colorado Colorado Springs

This paper reports a study of an overpressurized flow from a finite tank. The research analyse the evolution of this flow over time and consider the three most important regimes: a choked condition, an unchoked compressible condition and incompressible condition. All of these regimes follows their own equations and using its dimensionless form they have been plotted using the software program MATLAB.
Antigen Loading Exosomes for Therapeutic Purposes

Maria Font, Clairelise Post
Faculty Advisor: Jarred Bultema
University of Colorado Colorado Springs

Exosomes are small, heterogeneous 30-100 nm extracellular vesicles that play prominent roles in intercellular regulation and communication. Studies suggest that exosome provide promising advances for immunotherapy treatment of cancers and neurodegenerative diseases. The goal of this project is to design and produce exosomes that stimulate specific immune responses for use in cancer immunotherapy. This will be accomplished using a SpyTag/SpyCatcher linker system to covalently attach proteins of interest onto the surface of exosomes. Exosomes from matured dendritic cells contain peptide-loaded MHC class-I and –II molecules for T-cell stimulation, as well as proteins CD63, CD81, CD9, are able to stimulate antigen-specific immune responses. Incorporation of SpyTag into these proteins may allow an antigen to be covalently attached to exosomes through the SpyTag-SpyCatcher isopeptide bond. Atypical cloning techniques are used to insert SpyTag into specific internal protein locations. After successfully cloning SpyTag into specific protein sites, these Chimeras will be tested in vitro and in vivo in mice to judge effectiveness as an immunotherapy.

How the UCCS Technical Writing Program Equips Technical Writing Alumni for the Workforce

Katherine Franks
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

When students graduate from the UCCS Professional and Technical Writing (PTW) Program they bring the skills that they have gained from the PTW Program and from their professors' teachings into the workforce. But are technical writing alumni graduating from the PTW Program with all the skills they need to excel in the workforce? From Stephan Bremner’s article, “Collaborative Writing: Bridging the Gap Between the Textbook and the Workplace,” the idea that the academic setting and the workplace are not being bridged by skills that PTW students should have when leaving the classroom and entering the cubicle is paramount to the success of technical writing alumni’s careers.

Interviewing technical writers who recently left the academic setting and entered the workforce and interviewing UCCS technical writing instructors also show the differences and similarities between the expectations of the Technical Writing Alumni in the academic setting and the workforce. Technical writing alumni also shared what skills they have gained from the PTW program and then afterwards from the workforce and if the two areas of skills overlap. UCCS technical writing professors also spoke about the PTW program and how the program could change to help PTW students excel. My hypothesis is that technical writing alumni are learning more in the workforce than in academia due to lack of work experience, outdated concepts, and not knowing how to transition academic concepts to work situations. I believe both the UCCS technical writing instructors and technical writing alumni know what problems persist in the academic program but do not know how to change the culture of the PTW program to make it more effective in teaching technical writing at UCCS.
Bacterial Biofilm Growth and Ionic Liquid Challenge Assay

C1C Balys Gintautas  
Faculty Advisor: Dr. David Hale  
United States Air Force Academy

The objective of these assays was to efficiently and reliably grow bacterial biofilms, and to consistently challenge them with various ionic liquids (ILs) to precisely measure the efficacy of ILs in disrupting antibiotic-resistant bacterial biofilms. For this purpose, highly specific 4-day biofilm-growth procedures for Pseudomonas aeruginosa and Salmonella enterica serovar typhimurium (strain LT2) were developed. Furthermore, a flexible IL-biofilm challenge assay was designed. These assays are highly adaptable because parameters such as bacterial strain, incubation conditions, IL and control solutions, and exposure times can be readily modified for further experimentation.

Lichens and Trees versus Sediments as Temporal Records of Pb Use

Ben Greydanus  
Faculty Advisor: Nate Bower  
Colorado College

Lead (Pb) isotopic analyses of remote lake sediments and peat bogs have been successfully used to obtain regional records of anthropogenic Pb released into the environment. These profiles help identify specific Pb sources that were active over the last century or so. But in more arid regions such as the Rocky Mountain West, readily dated lake sediments and peat bogs spanning a century are uncommon. In this study we employ multi-collector inductively-coupled mass-spectrometry (MC-ICP-MS) to measure the isotopic profiles of Pb in tree rings and epilithic lichens, comparing their efficacy to lake sediments as biomonitors that preserve human Pb releases over time and space.

How to Engineer Change: Impact of Engineers Without Borders  
Community-Driven Development Model in Suncallo, Bolivia

Barbora Hanzalová  
Faculty Advisor: Barbara Whitten  
Colorado College

Engineers Without Borders is an international NGO which focuses on development engineering. Its chapters manage Community Driven Development (CDD) projects that include three stages: Assessment, Implementation and Monitoring. The Suncallo 2009-2014 project of the Colorado Springs Professional chapter led to success, because the structure of CDD Model was followed. Two years of Assessment of the site and discussions with the community were followed by two years of implementation, and two years of monitoring and repairs of the water system. The community was actively engaged during all stages and in 2014, last year of the project, was found self-sufficient in maintaining the water supply system. Successful implementation of this tap water and irrigation system benefits the community members. Because of easier access to clean drinking water, the health of Suncallo's inhabitants
has improved. Thanks to a better irrigation, the local agricultural productivity has increased, and families enjoy higher income and living standards.

Quantification of Exercise-Induced Salivary Cortisol Production and the Relationship between Cortisol and Lactate Concentrations After a Maximal 1.5 Mile Run For Time

Lucy Hartshorn  
Faculty Advisor: Murphy Brasuel  
Colorado College

The body reacts to stress by activating the hypothalamic-pituitary-adrenal axis (HPA axis). The HPA axis produces adrenocorticotropic hormone (ACTH), which stimulates the kidneys to produce cortisol. Cortisol, commonly known as the stress hormone, exerts many effects felt virtually everywhere in the body. It operates by manipulating metabolism during stressful situations in order to restore homeostasis. Maximal exercise above the anaerobic threshold is a stressor that activates the HPA axis to release cortisol into the plasma. Plasma cortisol levels are reflected in saliva, which is often used in examining cortisol concentrations due to its minimally invasive and stress free sampling compared to blood draws. Liquid Chromatography-Mass Spectroscopy/Tandem Mass Spectroscopy is a technique used to quantify the low levels of cortisol in saliva due to of its ability to detect and quantify specific compounds within a complex mixture. Participants (n=11) were subject to a 1.5-mile run for time and lactate and cortisol were collected at various time points after run completion. Peak lactate concentration ranged from 3.7 to 14.7 mmol/L. Peak Cortisol ranged from 31 ng/ml to 200 ng/ml. Lactate and cortisol concentrations were subject to mean-centered normalization for subsequent analysis to account for the effects of individual biochemistry. All peak lactate concentrations were at 3 min (n=11). Peak cortisol concentrations were at 28.6 ± 6.7 min (n=11). Participants were equally divided into higher fit (n=5) and lower fit (n=5) groups based on their VO2 max values. There was no significant difference in the time delay between lactate peak and cortisol peak between the two fitness levels (P > 0.05). For all participants, cortisol concentrations peaked after blood lactate concentrations, which supports the idea that chemoreceptors in muscle tissue, stimulated by the buildup of lactate, activate the HPA axis to stimulate downstream cortisol release.

Optimization of Laser Ablation Technologies for Peripheral Artery Disease

C2C Jeffrey R. Herrala  
Faculty Advisor: Dr. Katherine L. Bates  
United States Air Force Academy

The goal of this research is to identify the ideal wavelengths for selective ablation of unwanted occlusions in patients suffering from peripheral artery disease and critical limb ischemia, while simultaneously reducing laser damage to surrounding vascular tissues. The ablative properties of various tissue samples, both human and porcine, were characterized using spectra produced by Thermo Scientific's UV-Vis Evolution 220 Spectrophotometer and the Integrating Sphere Accessory 220. The spectra were then evaluated to identify wavelength patterns which produced maximum absorbance in plaques and thrombus, and minimum absorbance by healthy vascular tissue (e.g., leaflets, endothelial cells, etc.). Identification of such wavelengths will increase the effectiveness of laser atherectomy procedures, while reducing tissue damage and scarring. Optimization of ablative laser technology will provide physicians with a more diverse selection
of wavelengths to safely ablate undesired tissues, thereby increasing the number of peripheral artery disease and critical limb ischemia patients who can be treated by laser atherectomy.

Investigation of the Meteorological Conditions Associated with Onset of In-Flight Icing

**C2C Jeffrey Herrera, C2C Travis Hodos**  
Faculty Advisor: Lt Col David Vollmer  
United States Air Force Academy

This study uses data sets retrieved from the AIRS (Alliance Icing Research Study) experiments containing measurements from the RID (Rosemount Ice Detector) and aircraft cloud microphysical measuring devices to conduct statistical analyses for ascertaining the meteorological conditions most associated with the onset of inflight icing. In situ measures of ambient air temperature, dew point, and cloud liquid water content (LWC) were correlated with voltage responses of the RID to determine when possible icing was occurring within the data. Consistent with other icing studies that used the RID, a voltage threshold for icing was inferred using the observed voltage signature which occurs once a threshold amount of ice mass has accumulated on the sensor. Comparing time-series graphs of temperature, dew point and LWC with RID voltage, it was observed that the voltage effectively spiked when trends in the other measurements likely favored icing conditions. These favorable conditions were assumed to be when temperature was below 0°C and some amount of LWC was present (>0 g m⁻³). The data were then categorized as icing or no icing. The temperature and dew point regimes associated with this binary categorization will then be used to develop a set of predictive criteria for aviation icing.

Bacterial Ecology of an Undergraduate Engineering Laboratory

**C3C Zachary H. Hodges**  
Faculty Advisor: Dr. Katherine L. Bates  
United States Air Force Academy

To assess the presence of bacterial communities within specific ecological subsets of human environments, we cataloged the Gram-negative microbial diversity within the Engineering and Mechanics Applied Materials Laboratory at the U.S. Air Force Academy. Specifically, we sampled locations within the laboratory, and incubated the samples on Tryptic Soy Agar. Gram-negative bacteria were run through a VITEK® MS Automated Microbial Identification System, allowing species-specific identification in most cases. Of the 127 samples collected in the laboratory, 29 have tested Gram negative thus far. Many of the Gram-negative samples identified with the VITEK unit belong to the genera Sphingomonas or Rhizobium. This research provided insight into the microbial diversity of this specific human environment, and helps to further understanding of microbe distribution as a potential health risk.
Characterization of Functional Pervasive Transcription in E. coli

Paul Hong and Laura Finger
Faculty Advisor: Dr. Meghan Lybecker
University of Colorado Colorado Springs

Transcription initiation is a highly regulated step in gene regulation; several novel mechanisms of post-transcriptional gene regulation have been characterized in the last decade. RNAs have emerged as major regulators of gene expression in both bacteria and eukaryotes. Recently, advanced high-throughput sequencing techniques have uncovered a new type of RNA termed pervasive transcripts. Pervasive transcripts occur genome-wide and do not adhere to canonical gene boundaries. Transcription was thought to occur only at genes encoding proteins, ribosomal RNAs and transfer RNAs. Pervasive transcription has been reported in many different organisms across all domains of life and appears to yield a conserved class of RNAs. Despite the widespread occurrence of pervasive transcripts, little is known about their function and initially they were considered to be transcriptional noise. Recently, we have shown that subsets of pervasive transcripts are functional. We are elucidating the molecular mechanisms and biological roles of several pervasive transcripts, including antisense-ompX and intra-yadD. The well-studied and genetically tractable bacterium Escherichia coli is ideal for this study. Traditional loss-of-function reverse genetics assays are challenging to perform on these RNAs because they overlap or are complementary to annotated genes. Therefore, we have developed innovative methodologies to construct deletions of pervasive transcripts. These deletion strains will allow us to probe the role of pervasive RNAs in gene regulation and dissect the molecular mechanisms of their regulation.

Drought Response Strategies in Clarkia gracilis from Serpentine and Non-Serpentine Soils

Marley Jamason
Faculty Advisor: Shane Heschel
Colorado College

As a result of climate change and water management problems, chronic drought now affects much of North America. Understanding plant drought stress tolerance is pertinent to developing informed strategies for responding to stressful and changing climate conditions. Studying weedy species such as Clarkia gracilis (Onagraceae) provides opportunities to examine whether water-use physiology is important to population persistence in drought. C. gracilis is an annual forb that is native to western portions of North America, and can be found in both serpentine and non-serpentine soils. Serpentine soils are typically drier and feature increased heavy metal content, which may disturb plant establishment and fitness. Comparing plant populations from adjacent serpentine and non-serpentine soils offers unique maternal environmental controls, as climate, disturbance, and soil composition remain similar between the neighboring locations. Moreover, studying serpentine soils allows for opportunities to determine whether soil metal toxicity interacts with drought tolerance. Seed pods were collected at various serpentine and non-serpentine sites and were grown in a common greenhouse environment for one generation before beginning experimentation, so as to remove maternal effects. Plants were then subjected to either a moist or a dry treatment. This study aims to address the following questions: 1) How do serpentine and non-serpentine plant populations respond to drought stress? 2) If serpentine and non-serpentine plant populations differ in their responses to drought stress, then what traits are different between serpentine and non-serpentine populations? 3) Are there any differences in biomass between serpentine and non-serpentine plant
populations when they experience drought stress? 4) Are there traits that seem to predict biomass when experiencing drought stress?

