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The Colorado Springs Undergraduate Research Forum (CSURF) is a collaborative venture designed to highlight the accomplishments of undergraduate students from Colorado College, the United States Air Force Academy, and the University of Colorado Colorado Springs.

In its ninth year, the conference has grown to over 300 student participants and continues to reflect the commitment and dedication of our faculty and staff to our students from all disciplines. Participation in this forum is free for currently enrolled undergraduates of CC, USAFA, and UCCS.

Thank you for your support of the 9th Annual CSURF

Colorado College
(2012 Host)

University of Colorado Colorado Springs

and

United States Air Force Academy

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Thomas Wolkow, Chair CSURF Committee  
Associate Professor  
Department of Biology  
University of Colorado Colorado Springs
“We now know that the universe is 13.7 billion years old. We know that it is expanding at an accelerating rate propelled by a sort of antigravity. This antigravity effect might have produced the vacuum itself. We also know that ordinary atomic matter makes up only a small fraction of the "stuff" of the universe. The scientific account of creation seems as unlikely as any ancient myth.

How did we come to know these things?
In this talk I will trace the history of scientific cosmology from its inception in the early part of the twentieth century to today. I hope to show how the interplay of theory and observation led to the very convincing, but arguably bizarre, scientific story of creation”…Shane Burns
Oral Session I
(10:00-11:20 am)

Cornerstone 301 Room

Icons of Multimedia

Exploring Imagined Lands in Visual Media: How Comics and Videogames are Leading the Way for the Return of the Adventure Tale
Greg Collette
Colorado College

Adventure is “the oldest, most persistent subject matter in the world” argues author Paul Zweig in his work The Adventurer. The greatest works of the ancient world are those in which the hero leads the safety of the familiar to confront the unknown, yet as the blank spaces on the map began to fill, and the endless landscape collapsed into the quotidian cityscape, tales of introspection replaced those of exploration. As Zweig notes, the rise of the novel led to the fall of the adventure story, with modern perception regarding it as nothing more than “second-rate literature, appropriate for pulp magazines and low-grade movies” (9). Here, though, it has found a new home and become one of the dominant subject matters for forms relegated to the same realm. Video games and comics, in particular, have latched on to the adventure tale, yet as visual media, they present a challenge in representing these stories of travel to the unknown. Whether written or spoken, the abstraction of language concealed an inherent aspect of these stories: the imagined lands to which an adventurer travels, are not of the author’s mind but the listener. Absent in Odysseus’s journey to the underworld or Beowulf’s to the lair of Grendel’s mother, are these terrifying places themselves. To understand how visual media overcome this problem, I will analyze how Le Temple du Soleil, a volume of the Belgian comic series Les Aventures de Tintin, and Shadow of the Colossus, a Playstation 2 action/adventure game on the Playstation 2, utilize the elements of their medium to undermine the concreteness of visual representation. This examination reveals that the connection between these mediums and the adventure genre runs much deeper than shared high-culture derision. In a culture that has undergone, as media theorist W.J.T. Mitchell argues, a pictorial turn, the unique features of comics and video games make them ideal forms for a narrative return to exploration over introspection.
PLAYING THE ROLE: Understanding the Imposition of Mainstream America's Definition of Blackness in the Context of Hip Hop
Norbert Grover
University of Colorado at Colorado Springs

It can be argued that the emergence of pop culture in the early nineteenth century produced its most iconic figure with regard to popular portrayals of authentic blackness, the minstrel. The minstrel acted not only as an icon within American popular culture, it also illustrated the racial perceptions of the American black by whites. With hindsight being 20/20, Americans, in general, regard the minstrel as a derogatory reminder of a long dead, shameful, and racially charged past. Others, such as Dr. Jeffery Ogbar, may argue that the minstrel is alive and well due to racism’s "uncanny ability to mutate and adapt to changing social and cultural currents" (36). As a result, many academics have argued that rap's modern incarnation may exemplify racism's societal evolution in that it perpetuates imagery that is congruent with the white supremacist ideology that rationalized slavery, lynching, and Jim Crow. This paper will be an analysis of the aforementioned correlation and what the ramifications of said relationship are.