Evaluation of Digital Checklists for Command and Control Operations

C1C Forrest Jeffery, C1C Oliver Myers
Faculty Advisors: Dr. Victor Finomore, Lt Col Chris McClernon
United States Air Force Academy

Checklists are a critical component of most any military operation and both the construction of and presentation of checklists can affect the performance and efficiency of these operations. The purpose of this research project is to compare methods for displaying and executing checklists in a command and control operation to increase both performance and efficiency. The NORAD/NORTHCOM Command Center (N2C2) currently uses a paper checklist system to facilitate responding to any number of disasters, to include air catastrophes. This project investigates the feasibility of a digital checklist system in this context. We hypothesized that a digital checklist that incorporates a hierarchical design could be more effective in speed and accuracy than a paper, linear design. We used a between groups experimental design to analyze the relative effectiveness of each system. Researchers introduced each group of subjects to a timed task on different systems (linear, hierarchical, or paper) and asked them to complete an Air Force Academy Command Center checklist as accurately and quickly as possible. Then, they analyzed and compared performance and subjective assessments of each system. The data shows that the linear checklist takes a longer amount of time than both paper and hierarchical checklists. The hierarchical checklist takes the shortest amount of time of the three checklists. In addition, the subjective data being collected shows that the hierarchical system is easier to use and navigate through than the other two systems.

Benefits of an Early CURE Persist in a Biology Curriculum

Jill C. Jenkins
Faculty Advisor: Dr. Lisa Hines
University of Colorado Colorado Springs

In an effort to engage more students in scientific thinking and practice, many educators are providing undergraduate students with research experiences. CUREs are Course-based Undergraduate Research Experiences that allow whole classes of students to address a research question of scientific interest. During a CURE, students (1) employ science practices, (2) discover, (3) address a broadly relevant or important question, (4) collaborate and (5) iteratively build upon their own findings. However, the degree to which individual CUREs integrate these five activities can vary. Three years ago, we integrated CURE called “Soakin’ Up the Rays with S. pombe” into an introductory biology laboratory course at a public, primarily undergraduate institution. Using a randomized study design with control and experimental groups, we observed short-term gains in both knowledge and perception. To date, we continue to evaluate these students as they progress into their upper-level biology coursework. Our data indicate that the short-term benefits observed from this single CURE intervention continue to persist even one-two years after completion. Here, we summarize the extent to which our CURE integrated the five learning contexts to better define those elements that have highest potential for a long-term impact.
Synthesis of Conjugated Fulvene Polymers for Use in Electronic Materials

C1C Kristian J. Knuths
Faculty Advisor: Dr. Scott T. Iacono
United States Air Force Academy

Conjugated π-electron and donor-acceptor molecules have received considerable attention as possible energy-harvesting and electronic materials due to the ease of electron transfer down their molecular backbone. The use of pentafulvene-based organic donor-acceptor systems has received very little attention in comparison, but their unique structure-property relationships are promising in this field of research. In our research we have used 6 substituted 1,3-diphenyfulvenes to form a conjugated polymeric system via a palladium-catalyzed Suzuki coupling. The polymers were characterized by NMR, ATR-FTIR, GPC, TGA, DSC, UV-vis, and fluorescence measurements. DFT calculations were performed on small molecule fulvene chromophores. Applications in the field of electronic materials will be addressed and explored.

Analysis of Nitrate Effects and Treatment Options in Idaho’s Snake River

C2C Kaylee Kostka, C2C Sandra Suito
Faculty Advisor: Maj Andrew J. Hoisington
United States Air Force Academy

Agricultural states use nitrogen-rich fertilizers to support their crop rotations and growth but those nutrients can have a negative effect on surface water quality. Indeed, overland flow of farm water runoff into local rivers can cause health risks and ecological harm. One interesting example of nitrate pollution in a river is the Snake River in Idaho, which has both increasing and decreasing nitrate concentrations in the river dependent upon the location. In 2007, more than half of Idaho’s farms were located in counties that border the river, making the Snake River a vital asset to Idaho’s agricultural and economic wellbeing. In the analysis of the nitrate problem in the Snake River, this research includes discussion of the hazardous aspects of nitrates, the risk they pose to local the environment, and a computational based model of nitrate concentrations with recommended water treatment solutions when feasible. The result of this work will provide a baseline for future research in nitrate reduction for agricultural areas and can be applied at multiple locations in the United States.

Estradiol Triazole Derivatives of Ethynylestradiol as Effective Non-toxic Contraceptives

Alison Lanier
Faculty Advisor: Dr. Allen Schoffstall
University of Colorado Colorado Springs

Ethynylestradiol, an estrogen receptor agonist, is currently administered in medicine as a prophylactic to pregnancy. When paired with progestins, its effectiveness as a form of birth control is denoted by its ability to target specific receptors related to gene transcription and translation that affect ovulation and the menstrual cycle. Though it is a potent contraceptive, ethynylestradiol has many adverse side effects with chronic toxicity such as increasing the risk for stroke, myocardial infarction and thromboembolic disease, as well as endometrial, breast, and certain liver cancers.
Our research is centered on developing a potential non-toxic, yet effective contraceptive agent. A stable derivative of ethynylestradiol that is based on a triazole structure could be a possibility for future contraceptive evaluation. Triazoles are aromatic heterocycles that do not occur naturally and possess relatively non-toxic properties. Therefore, these compounds are of interest to be explored for pharmaceutical purposes. Ethynylestradiol will be submitted to reaction with a variety of organic azides using modern triazole synthetic methods to produce several estradiol triazole derivatives. These compounds will then be tested for possible biological activity.

From Rucksack to Backpack: Transitioning from Military Service to Successful STEM Students

Alyssa Mallette
Faculty Advisor: Lisa Hines
University of Colorado Colorado Springs

It is well-accepted that the United States economy is lacking skilled professionals who are knowledgeable in science, technology, engineering and mathematics (STEM). The availability of the Post 9/11 GI Bill for service members has increased the number of veteran enrollment in post-secondary institutions who are well-suited for STEM degree programs and can potentially help to fill this need for STEM professionals. However, the transition of veterans from the military environment to an academic setting poses many barriers that ultimately lead to the unsuccessful completion of an undergraduate degree and subsequent progression into the STEM workforce. With the support from the National Science Foundation, we have developed and implemented the Military STEM Scholarship Program at the University of Colorado Colorado Springs. The goal of this distinct program is to provide the necessary support for the unique needs of this underserved population to ensure that they graduate and successfully transition into professional civilian jobs within the science, hi-tech and engineering industries, or into graduate level programs. Through this program, we are also conducting research to identify and overcome the major barriers so that military STEM students can be successful. We will discuss our preliminary results in this poster presentation. Ultimately, the findings from this project will be informative for addressing a national issue and can serve as a model for other institutions to follow.

Artificial Grammar Experiment:
The Effect of Implicit Knowledge and Explicit Knowledge of an Underlying Process
on Our Ability to Detect Changes in that Process

Wan Hung Yau
Faculty Advisor: John Horner
Colorado College

Artificial grammar learning (AGL) is an area that studies people’s ability to detect changes to complex underlying processes. This study explored the relative detectability of different kinds of deviation between expected and actual outcomes, with either implicit learning (Experiment I) or explicit learning (Experiment II). Each participant was assigned to one deviation condition. In experiment I, participant first experienced list created by an artificial grammar (training phase), then were asked to detect changes to the underlying process and to state the likelihood of judgment (testing phase). In experiment II, participants were introduced to an explicit instructional presentation, where they learned about the underlying process, prior
to the training and testing phases similar to the experiment I. In both experiments, participants demonstrated an ability to discriminate a change when it occurs, with varying degree of discriminability among different deviation conditions. In experiment II, moreover, there were two distinct patterns of discriminability: one that comparable to the performance in the control condition, and one with much better discriminability.
Oral Session 2  
1:00-2:20

Worner Campus Center 116  
Conversations in Sexual Identity

Conscious Variety

Yuliya Drakh  
Faculty Advisor: Corey Drieth  
University of Colorado at Colorado Springs

My artwork separates the exploration of sexual identity from morality and redefines it as a part of an overarching and essential step in human development: inquisition and definition of the unknown in its relation to the self. Through art, I dig for the roots of our present-day conflicts in sexuality and gender and examine the consequences of imposing chasteness and self-restraint onto the curious brains of our developing youth. In my painting and printmaking I illustrate sexual development as a personal and dynamic journey by use of various themes including implied narrative, mythology, and folklore. My most recent work in monotype printmaking focuses on cultural disapproval in addressing sexual inquisition and the subliminal consequences of that suppression.

The Firmest Wrist:  
A Queer Reading of Toni Morrison

C3C Michael Borger  
Faculty Advisor: Lt Col Candice Pipes  
United States Air Force Academy

Toni Morrison’s first novel, The Bluest Eye, features a series of short, powerful scenes in which the diverse cast of characters realize their inferiority and internalize crippling racial shame. Whether suffering under the critical eye of higher class white people as they make embarrassing mistakes, or offending insecure members of their own black community, Morrison’s characters are unable to live their lives without invoking the sinister implications of racial difference. Similar to Morrison’s literary depiction of racial shame, empirical and experiential evidence link the idea of internalized shame to members of the LGBT community. Not only does the shame exist, but it also is shown to manifest itself in interpersonal dysfunction, much like the dysfunction Morrison demonstrates in her novel. If the same shame inflicts both the black community and the LGBT community, it allows LGBT readers to read The Bluest Eye as a literary work that informs their own lives. It also allows straight readers to see past the publicized successes and failures of the LGBT rights movement, and to identify the real challenge that has yet to be confronted – the LGBT consciousness. Unfortunately, the LGBT community lacks support from literary critics in finding themselves in works like The Bluest Eye. This paper works to connect the LGBT experience with shaming
to Morrison’s novel in a way that resists recent critical judgments. Moving beyond the idea of shame, my criticism illuminates The Bluest Eye’s purposeful placement at the “end” of the civil rights era, allowing LGBT readers to set their course to a higher level of self-consciousness.

Come Together Right Now Over Me:  
The Case of Leelah Alcorn

Celina Houtman  
Faculty Advisor: Dr. Michelle Neely  
University of Colorado Colorado Springs

There have been studies on advocacy groups who use social media to promote their causes and civic engagement actions. But those studies do not focus on why people rally together after a certain event that causes unrest within communities. Building on the work of Danah Boyd and the research of three professors from the University of Michigan, I have delved into the case of Leelah Alcorn, the transgender teenager from Ohio who committed suicide, and the social media site she herself used daily – Tumblr. Tumblr is a social media blogging site in which users can post whatever they’d like: pictures, videos, even just text posts about their lives or social topics. After news of her death the Tumblr community exploded with people who support the LGBTQ community, all of whom were ready to stand up and fight for equality. This study sets out to identify why certain events spark responses in certain communities. By using the grounded theory approach, I interviewed nine separate blog owners whose blogs have spoken specifically about this case and want to help change the world.

Worner Campus Center 213  
Socio-Economic Models

Investing in Real Estate:  
Protecting Against Market Downturn

C1C Keith Link, C1C Jared Jones  
Faculty Advisor: Capt Anthony Perone, Lt Col Thomas O’Malley, Lt Col Tim Pettit  
United States Air Force Academy

The recent changes in the real estate market (2008) have caused military and civilian home buyers to become fearful and look for other means to protect against the devaluation of their home. Statistically, buying a home is one’s biggest investment in life, but many military and civilian jobs force people to relocate every two to three years. This poses two potentially undesirable choices: 1.) Being forced to rent at every duty location and subjected to volatile and increasing rental market 2.) Buying a home and hoping its value will increase in only two to three years. The project that we are exploring is a protected put option that can safeguard the value of your house against a downturn in the overall housing market. This allows people with shorter duration stays in a job location to capture the advantages of home ownership with the comfort of a safety net if the market does indeed decline at the point when they have to sell to relocate to the next job location.
Hotel Eleganté Room Occupancy Forecasting

C1C Garrett Jameson, C1C Maxwell Krasnov, C1C Connor Lee
Faculty Advisors: Lt Col Thomas Boushell, Lt Col Justin Hill, Maj Jesse Pietz, Dr. Nathan Wozny
United States Air Force Academy

Hotel Eleganté Conference and Event Center, with 500 rooms and more than 48,000 square feet of event space, is the second largest hotel in Colorado Springs, Colorado. The hotel develops schedules for its 200 employees, orders supplies for its rooms, restaurants and events, and sets room rates based on an occupancy forecast that is developed manually by the revenue manager each week. Its direct competitors use proprietary computer-based software to make room occupancy forecasts that allow them to operate efficiently and price rooms competitively. In order to improve the accuracy of Hotel Eleganté’s forecasts, we developed a linear regression model of room occupancy that is based on past and present occupancy, and knowledge of major events in the city. We show that our forecasting model is able to predict room occupancy faster and with greater accuracy that the hotel’s current method.

Juvenile Demographic Analysis Model

C1C Garrett Braun, C1C David Burleson, C1C Robert Gutierrez, C1C Petar Jackovich
Faculty Advisors: Dr. Jim Lowe, Lt Col Marty Gaupp, Maj Jesse Pietz
United States Air Force Academy

As local law enforcement agencies face dwindling budgets, incorporating intelligence into preventative strategies and efficient resource allocation has become a top priority. The Colorado Springs Police Department’s (CSPD) Crime Analysis Unit is looking to be on the cutting edge of Intelligence Led Policing (ILP) to focus their limited resources on keeping the community safer. In this project, we support CSPD’s ILP efforts on two fronts. First, previous efforts have been limited in scope to only adult criminal activity. To incorporate juvenile criminal activity, we apply geo-spatial tools such as Hot Spot Analysis, Cluster and Outlier Analysis and choropleth maps to provide the CSPD with descriptive analysis of their juvenile data. Second, we repair their Criminal Activity Tracking System’s (CATS) web scraping tool while cutting its run time in half.