Making Myths: Billy the Kid, George Armstrong Custer, Buffalo Bill, and the Media
Veronica Spicer
University of Colorado Colorado Springs

The American West was a place where myths were created from the framework of reality. It was a place of legend that continues to mystify people today. The media – newspapers, books, paintings, and the like – molded the mythic status of Billy the Kid, George Armstrong Custer, and Buffalo Bill. Were it not for the power of the media, these names would not be as well-known today. They were not born as legends. The media shaped their image. Drawing on factual information, the media frequently distorted, altered, and transformed these men so that their images became interwoven into America’s vision of the West. This presentation will focus on several pictures and discuss how each image contributed to their myth. It will discuss what role each man played in shaping his image.
Cornerstone 302 Room

**Populations in Motion**

Female Mule Deer Movement Patterns near US Air Force Academy Roadways
David L. Riegleman, Kevin W. Weaver, Justin J. Sleeter, Ryan D. James, Dr. Steve J. Gordon, and Dr. Edward T. Unangst
United States Air Force Academy

In 1990, the Colorado Division of Wildlife and USAFA Natural Resources began a lethal management program to reduce the resident deer population to address ecological and deer-to-vehicle collision fatalities concerns on USAFA reservation. A 70% reduction was achieved with deer numbers reduced for approximately 1000 in CY 1990 to 250-300 currently. A subsequent reduction in deer-to-vehicle collision fatalities also occurred ranging from a high of 118 in CY 1990 to a yearly average of 20 from CY 2000 to present. To date, no evaluation of “potential risk” of deer relative to vehicular roadways has been accomplished. Thus, in this one-year study, we monitored movement patterns of 14 radio-collared mule deer does to evaluate deer location in proximity to roadways. Deer were quantified using remotely-received GPS locations within 10 meters of the roadway centerlines on USAFA. This information allowed us to quantify potential risk to vehicular collisions based on deer locations.

**Borne to be Wild: Can We Stop the Foodborne Illness Epidemics?**
Sarah Miller and Professor Lisa Hines
University of Colorado at Colorado Springs.

This past year, Listeria made headline news as the cause of a nationwide foodborne epidemic resulting in major illness and death, with an unsuspecting local culprit: Rocky Mountain Ford cantaloupes. Over the past decade, foodborne illnesses have become more prevalent and widespread. The CDC estimated in 2011 that each year about 1 in 6 Americans get sick, 128,000 are hospitalized, and about 3000 people die from foodborne illnesses. In an effort to increase public awareness, we are creating an online, user-friendly resource that summarizes the latest information regarding some of the most common and serious foodborne pathogens in the US, which includes Listeria, E. coli, Salmonella, Campylobacter, and Norovirus. This tutorial was developed utilizing the most current information from various reliable resources, such as the Centers for Disease Control and Food and Drug Administration. The contents of this tutorial include: prevention, statistics, causes, symptoms, pathogenesis, and treatment. To summarize, these pathogens use food and water as a carrier to infect humans, entering the intestinal tract and causing symptoms including vomiting and diarrhea. However, foodborne pathogens are continuously evolving, and all have unique means of spreading infection. The most common cause of any foodborne illness is the lack of proper hygiene when handling food products both in processing and at home. Through awareness and proper hygiene, foodborne illnesses such as Listeria and Salmonella can be contained and become less of a threat to humans. 

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THE ROLE OF THE UNITED NATIONS: A CASE STUDY OF THE PALESTINIAN BID FOR MEMBERSHIP
William O. La Rivee, Melanie K. Daugherty and Dr. Claudia Honeywell
United States Air Force Academy

In the modern world of international politics, the United Nations has struggled to find an appropriate mission according to the goals of its charter. Although the UN originated as a courageous attempt to maintain global peace and security, its role as a peacekeeper is ambiguous in today’s multipolar environment, as demonstrated with the case of Palestine’s recent bid for UN membership. On-site interviews with top UN staffers will help assess the role the organization can play in the future as an international body in such conflicts and how its goals should be redefined. The Palestinian bid serves as testament to the need for a reassessment of the organization’s mission as an international forum, as Palestine was able to bypass the necessary direct relations with Israel while making strides toward achieving statehood status. The structure of the UN should instead emphasize negotiations and prevent manipulation for political advancement.

Cornerstone 303 Room

Genuine Art

δόκιμος; Accept Nothing Counterfeited
Jeremiah Stanley
University of Colorado Colorado Springs

The name of the project is δόκιμος, or transliterated, dokimos. Dokimos is an ancient Greek word meaning:
1. Accepted, particularly of coins and money. 2. Accepted, pleasing, acceptable. The whole of society operates under the tenets of social acceptance and rejection. The manner in which we are perceived impacts the way in which we view and identify ourselves. We all have a deep-seated desire to belong and to be accepted by our peers. The human fear of rejection propagates secrecy. We hold our secrets dearly because we fear that if others saw us for the way we truly are then they would either reject us, or their perception of us would change in a deep and profound way. On the other hand, we also all have the desire to be transparent: the desire to be seen as we really are and accepted in that light. These two human desires are constantly in conflict – we desire anonymity; the ability to hide the unsightly areas of our personal identity, yet we yearn to be loved and accepted to the core of who we are as individuals. This work addresses one of the foundational experiences of being human – the desire to be accepted, and the desire to be known entirely. This is the heart of the project: an unwillingness to accept anything less than what is authentic and genuine – both in ourselves and in others.
Super-Dad: *Unbreakable* -- the Father-Son Relationship and the American Fable
Tyler Jonas Castro
University of Colorado Colorado Springs

M. Night Shyamalan's 2000 film *Unbreakable* is a post-modern hybrid genre film incorporating elements of the psychological thriller, a superhero epic and a family drama. It takes the conventions and utilities of everyday life and creates a dual narrative defining what it means to be a (super)hero in a society that operates in banal mediocrity and where such fantastic notions are regarded as childish. In this film, metaphysical understanding becomes the rational path to the American dream of "normalcy," which itself is a myth. *Unbreakable* creates a story that not only rekindles the possibility of a powerful defender of the weak, but also underscores how a son's belief in a father's abilities can reawaken a father's passion for life and purpose and thus create new family bonding.

The Art Experience in Robert Irwin’s Getty Garden
Erika Leon
Colorado College

This thesis examines the Central Garden at the Getty Center, designed by Robert Irwin, focusing on the ways it embodies Irwin's philosophy. Irwin’s contributions to the ongoing discourse of what qualifies as art makes him one of the most significant artists of our time. Central to Irwin's art and philosophy is the notion that an experience qualifies as art; art is not an object, but rather a moment, a revelation, or a state of mind that occurs in the viewer. The intricacies of the Getty Garden are meant to incite in viewers a concentrated state of mind, which they take with them outside of the garden to be able to appreciate everything, natural or incidental, as if it were art. This thesis first explores Irwin's own writings and the philosophies which influenced him, namely Zen Buddhism and Phenomenology. Then, it examines his artworks and how his ideas developed alongside his own artistic style. Finally, it will look closely at the Getty Garden and demonstrate how it is the ultimate manifestation of his idea of art as experience.

The Serpentarium: Uniting the Literary Community in Colorado Springs
Eleanor Anderson
Colorado College

Olivia Wall, Eleanor Anderson and Robin published a literary magazine entitled *The Serpentarium*. Our publication featured poetry and short prose, taking submissions from Colorado College, The United States Air Force Academy and University of Colorado at Colorado Springs. We created a publication with a letterpress cover and insert, landing somewhere between the aesthetic of a high-quality artist-book and a
DIY Zine. We published 18 independent poems or short prose pieces, trying to evenly represent the three schools involved. Our project fostered dialogue and collaboration between the three schools through a workshop at the Press at Colorado College with to involve students in the printing, binding and production of the actual chapbook. We also hosted a reading and release party at the Springs Orleans in order to celebrate our success.

Cornerstone 308 Room

A Global World

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Teaching Reproduction: the Use of Gender Stereotypes in Children’s Non-fiction Literature
Elise M. Samuelson and Dr. Andrea Herrera
University of Colorado at Colorado Springs

Children’s literature, as a means by which societal norms are transmitted to the upcoming generation, provides valuable insights into how the definitions of male and female are constructed. While there are a number of studies on gender stereotypes and children’s literature, there is little research on the contents of children’s non-fiction, particularly on works that teach human reproduction. Twenty-five books available in several school districts in the Colorado Springs area were selected for analysis. It was determined that in these books, which should teach scientific fact rather than cultural opinion, females are devalued in a number of ways, such as being portrayed as unimportant, inefficient, inactive, and wasteful. This is accomplished using both images and literary narratives. Recognizing this type of gender bias can help parents and educators select more egalitarian books and learn techniques to counter forms of bias when they are present.