Optimizing Operation Unified Response

C1C Kevin Guadagno, C1C Kevin Saval, C1C Quinn Van Drew, C1C Sophia Vasiliadis
Faculty Advisors: Maj Jesse Pietz, Capt Philip Cho
United States Air Force Academy

The 2010 earthquake in Haiti caused nearly 112,000 fatalities making it one of the deadliest natural disasters ever recorded in the western hemisphere. In the weeks following the disaster, the United States Air Force Air Mobility Command moved over 29,000 passengers and 18,000 tons of relief aid in support of the relief effort, Operation Unified Response. During the first 96 hours of the operation 59 percent of aircraft transporting relief aide to Haiti arrived late. In order to assist planners in responding to future disaster relief efforts, we introduce a mixed-integer programming model that minimizes the time required to deliver
available relief aide into Haiti. The aircraft routing schedule outputted by the model demonstrates that our optimized airlift network increases the amount of relief aide delivered in the first 96 hours of the operation.

Worner Campus Center 216
Biological Detection

Geophysical Evidence for Englacial Brine Associated with Blood Falls, McMurdo Dry Valleys, Antarctica

Jessica Badgeley
Faculty Advisor: Dr. Eric Leonard
Colorado College

Ground-penetrating radar (GPR) images of Taylor Glacier, in the McMurdo Dry Valleys, Antarctica, uncover an englacial drainage system near the terminus of this polar glacier. GPR analyses showing an area of warm or water-saturated ice at the terminus of Taylor Glacier near Blood Falls give new insight into the location, extent, and mechanisms driving basal brine to surface. Blood Falls is the remnant surface manifestation of episodic releases of hypersaline, microorganism-bearing brine. Studies hoping to understand the microorganisms of the brine as a proxy for possible extraterrestrial life have only analyzed surface brine. As the brine changes environments from subglacial to supraglacial, the chemistry and biology of the brine are likely affected. Thus, locating englacial brine near Blood Falls has allowed us to extract unaltered brine in order to refine existing analyses. This study also uses observations and GPR data to determine the extent of the subglacial brine reservoir and hypothesize about the mechanisms driving the brine to the surface in order to better understand this anomalous englacial drainage system.

Preparation of Zinc Gallate (ZnGa2O4) for Neutron Detection

Kang-Min Kim
Faculty Advisor: Amy Dounay
Colorado College

Analytical methods based on neutron scattering have advanced various disciplines, including physics, chemistry, materials science, and biology. Because of unusually properties of neutrons, they penetrate matter more deeply than other probing particles without interacting with protons or electrons. This feature makes neutron-based analysis methods very useful, especially for understanding material structure and dynamics at the atomic scale. With the increasing price of helium-3 gas for neutron detection and the need for higher resolution, Oak Ridge National Laboratory is working on next-generation solid-state neutron detectors. To help realize this goal, our research focused on synthesizing novel solid-state neutron detectors based on zinc gallate (ZnGa2O4). We explored three methods to prepare zinc gallate thin film or powder, and developed a method to prepare highly crystalline single-phase zinc gallate materials. With new solid-state neutron detectors, scientists will be able to more accurately and affordably characterize materials by neutron-based analyses.
Visual Analytics to Study Movement in a Geographic Context

Glenn Xavier  
Faculty Advisor: Somayeh Dodge  
University of Colorado Colorado Springs

In order to protect threatened and endangered species, it is critical to understand how animals use space while breeding, migrating, foraging, and patrolling. It is therefore essential to develop methods and tools to facilitate the study of movement behavior of animals in a geographic context and a changing environment. This research explores several methods of calculating an animal’s home range utilization over time. Furthermore, with the development of a new exploratory visualization tool, named DYNAMO (Dynamic Visualization of Animal Movement and the Environment), this research attempts to explore the relationships between an animal’s physiological states, movement behavior, and its environmental context. As a case study, the GPS tracking data of endangered tigers in Thailand are analyzed to explore and visualize the influence of terrain characteristics and behavioral states on tigers’ movement patterns. We present the preliminary results of our case study and demonstrate how DYNAMO facilitates research in movement ecology domain.

The Heartleaf Philodendron

Ian Bruner  
Faculty Advisor: Bill Bannister  
University of Colorado Colorado Springs

This essay proposes that, in the age of the hyper-real, the modern middle-class worker exists divorced from nature, and in this disconnect, society has created simulated connections to the natural world. The common houseplant Philodendron Scandens Oxycardium, commonly referred to as “the heartleaf philodendron,” represents this pseudo-relationship between the middle class and the natural world. This essay will examine the cultural significance of the common house plant, using the semiological systems proposed and used by Roland Barthes. In his book “Mythologies,” in which, he wrote cultural critiques about specific aspects of French culture at that time (1950s).

Cornerstone Arts Center 301  
Software Engineering

The Standardization of Air Force Analysis Software

C1C Ryan Bruns, C1C Gregory Potts, C1C Patrick Ryan  
Faculty Advisors: Maj David Caswell, Maj Raymond Magallanez, Maj Jesse Pietz  
United States Air Force Academy

Learning software to perform analyses for the USAF requires a large investment in time and resources. As USAF analysts change duty station locations, analysis software can vary, often requiring personnel to learn new analysis software in order to perform their duties. This learning process detracts from mission
effectiveness as analysts spend time learning software that could instead be used to perform analysis as part of a mission. Researching and implementing a standardized, force wide set of analysis software packages has the potential to help save the Air Force time and money by limiting the amount of time analysts spend learning new software. We construct a MODA model to determine the best software packages to use using software attribute data derived from analyst community inquiry as well as personally conducted research. Our model is able to produce a list of recommended software packages for standardized use for Air Force analysts.

The Flightline of the Future:
Augmented Reality to Defuse Improvised Explosive Devices (IEDs)

Thomas Spiotta
Faculty Advisor: Lt Col Tim Pettit
United States Air Force Academy

The US Air Force has sustained a number of budget cuts in recent years that have placed increased demands on a reduced workforce, potentially affecting aircraft availability and the quality of life of the maintainers. Augmented reality allows a clear view of the real world while overlaying pertinent user data through a hardware medium such as Google Glass or Epson Moverio. The purpose of this study is to determine if there is a competitive advantage by implementing augmented reality into the aircraft maintenance process to cut down the amount of time spent maintaining an aircraft. Before this technology is tested out on the flightline, three different mock improvised explosive devices (IED) defusion techniques will be evaluated. Each IED is similar in size and complexity, but will be defused using standard technical orders, with the aid of Just-in-Time Training, and with the aid of a live but geographically separated Subject Matter Expert (SME). Lockheed Martin Corp, Air Combat Command and Air Mobility Command are sponsors of the project.

The Flightline of the Future:
Augmented Reality Delivering On-Site Subject Matter Experts (SME)

C1C Matthew Bowyer
Faculty Advisor: Lt Col Tim Pettit
United States Air Force Academy

The US Air Force has sustained a number of budget cuts in recent years that have placed increased demands on a reduced workforce, potentially affecting aircraft availability and the quality of life of the airman maintainers. Augmented reality displays a real-world view while adding in pertinent user data through a hardware medium such as Google Glass. Having a Subject Matter Expert (SME) is extremely valuable on the flightline, but due to manpower demands they cannot always be on scene when a problem arises. By sending a video feed to the SME, he/she can view the live feed from the maintainer’s perspective and communicate more effectively the solution to the problem utilizing two-way audio/video with content overlays. This project will analyze the effects of the technology on active duty and reserve F-16 mechanics. The analysis will provide recommendations to the Air Force for further investment in augmented reality technology. This project is sponsored in part by Lockheed Martin Corp and Air Combat Command.
America's Great Myth: Why the Civil Rights Movement Cannot be Finished

C2C Nolan J. Mayhew
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It is impossible to project what prominent Civil Rights leaders from throughout American history would say or do if faced with the present day racial conditions of the United States, but questions and issues raised by two prominent 20th century writers of the Harlem Renaissance, namely Langston Hughes and W.E.B DuBois, and their lamentations and dreams can be examined today. Langston Hughes’s poetry focused on granting freedom to African Americans, the elimination of Jim Crow laws in the South, and institutionalized racism in American law, while DuBois’s work looked beyond abject racism and towards the elimination of discrimination in the hearts and minds of America’s white majority. American lawmakers and the American consciousness has accepted Hughes’s message, eliminating legalized discrimination against African-Americans in the United States, making him a character of history grouped with Civil Rights Movement, the Emancipation Proclamation, Harriet Tubman, and Frederick Douglass. W.E.B DuBois remains a voice that could join the chorus of present day African-American leaders because his call for a transformation of the majoritarian discriminatory mindset towards full inclusion and legitimization of African-Americans as fully realized Americans is more necessary today than at any historical racial flashpoint in the last thirty years. This paper suggests that legal equality and equal lawful status have been granted to African-Americans, but equality in the hearts and minds of the greater population has not been achieved, as evidenced by notable events showcasing disturbing hate and discrimination directed at African Americans such as the Eric Garner and Michael Brown murders in the summer of 2014.

Arctic (in) Security: The United States and Polar Politics in the Age of Climate Change

Nicholas Blanchette
Faculty Advisor: David Hendrickson
Colorado College

My research project examines the impact of continued climate change on the Arctic Circle, and politics in the Arctic region. As a result of increasing global temperatures and the corresponding acceleration of Arctic ice melt, international interest in the region is heating up, with prospects of new shipping lanes and access to resources proving to be especially enticing for Arctic States. However, the surge in international interest in the region has brought about new tensions between states, punctuated by both a lack of regulatory mechanisms and a power vacuum in the Arctic North. To further complicate matters, the United States largely remains in the cold when it comes to the Arctic Circle. Ultimately, I find that a renewed American role in the Arctic is critical both for securing American interests and the peaceful development of the Polar North.
Edwin Cater: The Activist Naturalist

Thomas Price
Faculty Advisor: Dr. Christina Jimenez
University of Colorado Colorado Springs

The name Edwin Carter does not readily come to mind as a significant figure in Colorado and western United States history. However, this 19th century Breckenridge miner became any early voice for ecological stewardship and naturalist activism. Through his expert taxidermy, he preserved and displayed over 3,000 pieces of Colorado fauna in his small “log cabin museum,” garnering not just local interest but world-wide acclaim. Carter saw native animals disappearing, mutating and/or diminishing due to human encroachment and mining devastation. That era’s notion of “manifest destiny” – the perceived inherent right of certain persons to take without thought of consequence to native people, plants or animals – fueled much of this change. Carter had the determination and foresight to see his collection form the nucleus of what would become the Denver Museum of Natural History, also bridging the gap from old-style museums – often oddly assorted personal collections – to the modern day model of professional display, education and accessibility. Five years of Carter research has been distilled into a volume in the "Now You Know" biographical series of prominent Colorado figures for elementary through middle school students, to be published in 2015 by Filter Press.

Joan Miro: Politics and Surrealism

Rachel Jovene
Faculty Advisor: Maria Steen
University of Colorado Colorado Springs

Joan Miro, (20 April 1893-25 December 1983) is an internationally recognized artist from Barcelona, Spain. Joan Miro’s work is known for its surrealism, which he used to express his political opinion throughout his life. Works such as “la Segadora,” “Cabeza de un campesino catalan” and "Mayo del 68” show his unique style and significant political stance.
Electrochemical Studies on the Influence of Precipitates on the Corrosion of Duplex Stainless Steels

C1C Daniel Barbera  
Faculty Advisor: Dr. Brent Talbot  
United States Air Force Academy

Duplex stainless steels are an increasingly common type of metal which are used regularly in a variety of disciplines. The austenitic and ferritic microstructure is strengthened by the presence of alloying elements such as chromium to prevent pitting corrosion. Chromium structures form properly when the metal is quenched after heat treatment. Improper cooling can lead to poor distribution of alloying elements which may damage the corrosion resistance of the metal. Annealed LDX 2101 and 2205 were observed using microscopy to confirm the formation of carbides and σ – phase in the microstructure of the duplex stainless steel. Potentiostat results showed that the passive layer was corroded significantly earlier in the aged samples compared with the control, unaged samples. The formation of carbides and σ – phase in the two steels supported that annealing followed by slow air cooling would form these elemental impurities where precipitates of chromium form. The aged samples’ differing passivation from the control demonstrated that the formation of these impurities do in fact lead to a decrease in pitting corrosion resistance. This is crucial to metallurgists who heat roll, weld, or heat up stainless steels to manipulate their shape. They must ensure to quench the metal properly, often more quickly, in order to prevent the formation of precipitates which could limit the metal’s fatigue life.

The Interphase Microtubule Damage Response of S. pombe

Rose Doss, Sindi Xhunga  
Faculty Advisor: Tom Wolkow  
University of Colorado Colorado Springs

Human ATRIP is a regulatory subunit of the ATR kinase that occupies central positions within DNA damage response (DDR) pathways. However, patients with mutations in ATRIP or ATR present with microcephalic primordial dwarfism by a mechanism that appears to be independent of DDR activity. This suggests that the ATRIP/ATR complex participates in a novel pathway that broadly influences human morphology. In addition to its DDR activity, we have found that the fission yeast homolog Rad26ATRIP participates in an interphase microtubule damage response (IMDR) pathway that preserves cellular morphology. Our data suggests that Rad26ATRIP localizes to microtubule organizing centers where it controls this IMDR pathway. To test this hypothesis, we aim to identify and mutate the residues of Rad26ATRIP that direct
localization to microtubule organizing centers and determine if this affects IMDR signaling. Our data thus far conveys that this localization code is located in the N-terminal region of Rad26 ATRIP.