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Restructuring Intersectionality with Disability: Reconceptualizing Cleft Lip and Palate
Marley Hamrick
Colorado College

This paper is a dual intervention in contemporary feminist intersectional analysis and the Western charity model of cleft lip and palate. The first intervention illustrates that contemporary feminist scholars have excluded a central category of difference in conceptualizing intersectionality. As a result of the exclusion of ability/disability, feminist theory perpetuates a social construction/materiality binary that disregards how the material body and socially constructed norms of bodily function and appearance interact with one another. The second intervention applies an intersectional and non-dualistic framework to question the practices of USA based medical cleft organizations. Neither an exclusively social constructionist nor materiality theory is sufficient to conceptualize and question the hegemonic model of clefts created by these organizations. While my intervention in feminist conceptions of intersectionality build upon existing arguments, my intervention in the disease regime of clefts suggest an innovative direction for feminist, disability, sociological and medical scholarship.

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Determination of the Purchasing Power Parity of the Renminbi Relative to the US Dollar for a Foreign Exchange Student by use of a Bedding Index
Jason E. Besecky, Dr. Steve G. Green, and Dr. Kurt A. Heppard
United States Air Force Academy

The global recession that began in 2008 has increased protectionist desires and has led to increased calls for the People’s Republic of China to revalue its currency, the renminbi. The objective of this study is to investigate a specific instance of how currency exchange rates can impact college students studying abroad. This paper puts forth evidence to suggest that the official exchange rate, which is one US dollar for 6.30 renminbi on a dirty-float exchange, is appropriate based on calculations involving a foreign exchange student’s bedding requirements. The bedding index is developed, which is based on purchasing power parity (PPP) and is similar to the well documented Big Mac Index. The bedding index used in this paper indicates that an exchange rate of 6.04 would be an appropriate estimate for a foreign exchange student, and perhaps the larger group of consumers and producers.

The Evolution and Success of the Organizational Climate
Simone E. Barrette, Meagan A. Wyngarden and Lt Col Denise L. Cooper
United States Air Force Academy

Recently, a close friend took a class in a department she was unfamiliar with. Our friend was surprised by the attentiveness, interest, and respect the instructor demonstrated – more than she had ever received from other teachers. This anecdote spurred in us the realization that there is a vast difference in organizational climate between various departments in the same organization. These differences are quantified in its climate survey ratings for the department and the overall performance of the students on national rankings. The purpose of our study is to identify the basic reasons that the department is so successful in maintaining both high climate ratings and high performance. We assessed performance through qualitative interviews with fundamental members of department. As well as the quantitative data results from the most recent climate survey.
Using Greek Ladders to Approximate Roots of Polynomials
Casey V. Horgan and Dr. Kurt Herzinger
US Air Force Academy

Greek ladders are an ancient method of approximation based on a recursive formula applied to each rung to create the next rung. They are traditionally used to find $n^{th}$ roots of a real number $x$. We will discuss the application of Greek ladders to finding roots of polynomials of the form $x^2 + cx + d$.

Modeling and Simulation to Compare Geosynchronous Satellite On-orbit Refueling Concepts
Jeffrey Benson, Sean Knowles, John Lerch, Mark Williams, and Capt John Feely
United States Air Force Academy

Currently, the Air Force space mission is facing budget cuts and must find creative, cost-effective solutions to extend the life of its satellites. This project used SpaceBrawler, an agent-based simulation software provided by AFSPC/A9, to simulate the different combination of geosynchronous on-orbit satellite refueling concepts and analyze which concept provides the most cost-effective strategy when applied to the DSCS constellation. The project had three phases, the first consisting of problem definition, research, and concept development, the second created a design of experiments and programming for the logical interaction of satellites, refuelers, and depots in the model, and the third executed the simulation, cost model analysis, and finalized conclusions. The statistics from the SpaceBrawler simulation were input into the cost model to analyze the value-added by each of the concepts. This study’s conclusions will provide insight into the value-added of various satellite on-orbit refueling concepts in the geosynchronous orbit.

Understanding Political Policy

The Great Intellectual Transformation: The quest for rational political philosophy after the revolutions
Patti Weintraub
University of Colorado Colorado Springs
From the turmoil of the American and French revolutions emerged a new ways to approach the concept of rational and right rule. This essay examines early American political philosophy from the perspective of Alexis de-Tocqueville. At the time in which Tocqueville was writing, American Democracy was still a work in progress: a grand new experiment in the untouched lands of North America. Europeans were fascinated by this "new world", relatively detached from the ancient civil strife that plagued the European continent. America was the experiment to answer the question of whether Democratic rule could be organized and conducted in such a way that it would not collapse into the tyranny of absolutism. Tyrannical absolutism had been a mainstay of western political structure. The Enlightenment of the 18th century guided the intellectual tidal wave that washed across Europe, corroding away the superstition, conventional thought, and received wisdom of the ancien régime. These new modes of critical thought caused many intellectuals and citizens of society to question the legitimacy of monarchical rule and similar forms of government in place at the time. Was there a rationale that allowed for the socio-political minority to rule the majority? Tocqueville devoted his research to understanding why the American revolution had produced such a vastly different political structure than the French revolution. I will focus my own work on Tocqueville’s two masterpieces Democracy in America (1835-40) and The old regime and the revolution (1856).

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An Analysis of Factors Affecting Soviet Historiographical Silence on the Holocaust in a Case Study of Soviet Karelia
Elisha Henry
United States Air Force Academy

Soviet historiography was silent on the Holocaust. Modern-day historians attribute this silence to political motives as well as unique regional characteristics, such as Ukrainian anti-Semitism. To fill this silence, Soviet propaganda often emphasized the suffering and heroism of the Soviet people in the Great Patriotic War. At this, many readers harshly judge the Soviet, particularly Russian, people for writing the Jewish dimension of World War II out of history. Hitler’s Final Solution, however, did not reach some areas of the Soviet Union. Soviet Karelia during the Continuation War is a case in point. Although there is no excuse for the Soviet silence on the Holocaust, Karelian Russians readily accepted the Soviet narrative of the Great Patriotic War because of their experience of discrimination under Finnish occupation in addition to the lack of a Jewish-Karelian population.

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Corporate Paternalism in Southern Colorado at the Turn of the Twentieth Century: The Dangers of the Company Store
Amy Haines
University of Colorado at Colorado Springs

The coal fields of southern Colorado at the turn of the twentieth century exemplify the most egregious paternalistic labor conditions that existed in the United States. The Colorado Fuel and Iron Company
(CF&I), not the first, nor the last company to implement some form of paternalism, was one of the first industrial corporations to use scientific methods, in the form of their Sociological Program, to control their workforce. The Program included implementation of the company town structure, including company provided housing, education, and the company store. The Great Colorado Coalfield War of 1913-14, grew out of tensions between miners and operators in the Colorado coal fields, as a direct result of the CF&I’s abuse of their considerable power, and in direct contradiction to any intended aim of the Sociological Program to prevent this type of behavior from their employees. It was control over employees through its paternalistic social program, through unimpeded influence of local and regional politics, and refusal to negotiate in any capacity with their labor force that led to the extreme violence of the strike. The Sociological Program, which appeared as a benign, even sympathetic institution on its surface, was the vehicle for controlling CF&I employees and their families, and was put in place to create a grateful workforce; one that would not strike. The Program itself was based on the need to cleanse the workforce of the undesirable qualities that threatened the CF&I and their quest for profits. The Program exemplifies paternalistic ideology, even when those responsible for its creation denied its paternalistic nature. Ultimately, the Program failed to appease the miners. The men and their families were denied basic rights enjoyed by others living and working in the United States, civil liberties were trampled, and laws put into place to ensure the safety of the mines were ignored by the company, which lead to several horrific mining disasters. The paternalism of the Sociological Program, especially in the “closed camps” of the Southern Colorado coal fields, only helped fuel the flames of discontent among workers instead of its intended purpose of “domesticating” them. This particular discussion will focus upon the tactics of the Colorado Fuel and Iron Company’s use of the Company Store, and why this became problematic.

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Richard Wagner and Nazi Ideology
Aaron E. Foster and Dr. Ann B. Reagan
United States Air Force Academy

Adolf Hitler’s beliefs and vision for Germany that he would attempt to create as the German Führer originated from Richard Wagner. Hitler’s infatuation with Wagner’s writings and musical works almost one hundred years earlier engrained in him the deep hatred of the Jewish race that Wagner kindled. Wagner’s desire to create a strong and unified German nation would be a cause that Hitler would pursue as head of the Nazi Party. While Wagner did not openly declare the necessity to eliminate European Jewry to create a purer Germany, Hitler would nurture the fundamental principles of Wagner’s beliefs and take them to the extreme during his rule, culminating in the destruction of the Germany they both desired to create.
Spacecraft to Remove Charged Particles from the Van Allen Belts
Dustin Hayhurst
United States Air Force Academy