Development of Chinese Competitive Economic Policy

C2C Christopher M. Dylewski
Faculty Advisor: Dr. Bruce Linter
United States Air Force Academy

China has historically exhibited an isolationist stance on international trade. The Silk Road linked the Far East with willing trading partners as early as 200 BCE, but Chinese emperors maintained a policy of seclusion over the reign of numerous dynasties. The policy of Chinese self-sufficiency pervaded Chinese economic policy, and continued as a dominant theme in economic policy until the Opium War. Following the cessation of hostilities in the Opium War, the victorious British opened the “Central Kingdom” to international trade as never before, using military might to establish and enforce one-sided treaties. These unequal relationships persisted in some form until the establishment of the People’s Republic in 1949. It perhaps should come as no surprise, then, that the PRC has struggled to establish effective economic policies for competition on a global stage. Today, the Chinese market economy mirrors many other transitional economies in its struggle to establish regulations that will facilitate effective free market practices. To do so, China must address substantial institutional challenges. Current inhibiting factors include system-induced monopolies, agreements to restrain competition, and corruption and unfair competition, whether in policy or in practice. As an increasingly effective member of the international economy, China’s efforts to move toward a more competitive model are vitally important to the future of global commerce.

Seasonal Variation in Height Usage by Gray Mouse Lemurs (Microcebus murinus) in a Riverine Forest Fragment in Southeastern Madagascar.

Jenna Griffith, Leslie Dinkin
Faculty Advisor: Krista Fish
Colorado College

Predation shapes aspects of primate ecology such as social structure and the timing of activity. We hypothesized that predation would influence the height at which gray mouse lemurs (Microcebus murinus) were situated in a riverine forest. Between January and June 2009, 338 hours of mouse lemur walks were conducted at Berenty Private Reserve in southern Madagascar. Upon encounter with a mouse lemur, their height and behavior were recorded. Throughout the study, temperature and precipitation were also noted. Both an F-test and Lavene test confirmed a significant difference in height variation between the rainy and dry seasons, with greater variation seen during the dry season. Temperature and precipitation did not have an impact on variation in height use. The mouse lemurs ate a combination of fruit and insects during the rainy season but switched to almost exclusively insects during the dry season. Mouse lemurs showed greater height variation while eating/foraging insects than fruit. Predation threats remained constant except for an increase in owls during the dry season. We concluded diet rather than predation was the primary reason for the seasonal variation in height usage.
Is Auto-Correct Really Improving our Writing?

Valerie Larson
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

Auto-Correct is a software function that automatically makes or suggests corrections for mistakes in spelling or grammar made while typing. All smartphones and computers with Microsoft Word have auto-correct built into their systems today. A study was conducted by Cynthia D. Wilson called “Higher Education Meets Social Media” about teachers starting to incorporate technology into the classroom. The study talks about the challenges technology has brought into the classroom including suspected lack of authenticity within a student's writing and that technology is a poor teaching tool with students having to teach themselves a lesson instead of a lecture being given. I agree that technology is becoming an issue in the classroom due to the research I have conducted. A survey was uploaded to Facebook about how technology has affected writing in the professional world, and it received 36 responses. The results consisted of people from all different ages and background experiences in school, like homeschooled verses public school, and schools in states all over the country. Most of the data came back with people saying they checked their grammar and spelling themselves and that they did not rely on auto-correct at all except for a post on Facebook or Twitter. These results could mean that people know when to differentiate between personal and professional language when writing. There were also a couple of interviews that were collected from English professors at UCCS about the changes the professors have seen in their students’ writing with the advancement of technology. Some of the results from the professors were saying that technology has negatively affected student writing. The results might mean that students are becoming lazy and not rereading the assignments they are turning in, which means the assignments are being turned in full of grammar and spelling errors. It may not be the schools to blame for reading and writing skills to be declining; it may be our constant need to use technology.

Let’s Get Physical: Correlates of Exercise in Middle-Aged Adults

Vanessa Lavaty
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Regular physical activity (PA) is a key health behavior associated with a reduced risk of disease complications, morbidity, and mortality. Specifically, participation in PA has been linked to improved cardiovascular health and prevention of cardiovascular disease, prevention of diabetes, weight maintenance and prevention of obesity, and prevention of certain cancers (e.g., breast, lung, endometrial, and colon). These benefits extend well beyond physical health, with accumulating evidence linking PA with reduced anxiety and depression and improved quality of life in aging populations. Despite the evidence for benefits of regular PA, physical inactivity is a critical health problem in the United States. Consequences of physical inactivity include increased risk for cardiovascular disease, cancer, diabetes, and other non-communicable diseases. Although middle-aged adults are at increased risk for these chronic diseases associated with inactivity, data from nationally representative surveys in the United States suggest that only 30% of middle-aged adults engage in regular PA. Middle-aged adults are particularly well-suited for physical activity interventions, as physical fitness in midlife is a contributor to healthy aging and a reduction of morbidity in later life. However, the barriers to exercise in this population are understudied and likely
multifaceted. Therefore, understanding the relevant and modifiable determinants of PA among aging adults is necessary for developing effective interventions. The purpose of this study is to better understand factors associated with PA among adults aged 45-64 years old. Participants complete a questionnaire assessing self-efficacy, goal-setting, perceived barriers, benefits, and health variables associated with PA. Results will discuss preliminary findings; data collection is ongoing.

Augmented Reality and Its Implications for Dark Adaptation

C1C Emilee Ledford, C1C Alexandra Preiss, C1C Daniel Thomas
Faculty Advisor: Lt Col Chris McClernon
United States Air Force Academy

The Joint Strike Fighter (JSF) is one of the most advanced multi-role fighter aircraft in the world. A fighter this advanced requires constant developments in order to reach optimal performance. One of these state-of-the-art systems is the Distributed Aperture System (DAS) which projects an IR image from the outside world onto the Helmet Mounted Display (HMD). This advanced HMDs presents the pilot with an augmented reality view of their surroundings, giving a daytime-like view of the world even when in nighttime conditions. While the literature on dark adaptation is robust, little is known about the necessary transition times between augmented reality (such as the DAS) and unaided night vision. Seventy-two research participants completed a visual search task using a simulated, computer-based DAS at one of four operationally relevant brightness levels. This task involved identifying specific shapes in the middle of a target-rich environment 75 times in five minutes. To test the effects of brightness levels from the DAS system on visual acuity the participants took a Snellen visual acuity test and contrast test at five minute intervals for 30 minutes. Performance on vision tests between the groups was compared. The purpose of this study was to determine the optimum time for a pilot to switch from a DAS-like display to unaided night vision to adequately dark adapt to perform under unaided night visual condition.

Effects of Primed Self-Perceptions on Environmental Attitudes and Behavior

Julia Liao
Faculty Advisor: John Horner
Colorado College

A strong sense of pro-environmental self-identity is associated with higher levels of pro-environmental attitudes and behavior. Previous studies have shown that reminding people of their own past pro-environmental behaviors can be enough to increase their pro-environmental self-identity, which in turn increases their future levels of pro-environmental attitudes and behavior. In contrast, invoking a pro-moral or economic self-identity has been shown to have the opposite effect, reducing subsequent levels of pro-environmental behaviors and attitudes. The present study aimed to build on these findings by inducing pro-environmental, pro-moral, or economic self-perceptions in participants, in order to directly compare the effects of these types of self-perceptions on environmental attitudes and behaviors. Results showed no difference in post-manipulation attitudes or behavior between the three self-perception groups. These findings suggest that the previously demonstrated behavior-to-identity-to-behavior relationship may be more complicated than indicated in the existing literature, and that invoking stronger environmental self-
identities may not be a straightforward method to increase pro-environmental behaviors in the general public.

Did You Do the Reading? A Study of Assigned Reading within College Courses

Chelsea Mallory, Nicole Cobb
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

Studies, such as Karen Bradley and Brian Brost’s, “Student Compliance with Assigned Reading: A Case Study,” have indicated that frustrations between students and teachers regarding assigned reading have been an ongoing predicament for several years. Teachers have found frustration with their students due to a lack of compliance with assigned reading, and students have found frustration with the amount of assigned reading and its lack of relation to course material and lectures. Through this study, the research team was able to obtain an insight to student perspective of assigned reading within different majors, and the perspective of teachers regarding assigned reading. A survey was created for students that requested their major, how much reading they were assigned on average per week, how much of the reading they completed, how reasonable they believed the reading to be, how they believed assigned reading effected their success in the courses they took, and any personal thoughts they had regarding assigned reading. In addition to the survey, teachers from different majors were interviewed in order to gain insight into teacher’s perspectives on assigned reading, and why they assign what they do. With this information, teachers will be able to have a better understanding of why students are not being compliant with reading, and what they will be able to change within their classrooms to promote a willingness to cooperate with assigned reading from students.

Optimization of Synthesis of 1-(3-phenyl-2propenyl)-methylester-1H-1,2,3-triazole-4-carboxiylic acid

Andrew McGrath
Faculty Advisor: Dr. Allen Schoffstall
University of Colorado Colorado Springs

The EPA 2007 priority list of Superfund contaminants lists arsenic, lead and mercury as the top three of 275 hazardous substances. Unlike volatile organic compounds, metals are not removed from the environment by natural decay processes. Instead, these need to be removed from the environment to yield safer health and ecological conditions. This research project seeks to synthesize novel polycarboxylate monomers in order to bind and remove heavy metals from the environment. The oligomer can be recovered for re-use, which is a guideline set by the EPA for Sustainable Chemistry. The research goals of this project are to 1) synthesize triazole carboxylatess with multiple binding sites to form complexes that remove metals from soil and water, and 2) separate and recover the carboxylates from the complexes for reuse. We use green click chemistry to build new cinnamyltriazole carboxylates, to be used in metal binding studies. Some of the organic reactions are carried out in aqueous solvents at 60 oC using microwave heating. The piece of the project reported here is to establish optimized reaction conditions for the synthesis of 1-cinnamyl-1H-1,2,3-triazole-4-carboxylate by varying catalyst, temperature solvent and work up procedures.
The Great Academic Divide: Are High School Instructors Preparing Students for College?

Zachery Messenger
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

For the past two decades, secondary education across the U.S. has centered their pedagogy on product-oriented writing. This is largely due to the growing number of high school students from “diverse linguistic and cultural backgrounds” (Scherff & Piazza, 2005). With this complicating factor of diverse populations in high school, new standardized tests were implemented in order to aid all students towards a convenient, unified standard of writing, that would in effect, change writing instruction drastically. The result of this changing demographic would inevitably put standardized testing as a core function of secondary pedagogy. However, with focus on quantitative results over qualitative writing, freshman entering college meet unforeseen challenges in adapting to the universities’ expectations of literacy and writing: that is, freshman face steep learning curves as they are expected to think outside the box, develop their own voice, and write for multiple audiences. There is a strong disconnect between what high school instructors teach in English studies and what college professors demand from their students, which begs the question: is secondary education preparing students for success in college? This project will address this educational division, highlighting the differences between teaching styles of differing educational contexts, and will offer pedagogical practices utilized in college as a way of bridging this academic gap. The results of this study show that focus on writing as a process, daily free-writing activities, frequent peer-review, more instruction on analysis, and discussion about audience awareness, are all assets that prepare writers to be ultimately more successful in college. In essence, this project will not aim to correct secondary education; but rather, it will offer criticism that will guide secondary pedagogy towards practices more akin to a English college learning environment so that students can have a smoother transition from high school to college.

Drosophila larp5 Regulates Neural Development and Influences Viability

Marissa Metz and Allison Pabich
Eugenia Olesnicky-Killian Lab
University of Colorado Colorado Springs

A major goal of neurobiology is to identify genes that are involved in regulating nervous system development. Preliminary investigations have shown that inactivating the Drosophila gene larp5 causes aberrant development of sensory neurons in the peripheral nervous system. The current study investigated the effects of turning off larp5 throughout the nervous system. Various neuronal cell types of the central and peripheral nervous systems were stained and investigated in larp5 deficient embryos. The number of sensory neurons and the number of neurites within each neuron was quantified. Behavior and viability in larp5 deficient animals was assessed. Overall, loss of larp5 function has detrimental effects throughout the Drosophila nervous system and results in decreased viability. Continued work on larp5 may have important implications for medical research in humans, as the gene is conserved in the human lineage and has been associated with Alzheimer disease.
Synthesis of Lithium Cobalt Oxide Ink for use in Printable Lithium Ion Batteries

C1C Daniel Mihm
Faculty Advisor: Capt Nathan Ellsworth
United States Air Force Academy

In the emerging world of handheld technology, achieving a stable, reliable, and efficient power source is primary. Increasing the challenge, this source must also be reasonably small and portable, while also keeping up with rising power consumption. Current technology has embraced the lithium ion battery to answer these problems; however, the current battery architecture has reached a plateau in terms of smaller size yet larger output, and a new approach of using nanoscale reactions is needed. Using lithium cobalt oxide (LiCoO2) nanoparticles to create an ink useable in commercial printers decreases the size of the battery, while increasing the power density. We have developed a reproducible strategy of decreasing LiCoO2 powder to the nanoscale and have begun testing various solvents to determine the best method of keeping these particles in solution. Herein, this work will determine methods to achieve nanometer-sized particles and develop stable and printable lithium cobalt oxide inks, and prove the viability of an in-house developed printing capability.

The Collatz Conjecture

C3C Matthew Miller
Faculty Advisor: Dr. Kurt Herzinger
United States Air Force Academy

Most commonly attributed to Lothar Collatz circa 1937, the Collatz Conjecture, also called the 3x+1 Problem, arose while Collatz was attempting to induce cycles in number theoretic functions. In this presentation, we will examine what is known about the Collatz Conjecture as well as propose new avenues of investigation.