The Tethered Environmental Reconditioning Satellite (TERSat) will use deployed tethers of two kilometers in length to emit Electromagnetic Ion Cyclotron (EMIC) waves into the Van Allen Radiation Belts. These EMIC waves will remove high energy particles from the Van Allen Belts and reduce the threat of degradation and destruction to spacecraft operating in that area of space. TERSat will demonstrate an active method by which the United States can defend its space infrastructure from high altitude nuclear explosions (HANEs) and improve its space industry by allowing spacecraft to operate safely and effectively in the Van Allen Belts. This research focused on the development of the control law that will deploy the tethers of TERSat. This research encompassed the creation of an Earth based control law, a space based control law, and the physical braking mechanism that will interface with the control law to control the tether deployment. The Earth based control law produced successful simulated results while the space based control law serves as the foundation for further research in the sphere of tether deployment control laws. While the physical braking mechanism was ineffective, it served as a catalyst for other ideas and research opportunities and demonstrated success in other performance parameters of the deployment system.

Ionic Fluid Vaporization Testing for High-Efficiency Propulsion of Lunar and Interplanetary Spacecraft
Nolan A. Bader and Dr. Thomas B. Joslyn
United States Air Force Academy

The research presented evaluates momentum exchange through fluid streams as a means of propelling spacecraft without consumption of propellant. Ionic fluid streams projected through space from one spacecraft to another spacecraft where it can be stored for future momentum exchange or used as propellant by an electric thruster. Recently developed Ionic fluids retain low vapor pressures at relatively high temperatures and remain in a liquid state over a wide temperature range. Vacuum chamber testing of high-speed ionic fluid droplet streams at the US Air Force Academy confirms that they can be collected at high speed with minimal vaporization losses. All of the applications presented are applicable to interplanetary missions and significantly reduce the amount of mass needed at launch, possibly to the level that planned commercial launch vehicles can provide.
This experiment seeks to increase the efficiency of the radiometric engine using new experimental and numerical data. Recent studies [1,3] have yielded information on radiometric forces for a single vane and arrays of vanes aligned along the length of the vane. Additional information on the interaction of vanes aligned along the axis normal to the vane is presented here. Thermal data for different vane orientations and alignments is simulated using COMSOL Multiphysics[4]. The outcome is a scale model designed to increase the efficiency of the array incorporating both experimental and numerical results. This model will be used for further research and development of the near space radiometric propulsion system.
Poster Session I
(11:00 am-12:30 pm)

Cornerstone Atrium

Poster 1

Molecular evolution of a candidate gene involved in postmating-prezygotic reproductive isolation
Kim Hoang, Naren Clark, Joseph McGirr and Jeremy Bono
University of Colorado Colorado Springs

New species are formed when reproductive barriers prevent interbreeding between populations. Postmating-prezygotic (PMPZ) barriers occur when molecular interactions between female and male proteins are incompatible, preventing the formation of a zygote. Postmating-prezygotic barriers may occur early in the speciation process because genes involved in these interactions evolve rapidly due to intersexual coevolution and sexual selection. While the genetic basis of PMPZ isolation is poorly understood, a previous microarray study identified candidate genes for involvement in PMPZ by comparing transcript abundance in *D. mojavensis* female reproductive tracts when mated to either conspecific or heterospecific (*D. arizonae*) males. Here we investigate the molecular evolution of one of these candidate genes. The rate of evolution of this gene and population-specific patterns of variation suggest it may have played a pivotal role in the divergence of the two species.

Poster 2

Optimization of a Colorimetric Capsaicin Assay
Nick Koch
Colorado College

The current methods for assaying levels of naturally occurring capsaicin in chili peppers are HPLC, which is expensive, materials intensive, and non-portable, and organoleptic tests, which are unreliable. Experimenting with various base activated dyes which create dye-capsaicin adducts has been promising in the development of a portable colorimetric capsaicin assay. Dye and polymer gel matrix combinations have been optimized to reduce interference from other phenolic compounds present in pepper extracts.
**Poster 3**

Evaluation of Electroelution for Template Removal from Molecularly Imprinted Polymers  
Lauren Carter, Brent Drabek, Christina England, Andrew Glover, Jordan Hauschild, Jacob Houder, Kelly Laurent, Matthew Rogers, Sarah Sauter, Wesley Stowe and Dr. Barry W. Hicks  
United States Air Force Academy  

Molecularly imprinted polymers (MIPs) are materials that are polymerized from monomers in the presence of a template molecule. This creates binding sites for the template within the polymer network. Afterwards the template is removed in order to create molecular cavities complementary to the template. This allows the MIPs to be useful for a variety of applications in sensing and separation. By far the most difficult, expensive and time consuming aspect of MIP preparation is removing the template after polymerization. In this work, aqueous acrylamide polymers were prepared from a mixture of monomers in the absence (non-imprinted polymer control-NIP) and presence of flavin mononucleotide, a vitamin B$_2$ derivative. Four different techniques, passive solvent elution, microwave assisted elution, sonication assisted elution and electroelution were evaluated for their abilities to remove the FMN template from the acrylamide polymer. Afterward, the imprinting factor (ratio of newly added template molecule binding to MIP versus NIP) was determined by fluorescence spectroscopy. Initial results using electroelution suggest this may be a promising technique for removing template molecules from high affinity sites within the polymer.