Language Development and the Acquisition of Self-Regulation Mechanisms: An Exploration of Language Disorders and Externalizing Behaviors

Sydney Minchin
Faculty Advisor: Tricia Waters
Colorado College

Children are often misdiagnosed or treated for behavioral problems that are characterized as disruptive, aggressive, and inattentive. What might be overlooked in these cases is the child’s capacity for language. Language deficits often present as poor self-regulation (i.e. externalizing behaviors) in early and middle childhood. During this time a cycle emerges of breakdowns in communication pathways contributing to externalizing behaviors. Transition to school gives way to further problems if language deficits are not treated when they first present: poor peer interactions, peer rejection, and the possible development of aggressive tendencies and cognitions. This paper explores how self-regulation mechanisms are negatively impacted in children with language disorders. Discussion focuses on the implications for socio-emotional functioning as these children transition through childhood and into adolescence. A variety of intervention
techniques are reviewed that target specific aspects of language disorders, externalizing behaviors, and aggressive cognitions. The paper concludes with an extensive discussion of my field placement in an Early Head Start classroom where I worked with a two year old with language deficits. This section discusses how my interactions with him brought forth the research question at hand: Is language competence a necessary constituent of the development of self-regulatory mechanisms?

Evaluation of Communication Effectiveness CSURF Abstract

C1C Hunter Moody, C1C Alex Warner
Faculty Advisor: Dr. Victor Finomore
United States Air Force Academy

In the Air Force, Command and Control (C2) operators rely on multimodal communications to plan, direct, coordinate, and control assets over the battlefield. Their jobs are very workload intensive and the information they process is perishable. Due to the high workload, failures of detection and incomprehension of information is common. Air Force Research Laboratory has developed Multi Modal Communication management systems which utilize Automated Speech Recognition (ASR) to aid C2 operators retain information but the technology is not mature enough for perfect transcription. We tested five operators on their comprehension of multiple standardized stories that were either heard through radio only or spatial audio, read via text only, or listen to and read using the Multi Modal system. When the operators used the text only and the multi modal system, the ASR was degraded to either 60 percent or 80 percent accurate or remained 100 percent accurate. The comprehension level was determined by the accuracy when answering questions about the stories finding that radio only communication is perceived better than expected and that the 100 percent correct multi modal had also had one of the highest comprehension levels at 72% and whereas the degraded multi modal had a comprehension of 64 percent showing that maybe ASR technology does need to be fully correct. We also administered the NASA TLX workload questionnaire to the operators to see if the different communication styles affected perceived workload.

Creative Writing in Journalism: How Journalists Make News Interesting without Editorializing

Samantha Morley
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

As a journalist, there is a delicate balance between writing creatively and editorializing. Editorializing is inserting personal bias into a story that should be objective. Creative writing, however, is a means to attract and compel readers to continue to read an article. While these factors may seem distant from each other, journalists frequently begin as a creative writer and gradually start editorializing. This project will consist of using a set rule of guidelines that will be applied to newspapers ranging from local colleges to national companies. The process will determine the frequency of editorializing and/or creative writing through those levels and examine why or why not there may or may not be leniency depending on the level and experience of journalism. Examples of each will be identified and used to demonstrate how editorializing and/or creative writing is used in journalistic writing.
This project will primarily focus on large, national events such as the implementation of the Affordable Care Act, the uprising of the Islamic State of Iraq and Syria and other notable occurrences.
Investigating the recycling potential at USAFA and creating lasting partnerships in Colorado Springs

**C2C Trevor Muzzy**  
Faculty Advisor: Dr. James Pocock  
United States Air Force Academy

This presentation will provide a new cadet-led effort to revamp the existing recycling program. The Mitchell Hall Dining Facility, located in the Cadet Area at the United States Air Force Academy, generates 400,000 aluminum cans and 580,000 plastic containers annually. This suggests there is great potential for recycling at Mitchell Hall and throughout the dorms in the cadet area. In an attempt to identify the best practices, the authors have studied recycling efforts at neighboring campuses and military bases. Results indicate that single-stream recycling is a very popular tool within the local area and is much more cost-effective and environmentally friendly than landfill waste. With existing waste management contracts, the Air Force Academy has the ability to implement a robust single-stream recycling program in the cadet area. Additionally, these programs may save the government money and potentially generate income by selling clean recyclables to local businesses.

Building a Dye Laser Using a Tapered Optical Fiber

**C1C Elliot Myers, C1C James Stofel**  
Faculty Advisors: Dr. Brian Patterson, Dr. Randy Knize  
United States Air Force Academy

This experiment creates a simple dye laser using a single-mode optical fiber. Light from a frequency-doubled YAG laser ($\lambda = 532$nm) is launched into the optical fiber. The fiber is tapered to a diameter of 1μm and placed in Rhodamine 6G laser dye. The pump light interacts with the gain medium through the evanescent field outside the fiber causing stimulated emission. The stimulated emission couples back into the fiber. Mirrors on each end of the fiber provide the necessary feedback for lasing. This setup will be modified to create an alkali laser by replacing the laser dye with a gas of alkali atoms.

Coherent Beam Generation through Multiple Four Wave Mixing Processes in Rb Vapor

**C2C Robert Olesen**  
Faculty Advisors: Ms. Alina Gearba, Dr. Jerry Sell  
United States Air Force Academy

Four wave mixing in rubidium vapor has been shown to produce collimated beams at 420 nm (blue) and IR beams at 1.32 μm and 1.37 μm. While the behavior of the blue beam has been studied in detail, the origin of the IR beams is still an active area of research. To develop a better model of the IR beam generation, we use a process similar to previous studies. Input laser beams at 780 nm and 776 nm enter a heated Rb vapor cell collinearly and circularly polarized, exciting Rb atoms to the $5D_{5/2}$ state. Through four wave mixing, a coherent blue (420 nm) beam is generated, along with two IR beams (1.32 μm and 1.37 μm), whose coherence we are currently investigating. We filter the output beams produced to individually characterize each beam. We will describe the dependencies of all three beams in relation to the frequency detuning of the 780 nm beam, the input laser intensities, and density of the Rb vapor cell.
Using HPLC to Quantitate Indole Production as a Marker of Stress Response in Bacterial Communities

David Orban
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Indole, produced from tryptophan by many bacteria, serves an inter-cellular signaling molecule. In the presence of antibiotic, indole secreted by resistant cells has been shown induce protective measures in non-resistant cells (specifically, up regulation of efflux pumps). This study investigates indole production by bacterial communities in the presence of starch-capped silver nanoparticle (AgNPs), which have been shown to kill bacterial cells. Cell-free supernatants were prepared for high performance liquid chromatography (HPLC) by mixing 1 mL of the supernatant with 0.5 mL of a 75/25 (v/v) mix of acetonitrile and water. Indole was detected at 280 nm using a photodiode array detector. The HPLC assay, sensitive to micromolar amounts of indole, showed the robust resumption of indole production following exposure of Escherichia coli to AgNPs as compared to a slower response following exposure of E. coli to 10 µg/mL ampicillin, which is lower than the minimum inhibitory concentration. This methodology will provide information about how the cells of a bacterial population communicate among themselves in the presence of AgNPs.

Numerical Studies of the KP Line Solutions

Michelle Osborne
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University of Colorado Colorado Springs

The Kadomtsev-Petviashvili (KP) equation describes the motion of shallow water waves in a two-dimensional region [2]. It admits a class of solitary wave solutions, called line-soliton solutions, which are localized along distinct lines in the xy-plane. These types of solutions have been studied extensively in recent years [1, 3]. Using a variety of initial conditions, the corresponding soliton solutions will be simulated numerically, and how these solitons interact will be studied. The goal is to determine which of the many exact solutions of the KP equation the soliton solutions converge given the initial conditions.

Evaluation of Mobile Tools for Remote Guidance

C1C Corbin Palmer, C1C Emily Willson, C1C Ryan Vigil
Faculty Advisors: Dr. Victor Finomore, Lt Col Chris McClermon
United States Air Force Academy

Dismounted Battlefield Airmen operate in complex and dynamic environments which require a variety of skills to successfully accomplish their task. While they possess many skills, it is impossible to prepare for every situation they may encounter. Thus the ability to communicate and received real time instructions from a distributed subject matter experts is critical for their safety and the success of the mission. The advancements of mobile technologies that integrate various communication and collaborative tools can greatly improve the abilities for dismounted operators to collaborate with subject matter experts. Researchers think these advanced collaborative tools provide the team with more awareness and fidelity to
accomplish complex task faster and more accurate and with less workload then relying on only voice communication. This study evaluated the ability of a worker to communicate with a subject matter expert using a variety of collaborative tools to find hidden objects in a room and use them to build an abstract structure. Researchers evaluated three levels of collaborative tools (voice, camera view with annotation, panoramic and camera view with annotation). It is expected that the more immerse the helper is with the work’s environment the better the team will perform due to the ability to provide greater guidance. In the study we have seen that having the three tools of voice, visual and panoramic views have increased time, effectiveness, and efficiency. These results will help with the development of mobile collaborative tools to be used by Dismounted Battlefield Airmen.

Synthesis of Novel Human African Trypanosomiasis Compounds

Galina Parfenov
Faculty Advisor: Amy Dounay
Colorado College

Human African Trypanosomiasis (HAT), more commonly known as African Sleeping Sickness, is a parasitic disease endemic to central Africa. The disease is considered a Neglected Tropical Disease (NTD): although it kills over 10,000 people per year, it garners little funding and attention from the pharmaceutical industry. Our HAT research program is a response to the inadequacy of current treatments. We aim to discover and develop new drug leads and clinical candidates for combating HAT using medicinal chemistry techniques. Based on previous work, our lab has developed a synthetic route for the construction of a novel series of hydroxamic acids. Our new compounds will be assayed to test a hypothesis for the mechanism of anti-trypanosomal activity exhibited by a recently developed clinical candidate drug.

Social-Spatial Inequalities of the Public Transit System in Colorado Springs

Loretta Payne
Faculty Advisor: Dr. Emily Skop
University of Colorado Colorado Springs

The purpose of this project is to reach a better understanding of social-spatial inequalities with regards to public transport in Colorado Springs. The researchers will be selecting two distinct bus routes in Colorado Springs and will analyze a variety of data along each route to document differences and inequalities where they exist. Quantitative and qualitative data from the U.S. Census Bureau, the Mountain Metropolitan Metro, and Street Media Group (contracted with the city to handle all advertising of buses and bus stops, as well as all cleaning and maintenance of the bus stops) will be included. The researchers will then map the data in a Geographical Information System (GIS) for statistical analysis. The project is significant because it will demonstrate that inefficiencies of the local transit create social consequences that encourage broader social stratification.
Spatial Disorientation Caused by Augmented Reality

C1C Daniel Perkins, C1C Curtis Lackey
Faculty Advisor: Lt Col Chris McClemon
United States Air Force Academy

Due to a recent proliferation of augmented reality (AR) in helmet-mounted displays (HMD) (e.g., Joint Strike Fighter (JSF) Distributed aperture system), a need for understanding any negative consequences of AR-to-real-world transitions is needed. The purpose of this research is to determine any potential situations where Spatial Disorientation might occur in this unique context to effectively determine sound human factors design principles that may prevent such illusions. Fifteen participants flew simulated chair activities with both visual and vestibular requirements. Scenarios were focused to mimic the change from the high-visual-cue environment of the augmented reality to the low-visual-cue environment that exists in a nighttime flight environment. Participants completed a paired cognitive and search task to test performance within four different visual conditions: lights off with off-set night-vision goggles on (simulated AR), lights on with off-set goggles on (simulated real world with parallax), lights off with NVGs on (simulated AR with low visibility), and lights off with goggles off (real world low visibility). The participants completed a real time spatial disorientation assessment along with a standardized spatial disorientation survey and NASA TLX in order to quantify the extent of their symptoms and workload associated. Results are trending towards a decrease in performance and increase in spatial disorientation symptoms for participants in the low-visual-cue environment directly after switching from a high-visual-cue environment. These results show that spatial disorientation is a very real consideration when abrupt changes from a high-visual-cue environment to a low-visual-cue environment occur.

Detection of a Panel of Neurotransmitters in Human Urine Using HPLC with UV/Vis detection

Justin Petway, Zachary Pitcher
Faculty Advisor: Dr. David Weiss
University of Colorado Colorado Springs

Neurotransmitters are small molecules that carry signals from one nerve cell to another to control our central and peripheral nervous system. Serotonin (5-HT), dopamine (DA), norepinephrine (NE), and epinephrine (E) have been linked to many neurological conditions including Parkinson’s disease, schizophrenia, obesity, depression, and anxiety. However, as a result of complex brain chemistry it is not well understood how abnormal concentrations of these neurotransmitters are related to these disorders. Studying the amount of such neurotransmitters in urine can lead to a better understanding of these disorders and ultimately result in better preventative and treatment methodologies. Presented here is a method developed for a rapid, non-invasive analysis of neurotransmitters based on the examination of their concentrations in human urine samples. We used high performance liquid chromatography (HPLC), specifically hydrophilic interaction chromatography (HILIC) for the analysis of these four compounds due to its ability to separate small molecules from various samples and its high peak efficiency. We also used solid-phase extraction (SPE) to concentrate the sample and remove large molecules found in urine to produce cleaner results. The concentrated samples were analyzed with HPLC with UV/Vis detection. HILIC was the most effective method for the analysis of the specified neurotransmitters found in human urine samples.
Middle School Approaches to Writing Assignments: From the Pen of a Middle Schooler

Stephanie Rieg
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

Finding ways to motivate adolescent writers has long been an area of research. What are the instructional best practices? How do we get students to enjoy writing? In 2007, Steve Graham and Dolores Perin published an article entitled “What We Know, What We Still Need to Know: Teaching Adolescents to Write.” What we know is that “explicit and systematic instruction” as well as scaffolding parts of the writing process can help students improve their writing skills (320). Correlational studies are one way researchers can provide “useful and needed information” for writing instruction, especially in the middle levels (327). Recent work in the field has focused on filling many of the gaps in knowledge about instructional practices that Graham and Perin bring to light, but what is missing is a focus on what comes between the teacher and the students: the writing assignments themselves. How do teachers communicate what they are looking for? How does this change the way students look at writing? Can a writing assignment change the way a student approaches writing? In this study, I investigate whether the writing assignment itself plays a role in determining the success of student writing and engagement. The study looks at how writing assignments are designed and how middle school students respond to those assignments. The goal is to understand how different kinds of writing assignments can change the ways students look at writing. From the pens and voices of middle schoolers themselves, we begin to find some answers. By examining samples of their writing and asking them their opinions of writing, students begin to reveal the link between writing assignments and student responses to them.

Development of Carboxylic Acids Using Triazole Rings to Bind Transition Metals

Valencia D. Rogan, Anna Russel,
Faculty Advisors: Allen M. Schoffstall, Renee Henry
University of Colorado Colorado Springs

Ligands were developed to mimic plant siderophores in order to study how carboxylate ligands bind to transition metals. Ligands were developed that gave either one or two carboxylic acids. First the triazole rings were synthesized and then the ester was removed using THF and NaOH to make the carboxylic acid. Early stages of ligand binding have been done with first row transition metals.

Cadmium Selenide Quantum Dot Synthesis and Surface Modification for Application in Cell Imaging

Caleb Rolsma
Faculty Advisor: Dr. Kevin Tvrdy
University of Colorado Colorado Springs

Quantum dots (QDs) are semiconductor nanocrystals with radii on a nanometer-scale, and contain several hundred to several thousand atoms. QDs have size-dependent properties originating from quantum confinement of excitons in the nanocrystal, including size-dependent absorbance and emission spectra. Consequently, QDs have many potential uses, including cell imaging. Cadmium selenide (CdSe) QDs were
synthesized using cadmium oxide and trioctylphosphine selenide precursors in a trioctylphosphine oxide solvent, with the addition of various ligands to affect growth rates, producing QDs with approximate radii in the 1-3 nm range for different samples. After synthesis, QD surfaces were passivated using a zinc sulfide overcoating to improve emission quantum yield, followed by size-selective precipitation to narrow the size distribution within a sample. To produce water-soluble QDs, a silanization reaction was used to coat the QDs in a silica shell with hydrophilic side chains. Future plans include alterations to the silanization reaction to allow for the bioconjugation of biological molecules to the QD surfaces, which can then be used in cell imaging.

The Influence of Previous Concussions on Return-to-Play Recovery Time

**C1C Marie Rossillon, C1C Michelle Ferguson, C1C Gavin O'Neil, C1C Emily Willson**
Faculty Advisors: LCDR Brian R. Johnson, Dr. Christopher D'Lauro
United States Air Force Academy

Doctors have long treated concussions as an ephemeral injury leaving no lasting damage. However, recent evidence indicates neural effects may persist even after cognitive function has apparently returned to normal. At the Air Force Academy, cadets must complete required military training and sport participation that increases their susceptibility to concussions. Military command structure and free inclusive healthcare afford more complete concussion follow-up for return-to-play protocols than at civilian schools. Our goal is to use our integrated concussion care and high-risk population to better understand how prior concussion history effects return-to-play determinations. We have collected a two-year comprehensive database (N=307) cataloguing these assessments including: days until normalized neurocognitive assessment, source of concussion, prior concussion history, days until symptom free, days until completed return-to-play protocol, and others. These data indicate dramatically longer recovery times for anyone with a prior concussion history when compared to those experiencing their first concussion. For example, first time concussion sufferers reported being symptom free in a shorter time (M=28.0 days) than those with a previous concussion history (M=74.3 days; F(1, 75)=5.90, p < .05). When taking a neurocognitive battery (e.g., Stroop task, visual search task, working memory, etc.), first time concussion sufferers returned to their baseline earlier (M=25.2 days) than those with a previous concussion history (M = 53.0 days; F(1, 75)=4.67, p < .05). Taken together, these data support the idea that concussions cause latent neural damage that persist even with apparently normal cognitive performance.

A Risk Analysis of Formaldehyde Buildup in Military Deployment Barracks

**C2C John Rowan, C2C Lucas Guthrie**
Faculty Advisor: Maj Andrew Hoisington
United States Air Force Academy

Construction crews use formaldehyde in construction materials, found in abundance in travel trailers and emergency shelters. FEMA used trailers in disaster relief situations and post Hurricane Katrina conducted research of the environmental and health risks. Formaldehyde compounds are binders in building materials such as composite wood, carpet, and fiberglass insulation. Formaldehyde may cause adverse non-carcinogen health effects through inhalation to include headaches, occupational asthma, and irritation of the eyes. Additionally, EPA determined formaldehyde inhalation is a probable human carcinogen. Despite
this information, trailers may have a benefit for housing military troops during short term deployments overseas. To date, no detailed studies have been conducted to estimate indoor formaldehyde concentrations and risk analysis to the military occupants. This study modeled the indoor concentrations using mass balance methods in multiple scenarios and estimated the risk through parameters and procedures developed by the EPA. The results of the study will provide valuable information to military senior leaders regarding the risk to deployed servicemen if trailers are used instead of traditional tent barracks.

Functionalized-Microsphere Hydrogel Customization for Single-Walled Carbon Nanotube Separation

Jackson Rowland  
Faculty Advisor: Kevin Tvrdy  
University of Colorado Colorado Springs

Carbon nanotubes contribute to a useful class of nanomaterials, the applicability of which is expanded when tubes of a single chirality are utilized. Single chirality nanotubes are obtained through an electrophoretic interaction with the porous hydrogel Sephacryl-S200, however because Sephacryl is synthetically designed for size exclusion chromatography, there exists opportunity for improvement upon its functionalized polymeric structure. The method for development of a structurally stable microsphere hydrogel that can be made to chemically interact with SWNT has been determined. The chemical network configuration of the developed hydrogel will be exactly customized for optimal SWNT separation. The improved hydrogel will allow for efficient and inexpensive nanotube separations.

Gender Differences in Undergraduate Students’ Motivation for Future Interest in STEM Courses

Logan Savidge  
Faculty Advisor: Tricia Waters  
Colorado College

The current study investigates gender differences in the way motivational variables such as expectancy, value, cost and overall motivation predicted student achievement and future interest in STEM courses. Ninety-four students enrolled in PY 100 at Colorado College volunteered to participate in the survey; sixty percent of the sample identified as female and 40.4 percent identified as males. Our methodology was adopted from previous studies investigating student motivation with Jacquelynne Eccles’ Expectancy-Value-Cost Theory of motivation. Students answered questions on a five point Likert scale regarding their expectancies, values and costs related to the PY 100 course. Future interest in STEM courses was measured on the same Likert scale and achievement was measured by the student’s final grade in the course. Independent samples T-tests revealed that females reported significantly higher overall motivation, value and cost in PY 100 indicating differences in the way each gender perceives these variables. Multiple regression analysis revealed gender differences in the predictability of measured variables for future interest in STEM courses. For males, value independently predicted future interest, but the variables only predicted future interest for females when entered into the regression together. Additionally, this model explained a higher percentage of the male population than the female population suggesting more efficient predictability for males. Overall, the results suggest that males and females may be motivated by different variables interacting in different ways. For example, males’ perceived value in PY100 can be an
independent predictor of their future interest in STEM courses, but females appear to be motivated by a combination of variables. Future research needs to be done to determine whether there are other possible variables for females (as value is for males) that may be direct predictors of future interest in STEM.

Determining the Role of Caper in Drosophila Neural Development

Logan Schachtner, Laura Bell
Faculty Advisor: Dr. Eugenia Olesnicky Killian
University of Colorado Colorado Springs

A vast number of genes are involved in the formation and maintenance of the nervous system. One key goal of neurobiology is to identify all the genes involved in development of the nervous system and to determine the exact roles that these genes play. Importantly, although many such genes have been associated with human neurological disorders, little is known about their molecular function. The current study focuses on the effects of knocking down the gene caper within the Drosophila nervous system. To date, very little is known about caper function. To understand the requirements of caper in neural development, Drosophila embryos deficient in caper have been stained and examined, showing that several cell types within the peripheral and central nervous systems fail to form properly. Analysis has included quantifying the number of specific sensory neurons and also the number of neurites within each of those neurons. Overall, loss of caper function has been shown to cause severe nervous system defects, which may also be correlated with abnormal behavior. Future research on caper may lead to important medical discoveries, as this gene is conserved across nearly all species, including humans.

The Efficacy of the Matrix Chaperone for Bacterial Transport and Storage

C1C Justin C. Scheidt
Faculty Advisor: Lt Col Marcus D. King
United States Air Force Academy

The objective of this research was to assess the suitability for bacterial transport and storage of Gentegra's Matrix Chaperone swab, which was developed to eliminate the need for refrigeration during shipment and storage. The cotton swab control, generation 1 Matrix Chaperone, and generation 2 Matrix Chaperone elastomer were inoculated with challenges of Salmonella enterica ssp. pollorum, Streptococcus equi ssp. zooepidermicus, and Pasteurella multocida. The number of viable colonies retrieved after 0.25 hours and 2/7/14 days demonstrated that S. equi survived better than the other strains, suggesting that these bacterial species may have certain characteristics that result in survival differences. The Matrix Chaperone elastomer demonstrated markedly better performance than the generation 1 Matrix Chaperone, possibly due to the elastomer's physical structure which retains more residual moisture.
Application of Fluorescently Labeled Carbon Quantum Dots to D. discoideum for the Quantification of Intracellular Magnesium Levels

Haley Schroeder
Faculty Advisor: Murphy Brasuel
Colorado College

Magnesium deficiency can have negative effects on human health and can lead to serious illnesses, such as diabetes, metabolic syndrome, hypertension, cardiovascular disease, and occasional renal failure. Even through there is much evidence indicating the importance of magnesium in biological systems, very little is known on how to quantitatively follow magnesium transport real time within living cells. Researchers are striving to develop magnesium selective-nanosensors that would allow for intracellular magnesium measurements. This research was conducted with the goal to successfully develop a nanosensor capable of withstanding the internal conditions of living cells and detecting minute changes in magnesium concentrations both in the lab and within the living cells D. discoideum.

The Influence of Teacher Feedback on Students’ Writing

Lauren Shinnick
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

Fiona Hyland has done multiple studies on the influence of feedback on different groups of students. Her article, "The Impact of Teacher Written Feedback on Individual writers," focuses on ESL students and the feedback they have received from their teachers and how the feedback has influenced their writing, and interest in the class. This research expands Hyland’s studies by collecting data on the emotions that are involved in the feedback teachers give their students as well as the effects it has on their interest in the class. Teachers often take precautions when grading their students’ papers with an unbiased opinion without allowing emotions to cloud their judgment. It is common that students feel that even with taking these precautions, teachers still allow their emotions to affect the feedback that they give their students. A survey and interviews have been done to investigate this situation. Three veteran teachers were interviewed for this study to understand the precautions and thought process behind feedback given to their students. The survey asks students if they feel that they have been given feedback on their written work that was based off of emotions and not an unbiased opinion. The teachers were also asked to describe whether or not they feel that they do allow their emotions to affect how they grade their students’ writing. They were also asked what methods they use to help prevent this from occurring and if they even think that this problem can be completely avoided. This study explores teacher biases in graded student work.
Accurately Measuring Ion Events for Precision Excited State Atomic Lifetime Measurements

C1C Jeremy Snell
Faculty Advisor: Dr. Jerry Sell
United States Air Force Academy

Measurements of excited state atomic lifetimes provide a valuable test of atomic theory, allowing comparisons between empirical and calculated atomic matrix elements. However, as calculations have progressed, the most accurate direct lifetime measurements remain at the 0.1-0.2 percent precision level, partly due to the nonlinearity and calibration in conventional timing electronics. We will present our progress toward precision excited state lifetime measurements in Rb, where our focus has been on the reduction of various systematic errors. This presentation will highlight improvements to the apparatus aimed at reducing the error from the pileup of detected ion events. This error is caused by ions arriving at the detector at a rate faster than it can count each event, which results in an artificially long lifetime measurement. An electrode was designed and added to the experiment to reduce this error, and the simulated and actual effects it causes will be presented.

Approaches to the Expression and Overexpression of Cloned Yeast hexokinase I in Saccharomyces cerevisiae

Hari Sridhar, Steven Orban
Faculty Advisor: Wendy Haggren, Sonja Braun-Sand
University of Colorado Colorado Springs

Yeast hexokinase I (HxKI) from the single-celled bread yeast Saccharomyces cerevisiae shares a 33% amino acid sequence similarity to the human hexokinase isozyme IV (glucokinase). Low expression of glucokinase in liver characterizes Type 2 diabetes, and seems to be a result of several naturally occurring human mutations that affect regulation of glucokinase production or its ability to bind glucose. We use yeast as a cellular model in which to manipulate the expression level of hexokinase. Here we present several approaches we are taking to overexpress cloned yeast hexokinase I in a yeast cell which is also expressing its native version of the protein. The goal is to purify the cloned enzyme for kinetic analysis as well as to introduce mutations into the active site of hexokinase I and to purify the mutated proteins in order to correlate hexokinase structure to its function in diabetes.