**Poster 4**

Microwave Assisted Diels-Alder Synthesis  
Ross E. Haugberg and Allen M. Schoffstall  
University of Colorado Colorado Springs  

This is a synthetic organic chemistry project where a triazole was synthesized using click chemistry and then used to synthesize a Diels-Alder adduct with microwave heating. The triazole acts as the diene and dimethyl acetylene dicarboxylate (DMAD) serves as the dienophile. The adduct was isolated from the reaction mixture using flash chromatography and characterized by NMR and thin layer chromatography. The results suggest that a Diels-Alder adduct was formed. More of the product is being synthesized and isolated for further characterization.
Neuronal morphology in the giraffe (Giraffa camelopardalis) neocortex
Deborah Kennedy
Colorado College

The neuromorphology of giraffe (Giraffa camelopardalis) neocortex remains unexplored. To this end, the present study investigates giraffe primary visual and motor cortices by examining tissue from the perfusion-fixed brains of three sub-adults that was stained with a modified rapid Golgi technique. Neurons were quantified (N = 269) on a Neurolucida computer-assisted microscopy system (MBF Bioscience), which allowed examination of both dendritic and spine systems. Qualitatively, giraffe neocortex exhibited a vertical columnar organization, containing an array of complex spiny neurons that reflected both "typical" pyramidal neuron morphology (i.e., pyramidal neurons, n =143; magnopyramidal neurons, n = 10; Betz-like neurons, n = 6; extraverted neurons, n=35) and “atypical” spiny neurons in terms of morphology and/or orientation (i.e., horizontal neurons, n = 17; and crab-like neurons, n = 4). Although there was no significant difference in dendritic complexity for pyramidal neurons between the primary visual (n = 78) and motor cortices (n = 65), there was a significant difference in dendritic spine density (motor cortex > visual cortex) despite substantial interindividual and regional variation. Giraffe aspiny neurons appeared to be morphologically consistent with those of other eutherian mammals insofar as similarities in dendritic complexity. For cross-species comparisons, giraffe pyramidal neurons were compared to those quantified with the same methodology in elephants and cetaceans (e.g., bottlenose dolphin, minke whale, humpback whale). Across species, there appeared to be a continuum of apical dendrite morphologies, with elephant exhibiting widely bifurcating apical dendrites compared to cetaceans, which exhibited slightly wider bifurcating apical dendrites than giraffes. Quantitative dendritic measures (e.g., total dendritic length and dendritic segment count) exhibited a spectrum such that the giraffe falls roughly in the middle, with the elephant and humpback whale at the upper end, and minke whale and bottlenose dolphin at the lower end. Spine measures (i.e., dendritic spine number) were highest in the giraffe, which may be due to both perfusion fixation and stain quality. The current results indicate neuromorphological resemblance between the giraffe neocortex and that of the primate/rodent model. Keywords: giraffe, dendrite, morphology, Golgi method, brain evolution

Sitosterol Content in Three Commercial Sources of Saw Palmetto: an Evaluation of OTC Herbal Medicines for Benign Prostate Hyperplasia
Wesley Stowe, Sarah Sauter, Matthew Rogers, Kelly Laurent, Jacob Houder, Jordan Hauschild, Andrew Glover, Christina England, Brent Drabek, Lauren Carter and Dr. Barry W. Hicks
United States Air Force Academy

Benign prostate hyperplasia, BPH, is a disorder that affects more than 75% of the male population on a western diet by age 60. Voiding symptoms include weak urinary stream, urinary hesitancy, urinary intermittency, difficulty voiding, and urinary dribbling. This condition is due to enlargement of the prostate gland. Although controversy exists in the literature, several studies have indicated that ground or extracted berries from saw palmetto, Serenoa repens, can be used to minimize symptoms of BPH. Recent research
indicates that a plant sterol, \( \alpha \)-sitosterol, may be the active ingredient in saw palmetto because it limits hyperplasia in cell culture, presumably through a p53 mediated pathway. Because supplements are not regulated by the FDA, no standards exist for commercial saw palmetto. In this study, the amount of \( \alpha \)-sitosterol in saw palmetto from three commercial sources was determined by extracting the commercial powder with diethyl ether, purifying the product and quantifying and identifying the sterols with gas chromatography mass spectrometry.