Jared Strutton
Faculty Advisor: James Stevens
University of Colorado Colorado Springs

This study will focus on the rate of cooling of a material quenched in a finite sized bath compared to an infinite bath. Finite bath quenches have been used to quickly lower the temperature of a material after being heated. The rate at which the material is cooled will be determined by the properties of the metal and quenching fluid as well as the initial conditions of the two bodies. An infinite bath will be considered as a quenching fluid with enough volume that the fluids initial and final temperatures will remain constant.
Cognitive Broadening and the Other-Praising Emotions

Jake Sullivan
Faculty Advisor: Dr. Tomi-Ann Roberts
Colorado College

Experiencing a positive emotion like joy or mirth leads to cognitive broadening, which in turn causes people to build socio-emotional resources. This experiment extended the work on broadening to the other-praising emotions, a subset of positive emotions which focus on another person rather than one’s self. Given that the other-praising emotions lead to benefits for other people in addition to the self, it was hypothesized that they would cause a greater amount of broadening than joy. One hundred seventy-six people recruited through Amazon Mechanical Turk completed a memory induction to experience either joy, elevation, or gratitude and completed five measures of cognitive broadening. No significant differences were found between broadening caused by joy and broadening caused by the other-praising emotions. Positive emotions cannot be fine-grained according to the amount of cognitive broadening they cause, and future work should examine other differences between classes of positive emotions which can help account for the different appraisals and behaviors that they promote.

Synthesis of Tripodal Monomers for Polymerization with Potential Click Chemistry Applications

C1C Matthew Van Velzer
Faculty Advisor: Dr. Timm Knoerzer
United States Air Force Academy

Considerable interest exists within the realm of synthetic polymer chemistry for the development of novel materials for a variety of applications including microelectronics, catalysts, energy systems, environmental applications, and nanofabrication, among other uses. However, we are most interested in pursuing polymeric structures that possess the capacity for incorporation of pendant moieties that may be exploited for polymer modification or sensor development. In particular, we are interested in developing polymeric materials that are constructed around monomeric components that afford reaction-dependent orthogonal elaboration. The ideal monomeric structure is tripodal and has the inherent capacity to be polymerized via polyamide or polyester condensation reactions, leaving latent functionality that can be used to exploit the alkyne-azide 1,3-dipolar cycloaddition for precise applications. For example, the latent azide functionality can be readily used for cross-linking (via an adjunct di-alkyne moiety), and, therefore modulation of polymer properties. Alternatively, the azide functionality could be used to promote a site-directed biotinylation leading to a potential bio-sensor. Herein, we report the results of initial synthetic efforts leading to functional molecular frameworks.
Effects of Brief Postnatal PBDE Exposure on GABA–Dependent Behaviors in the Rat

Jordyn Watts
Faculty Advisor: Lori Driscoll
Colorado College

Polybrominated diphenyl ethers (PBDEs), a class of flame retardant compounds used in polymer products such as polyurethane foam and plastics, have become ubiquitous in our environment. Exposure to PBDEs produces endocrine disrupting and neurobehavioral effects. Previously, investigators in our laboratory have noted that rats exposed postnatally to the commercial PBDE mixture DE-71 require higher doses of pentobarbital (a GABAA receptor agonist) than control rats to reach the same level of unconsciousness for surgical procedures. This hyposensitivity to pentobarbital could be due to receptor level or metabolic changes. Therefore, the current study explored the effects of brief (postnatal days 6-12) DE-71 exposure on anxiety and on open field behavior in response to a pentobarbital challenge, both of which are modulated by γ-aminobutyric acid type A (GABAA) receptors. Male and female Long Evans were exposed postnatally to 0, 30, or 60 mg/kg DE-71 per day. No treatment effects were found on an elevated plus-maze measure of anxiety. Locomotor behavior was dose-dependently decreased by pentobarbital in the open field, but the magnitude of the effect was not altered in the DE-71 treatment groups. To determine if rats exposed to DE-71 metabolize pentobarbital differently than do control rats, blood was collected via cardiac puncture at several time points following a single dose of pentobarbital. The serum pentobarbital kinetic data are pending.

Synthesis, Application, and Advantages of Biofunctionalized Silica Coated (CdSe)AnS Core-Shell quantum Dots

Nathan Weeks
Faculty Advisor: Kevin Tvrdy
University of Colorado Colorado Springs

Synthetic methods for near-monodisperse, water-soluble, biofunctionalized quantum dots with increased quantum yield are well developed. This project involves the reproduction and refinement of these synthetic methods, with an overall goal of the further development of methods for biofunctionalizing silica coated (CdSe)ZnS Core-Shell quantum dots with novel bifunctional linker molecules. Quantum dots are powerful tools in the realm of biological imaging and intracellular tracking due to their tunable symmetric, and narrow size dependent emission peak properties, which can span the entire visible spectral range. Additionally, quantum dots experience little to no photobleaching, which is a problematic limitation of fluorescent dyes. Biofunctionalizing quantum dots with novel molecules will further enhance their applicability to biological and imaging studies in the future. Currently, the primary focus of this project is synthetic methods for ZnS overcoating. Specifically, various experimental pathways are being explored to maximize emission quantum yield, such as ZnS shell thickness and the advantages one-pot vs. two-pot syntheses.
Spectral Measurements of Geosynchronous Satellites during Glint Season

**C1C Evan M. Weld, C1C Ryan M. Tucker**
Faculty Advisors: Dr. Francis K. Chun, Dr. Roger D. Tippets
United States Air Force Academy

During certain times of the year, stable geosynchronous (GEO) satellites are known to glint or exhibit a very bright specular reflection, which is easily observed through broadband photometric filters. The glints are typically brighter in the Johnson red filter compared to the Johnson blue filter. In previous years, USAFA cadets have developed and refined techniques to take, calibrate and process satellite spectral data taken using a diffraction grating (slitless spectroscopy) on the USAFA 16-inch, f/8.2 telescope. To the best of our knowledge, we have not seen any published research on observing glints across the visible spectrum. We present research from an Air Force Academy senior physics capstone project on observing glints off of GEO satellites using slitless spectroscopy. We discuss the calibration of the measurements using solar analog and solar twin stars, as well as results of the spectra of a glinting GEO satellite. A key question is whether a GEO satellite glint is localized in wavelength or equally observed across the entire spectra.

**Zymography: A Means for Isolating Proteolytic Enzymes Responsible for Cleavage of Influenza Hemagglutinin**

**C3C John White**
Faculty Advisor: Lt Col Marcus King
United States Air Force Academy

The objective of this research is to identify and characterize the enzymes responsible for cleavage of influenza virus hemagglutinin. Bacteria-secreted proteases were separated by SDS-PAGE, and presence of proteolytic activity was determined via zymography. Isolated proteins were removed from the gel, and identified using on-line reverse phase HPLC coupled to a nanospray ionization source on a LTQ linear ion trap mass spectrometer. Identification of hemagglutinin-cleaving enzymes provide insight into influenza infectivity and its perpetuation in natural reservoirs.

**The Role of RNA-Binding Protein CPB-3 in Dendrite Morphogenesis in C. Elegans**

**Margaret Wolf**
Faculty Advisor: Darrell J. Killian
Colorado College

Neurons, or nerve cells, have specialized processes called dendrites that function to receive and integrate information from the environment or other cells. The development of branched dendritic trees is important for covering receptive fields and establishing neural connections. Many neurological diseases are caused by or are associated with defects in dendrites. For example, short dendritic spines are greatly reduced in patients with schizophrenia. Therefore, an understanding of the molecular mechanisms that govern dendrite morphology is critical to understanding the molecular etiology of neurological diseases. Evidence suggests that the morphology of dendrites is in part achieved through molecular mechanisms that generate asymmetric protein distributions within the cell. RNA-binding proteins (RBPs) are of particular interest.
because they are important for mRNA localization and translational control. Recently, several RBPs were shown to be important for dendrite morphogenesis in larval Drosophila (fruit fly) sensory neurons (Olesnicky et al., 2014). The vast majority of these RBP genes are evolutionarily conserved in animals including humans. To determine if RBP genes are conserved in their role in dendrite development across diverse animal species, we tested to see if loss of these RBP genes results in dendrite defects in C. elegans (worm) sensory neurons using the multidendritic PVD neuron as a model. During this genetic screen, we identified cpb-3 as important for PVD dendrite morphology. Animals that lack cpb-3 have a 33% reduction in the total number of dendrites. Furthermore, we show that loss of cpb-3 also results in a cell fate specification defect in roughly 20% of PVD neurons. Cpb-3 encodes a cytoplasmic polyadenylation binding protein, which suppresses mRNA translation into protein. We hypothesize that CPEB binds mRNAs and hold them translationally repressed during transport from the nucleus to the dendrites where they become active. Our finding that fluorescently-labeled CPEB particles are transported within dendrites in living cells supports this hypothesis. We are currently using biochemistry methods to determine which mRNAs are bound and regulated by CPEB to determine dendrite morphology and therefore function.


Lauren Yanez, Ethan Yanez, Olivia Yanez
Faculty Advisor: Michelle Neely
University of Colorado Colorado Springs

“Mommy Blogs” have become an internet phenomenon, with a rapidly growing writing and readership community. These blogs represent considerable variations on motherhood, from the very traditional to the very modern. The current research on “Mommy Blogs” establishes them as their own discourse community with distinct aims and outcomes for both the bloggers and readers. Some research suggests that “Mommy Blog” communities, including both the blogger and the readers, perpetuate gendered motherhood roles, while other research contradicts this by suggesting that “Mommy Blogs” subvert traditional roles for a more modern perspective on motherhood. The primary goal of this research is to determine why this discourse community has grown and what participants, both bloggers and readers, view as the effect on the traditional or modern versions of motherhood. Data was collected through an in person interview with a “Mommy Blogger” to gather the blogger’s perspective on their blog: the reasons for writing it and the purported effects on their readership. In addition, data was collected by anonymously surveying both bloggers and readers of “Mommy Blogs”, asking five separate questions aimed at collecting reasons for this particular discourse and what effects it has on both groups. Finally, through the comparison of three separate blogs, data was gathered by evaluating the blog posts and readership responses for each blog. The post topics and the responses were gathered and coded according to purpose and effect, both for and by the bloggers and readers. The findings of this research concludes that “Mommy Bloggers” write for reasons of finding community and combating isolation, particularly during the early years of new motherhood. In addition, the responses to “Mommy Blogs” illustrate that readers continue to perpetuate the main undercurrent of community building and combating isolation, as well. Whereas much of the current research highlights the societal, gendered roles associated with motherhood, the bloggers and readers of “Mommy Blogs” simplify the necessity of the discourse: community.
Samuel Zarky  
Faculty Advisor: John Horner  
Colorado College

The link between affect and probabilistic outcome was explored by subjecting participants to games with varying levels of uncertainty and providing different prizes depending on the outcome. 211 participants experienced the three game conditions: a control choice condition, a low probability game, and a high probability game. Baseline affect was measured before experimentation and then again after each of the conditions. Under these conditions, the affective scores of participants increased after winning games and decreased after losing games however the type of game that was played also had a significant effect. Participants who won no games had the lowest affective scores while participants who won both games had the highest affective scores but importantly, participants who won just the high probability game experienced less of an increase in affect than participants who either won both games or just the low probability game. It was concluded that winning the low probability game led to a larger increase in affect than winning the high probability game and similarly, losing the high probability game elicited a larger decrease in affect than losing the low probability game.

Cloning of the Ter Y-P Triad from Acineobacter baylyi ADP1

Samuel Zuke  
Faculty Advisor: Margaret A. Daugherty  
Colorado College

The bacteria Acinetobacter baylyi (ADP1) is abundant in nature and commonly found in soil. Its metabolic versatility allows it to survive under highly competitive conditions. Because of this versatility, ADP1 is also able to survive during long-term stationary phase (LTSP). An operon containing 10 genes has been identified as potentially being essential for the organism’s survival during this phase. Of interest is a conserved triad of genes, called the Ter Y-P triad, which have been hypothesized to constitute a signaling unit that responds to environmental stress, such as the oxidative stress that is found during LTSP. This triad has a gene order that is conserved across bacteria: it contains a TerY gene (ACIAD1966) of unknown function, followed by genes coding for a phosphatase (ACIAD1965) and a kinase (ACIAD 1966). These gene products in A. baylyi are currently designated hypothetical proteins, as they have not been cloned and shown to have a specific function. We hypothesize that they are indeed true proteins with their designated functions, and that the proteins interact together to carry out their biological function. In order to test this hypothesis, we have commenced cloning these three genes into a pMAL expression vector in order to express protein for biochemical characterization. We present initial cloning results for the genes ACIAD1964 and ACIAD1965. We present results on successful PCR cloning of these genes from genomic DNA. Agarose gel electrophoresis confirmed the correct sizes of the targeted genes. Subsequent ligation of these gene products into the pMAL vector was additionally confirmed.
Oral Session 3
3:00-4:00

Worner Campus Center 116
Exterminating Communities

Animated Map of the UCCS Historical Geography

Marta Blanco-Castaño
Faculty Advisor: John Harner
University of Colorado Colorado Springs

This project will create an internet map that animates the changes on the UCCS campus through time using geographic information systems (GIS). Users will interact with a map using any conventional web browser and move a time slider through the years, from before the campus beginning through to today, our 50th anniversary. Features will appear (or disappear) as the years change. There will be various layers users can turn on and off: buildings, land parcels, parking lots, or any other layers for which we can gather sufficient data. Also, links to historical photos and public art on campus will appear as the years change, so users can click on those and see images of the campus as specific places and specific times. This interface will have zoom and pan capabilities and an easy to understand design and functionality. The project will enable users to see and appreciate the changes that have occurred on campus throughout time. The project consists of GIS data collection and formatting, gathering and scanning archival imagery, georectifying historical aerial photos, research on dates built and destroyed for all map features, then custom programming to build the web interface. This project can continue to grow in perpetuity as new archival content materials are found or as changes occur into the future.

Taking the Steps: a Guide to Organizational Inclusion

C1C Aaron Oats
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Modern organizations increasingly emphasize diversity. We assert that it would be more beneficial for organizations to work towards inclusion rather than simple diversification. To support this effort, we propose a developmental model of inclusion with six intermediate steps. Diversity has benefits. However, focusing on diversity alone may lead to organizational problems like quotas, cliques, labeling, and assimilation. Inclusion, conversely, places emphasis on making members of an organization feel respected and valued. The problem with current models of inclusion is that they attempt to move organizations from non-inclusion to inclusion directly. This method creates a host of potential issues as the transition to more mature levels of inclusion is difficult, if not impossible to make. A six-step scale would be more effective in developing individuals’ inclusivity. Additionally, in a diversifying
workforce, this scale would offer more accessible goals for institutions to measure the development of their work environments. This scale could be used in workshops and training. The emphasis of movement up the scale must be deliberate for both organizations and individuals. If they are made aware of how low they actually lie on the scale, and where they can potentially move to, they may be motivated to take action.

We start by examining existing stage theories and then developed our proposal for a potentially psychometrically sound inclusion scale. Additionally, we apply systems thinking in our assertion that organizations can be evaluated using the same scale; rejecting the reductionist model that depicts organizations as the simple product of their members. Our scale starts descriptions at the beginning stages (Intolerance, moving to Tolerance), transitions to intermediate stages (Acceptance, moving to Accommodation) and finally aims for advanced stages (Respect, moving to Celebration). Specific behavioral and attitudinal indicators characterize each stage and transitions from one stage to the next.

Body, Mind and Community in Brazilian Jiu-Jitsu

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The martial art of Brazilian Jiu-Jitsu is a transformative and self-defining activity for many participants. This ethnography explores how a Brazilian Jiu-Jitsu becomes a transformative practice. It uses thick participation and theories of embodiment to explore this question. It proposes that Brazilian Jiu-Jitsu’s intense physicality facilitates community building and considers the role of gender within this community. This thesis suggests that re-learning the body through ritual and embodied knowledge can lead to an altered body-mind experience.

Worner Campus Center 213
Systems Engineering

The Flightline of the Future:
Augmented Reality to Provide Just-In-Time Training (JiTT)

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The US Air Force has sustained a number of budget cuts in recent years that have placed increased demands on a reduced work force, potentially impacting aircraft availability and the quality of life of the airman maintainers. Augmented reality displays a real world view while adding in pertinent user data through a hardware medium such as Google Glass. Just-in-Time-Teaching (JiTT) instructs the user on how to perform a task while they are performing it through on screen instructions. By integrating augmented reality technology and JiTT in a heads-up display system, this project will analyze the effects of the technology on active duty and reserve F-16 mechanics. The analysis will provide recommendations to the
Air Force for further investment in augmented reality technology. Lockheed Martin Corp and Air Combat Command helped sponsor the project.

Development of a MicroMouse Robotics Platform

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MicroMouse is a competitive robotics event that began in the 1970s. The event requires that an autonomous robot find its way from a predetermined starting location to the center of a maze made up of a 16 by 16 grid of cells. Participants developed a custom robotics solution to solve this task. The robot incorporates an array of sensors, stepper motors, and a custom-designed, 3d-printed chassis. They also implemented an efficient search algorithm for navigating through the maze. In addition, the group explored computer vision techniques, which could enable long-range identification of walls.

Attitude Determination Using Photocell Resistors in the EyasSAT3

**C1C Rebecca Esselstein**
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The EyasSAT3 classroom satellite serves as a platform for educating students about spacecraft attitude dynamics and control. By combining sun sensor data acquired from photocell resistors with magnetometer data, an estimate of the spacecraft’s attitude can be calculated via the Triad algorithm. This paper focuses on the sun sensor portion of the Triad algorithm. The relationship between the counts produced by the photocells when exposed to a light source and the angle with respect to that light source was determined for each axis of rotation. This allowed for the creation of a look-up table which outputs an angle of rotation for each axis based upon the input counts from each photocell resistor on the EyasSAT3. The error for these angles needs to be determined. The angles were then related to incidence angles for each positive face of the spacecraft ranging from -90° to 90°. The combinations of these incidence angles produce the sun vector of the spacecraft in the spacecraft’s body frame. This sun vector will then be put into the Triad algorithm to determine the overall attitude of the spacecraft, which will in turn allow for the development of an attitude controller.
Use of Extremophilic Organisms for Electricity Generation in Microbial Fuel Cells

**C1C Daniel Hicks**  
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The objectives of this study are to discover microorganisms which may be used in a Microbial Fuel Cell (MFC) to generate electricity, and to examine the value of using extremophilic prokaryotes in a MFC. We are using select enzymes as catalysts within photosynthetic organisms, to harness solar energy via electron transfer mechanisms to power electronics. We are constructing MFCs using various photoautotrophic extremophiles to determine if they will potentially lead to a more powerful and advanced MFC. By utilizing microorganisms with both extremophilic and autotrophic abilities, it may be possible to create a more efficient and durable MFC in the future.

Microbial Community Assembly on Plastic Marine Debris:  
An Experimental Colonization Study in the Coastal Waters of Woods Hole, MA, USA

**Keven Dooley**  
Faculty Advisor: Mark Wilson  
Colorado College

Study of plastic marine debris (PMD) has revealed widespread distribution of plastics within the ocean, and investigated how PMD influences marine ecosystems. However, few studies have investigated microorganismal interactions with PMD. I addressed this gap by studying the development and structure of PMD colonizing microbial communities. Plastic resin samples including polyethylene, polypropylene, polystyrene and a glass control were submerged in the waters of Woods Hole, MA and sampled from 1 week to 6 months after immersion. Microbial community structure was analyzed over time with scanning electron microscopy (SEM) and next generation sequencing of the 16S rRNA sequence. Next generation sequencing provided comprehensive taxonomic data allowing analysis of community structure over time. Analysis of Bray-Curtis dissimilarity values over time showed no significant difference between glass and plastic colonizing communities. SEM micrographs allowed the calculation of diatom abundance and observation of ecological interactions. 16S and SEM data both reported patterns in community development of initial autotroph dominance followed by a decline and replacement by heterotrophic groups. These results enhance our understanding of the succession and community structure of PMD colonizing microorganisms.
Type IV Pilus Proteins of Acinetobacter baylyi: Measuring Competence Quantitatively with Transformation on a Surface

Colleen G. Leong
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Acinetobacter baylyi are naturally competent soil bacteria. Our goal was to test the role of Type IV pilus proteins in competence using a novel surface-associated quantitative protocol. From the French collection, we obtained knockout mutants lacking proteins predicted to be important for comprising a Type IV pilus or for uptake of DNA across the inner membrane. Transformation of cells on a nutritive agar surface allowed for quantitative determination of transformation efficiency over nine orders of magnitude. Using this method we determined which genes were necessary for competence. Under the conditions we tested, genes absolutely required for transformation in A. baylyi include genes encoding the basal apparatus of a type IV pilus (comQ, comM, pilF, pilC, pilT, and pilU), the gene (comA) encoding the inner membrane DNA translocation protein, comP, encoding the major pilin, pilV, pilX, and fimT encoding minor pilins, and comC, encoding the pilus tip protein. Knockouts in comEA, thought to encode a periplasmic protein that helps target DNA to the comA channel, and in minor pilins fimU and comF causes a 2-4 log loss in competence. A knockout in the minor pilin, comE, had no effect on transformation efficiency, while the comB knockout resulted in a ten-fold increase in transformation. Type IV pili also mediate twitching motility, and there is a question regarding whether transformation and twitching are mediated by the same or different pili. Under the conditions we tested, the entire type IV pilus basal apparatus and major pilin were required for twitching, but certain minor pilins played different roles in twitching compared with transformation. Using transformation on a surface instead of in liquid, we have discovered that a type IV pilus, including its major pilin, is required for both transformation and twitching in A. baylyi. We hypothesize that the structures mediating these distinct activities are likely different from one another in terms of which minor pilins are present, and likely also in terms of their subcellular localization and abundance.

Cornerstone Arts Center 301
Social Science Research

Categorical Perception of Labeled and Unlabeled ASL Facial Expressions in Hearing Non-signers

Hadar Zeigerson
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Colorado College

Previous research has demonstrated categorical perception (CP) of facial expressions from American Sign Language (ASL) in hearing, English-speaking non-signers. Notably, CP was observed even for faces with no obvious linguistic labels in English, suggesting the existence of covert categories based on nonlinguistic facial properties. However, in the earlier work, CP was assessed using memory procedures, leaving open the possibility that such categories have no impact on the discrimination of simultaneously presented faces. Here, we used a visual search task with no memory component to test for CP for both labeled (happy/sad) and unlabeled (adverbial expressions with no lexical signs) categories of ASL facial expressions. CP was
observed for both sets of categories, suggesting that unlabeled covert categories—not just labeled ones—are accessed even when stimuli are readily available to perception. We interpret these findings in light of competing accounts of the interrelations of language, categories, and perception.

Aboriginal Cultural Preservation

Maia Wikler
Faculty Advisor: Christina Leza
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No Abstract

Continuous Process Improvement for the Pharmacy Joint Refill Center

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The government has several beneficial services that it provides to military members and their dependents; one of these services is the Joint Refill Center (JRC) for medical prescriptions at the United States Air Force Academy (USAFA). Currently the JRC holds a 48-hour turnaround time for all prescriptions within the military community in the Colorado Springs area. Rival civilian refill centers hold a 24-hour turnaround time. Customers appreciate the timesavings and this is causing the USAFA JRC to lose customers to these rival refill centers. If local military members were to only use the USAFA JRC, it would save the government, and taxpayers, approximately $23.76 million annually. This project examines the current process for the USAFA JRC and uses lean principles in order to maximize efficiency and decrease the turnaround time to one business day.

Cornerstone Arts Center 302
Sexual Assault Issues

“I Didn’t Say Yes, But…:” The Gray Area as a Euphemism for Sexual Assault

Savannah Johnson
Faculty Advisor: Vanessa Munoz
Colorado College

The majority of college women categorize troubling sexual encounters as ‘gray area’ non-assaultive experiences, prompting numerous scholars to call for a dichotomization of collegiate consent rhetoric. Initially in solidarity with much of the existing literature, I examine the nature of non-agent sexual encounters more deeply, contrarily arguing that consent binarism may be necessary to expound the true nature of gray area sexual experiences: sexual assault. College students, without labels and social scripts dictating with whom to process ambiguous ‘gray area’ sex or where to designate blame, are vulnerable to
interpreting their confusing sexual experiences in self-serving ways; as such, most do not interpret legally-qualifying assaultive encounters as sexual assaults, instead vocalizing dissonance between their experiences and their assumptions of what constitutes an assault. Positing that ‘gray area’ rhetoric exists as a euphemism for sexual assault, this research validates the lived experiences of victims – acknowledged and unacknowledged – while addressing the individual and collective implications of assault acknowledgment.

Uncovering Hidden Forces: Intersectional Perspectives on Acquaintance Rape and Interpersonal Violence

**Melissa L. Barnes, Ethan Wade, Spencer Spotts**
Faculty Advisors: Professor Patricia L. Waters, Catherine Kaukinen, Brett Gray
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Acquaintance based violence, the most prevalent type of personal violence, serves as a lens for understanding and identifying rape and intimate partner violence between two or more parties who are not strangers. In this symposium, interdisciplinary analyses of distinct communities and spaces will provide an intersectional account of acquaintance based violence.

Melissa L. Barnes presents her senior thesis “To Be a [Racialized] [Gendered] Target: Intersectionality of Racism, Sexism, and Gender on Attitudes toward Acquaintance Rape”. Two hundred ninety six participants were recruited on Amazon.com’s Mechanical Turk across the U.S. Participants read a vignette that depicted a sexually aggressive situation between acquaintances. Participants were randomly chosen into one of four vignette groups: Caucasian man, Caucasian woman; Caucasian man, Black woman; Black man, Caucasian woman; Black man, Black woman. Linear regressions showed racism, sexism, gender, and the interactions of these variables were found to be significant predictors of victim blame, perpetrator blame, rape proclivity, suggested sentencing, and suggested reparation, depending on the vignette participants read.

Ethan G. Wade presents his work to date on his literature review, a collaborative effort with Catherine Kaukinen, Ph.D. that analyzes the dynamics of sexual assault and the effects of different types of policies at civilian colleges in comparison with military service academies. The study addresses the ways race and gender affect dynamics of campus sexual assault, and how those effects differ from civilian colleges to military service academies. The study contrasts federal policies as well as those at civilian colleges (specifically, the Big Ten) to the policies at military service academies. This research also considers the different policies at military service academies that operate under the US Department of Defense (the US Military Academy, the US Naval Academy, and the US Air Force Academy) in comparison with the US Coast Guard Academy and the US Merchant Marine Academy.

Spencer M. Spotts presents his ongoing research investigating the dynamics of sexual assault and intimate partner violence against and within queer communities. His research is specifically interested in three key components: (I) the complexity and intricacy of sexual violence specific to queer communities, (II) the policies and legislation affecting and pertaining to queer sexual violence, and (III) a cultural and theoretical re-defining of sexual and intimate partner violence. This presentation is a culmination of research conducted at the 2015 National Conference on LGBT Equality and independent literature review. His research has been funded through the Keller Family Venture Grant Program for Student Research.