Poster 7

The role of RNA binding proteins in dendritic morphogenesis
Genevieve Kerr, Eugenia C. Olesnicky, Darrell J. Killian
Colorado College and University of Colorado, Colorado Springs

Neurons have highly asymmetric cellular morphologies and polarized cellular functions that are necessary for establishing neural circuitry and for proper functioning of the nervous system. Specialized processes called dendrites are used by neurons for reception of stimuli, while axons function in the transmission of signals. In neurons, mRNA localization and translational repression are used to change the protein composition of various regions of the cell, allowing for distinct axonal and dendritic morphologies and environments that are equipped for their various cellular tasks. A significant portion of eukaryotic genomes encode for RNA-binding proteins and other components of post-transcriptional regulatory machinery. Moreover, a large number of dendritically localized mRNAs have been identified. This suggests that regulation of localized mRNAs contributes broadly to neuronal development and function. In the first study, we performed a candidate RNAi screen to identify genes involved in the development of the highly complex dendritic trees of Class IV dendritic arborization (da) neurons of the Drosophila larval peripheral nervous system in order to assess the role of RNA binding proteins in dendrite morphogenesis. The screen uncovered substantial roles in dendrite development for genes encoding translational repressors, eukaryotic initiation factors, as well as genes involved in mRNA splicing. We find that the translational repressor Brain tumor (Brat) is expressed within Class IV da neurons and functions autonomously in the development of higher order dendritic branching within these neurons. Furthermore, we show that brat genetically interacts with the translational repressors nanos and pumilio in order to promote the generation of complex dendritic trees. Our screen highlights an important role for post-transcriptional gene regulation in generating morphological cellular asymmetries during Drosophila neurogenesis. Moreover, we find that the translational repression complex consisting of Nos, Pum and Brat, which is used to generate polarity along the antero-posterior axis in the early Drosophila embryo is re-employed for the generation of polarity within the dendritic compartment of the highly complex sensory da neurons. In a separate study, the role of ncl-1, a gene homologous to brat, in C. elegans was investigated in order to determine if the role of this translational regulator is conserved in the development of dendrites. Dendrite morphology in wild type and ncl-1 mutants was compared using a green fluorescent protein (GFP) reporter that is expressed in mechanosensory neurons in C. elegans. By looking at the dendritic morphology at different time points in development, we find that ncl-1 null mutant PVDs have reduced 4th order dendritic branching throughout development, which is consistent with the brat mutant phenotype. Since ncl-1 mutant worms have defects in dendritic elaboration, we then wanted to see where, temporally and spatially, ncl-1 is expressed within developing worms. GFP expression was found throughout the body, providing further evidence that ncl-1 functions in PVD neurons. Lastly, since ncl-1 is expressed in most, if not all, cells during development, we wanted to see where within neurons the NCL-1 protein is

\( \sim 23 \sim \)
localized. We find that NCL-1 is localized to both axons and dendrites, but was excluded from the nucleus of these neurons. This highlights the important role that NCL-1 plays as an RNA-binding protein, as it may regulate the localization or translation of mRNAs important for dendrite elaboration.

Poster 8

Forensic determination using multivariate analysis of the provenance of skeletons from a lost 19th century mental asylum cemetery
Austin Keller and Nathan Bower
Colorado College

Craig Lundstrom, Geology Department, University of Illinois, Urbana, IL 61801, USA
Some 150 skeletons from a forgotten 19th century Colorado Mental Asylum cemetery were unearthed during recent construction projects. Skeletal materials were analyzed for stable isotope ratios (e.g., Pb-208/206; Sr-87/86) and elemental compositions using MC-ICP-MS (Nu-Plasma HR) and XRF (PANalytical Epsilon-5). Multivariate statistical analyses (e.g. cluster analysis) of these diverse provenance indicators using data from European Crusader, Native American and Bronze Age populations as well as the asylum’s hospital records sheds light on the origins and mobility of these diverse populations and provides insights into sources of error in the forensic use of these methods.

Poster 9

The Effect of Ralstonia Picketti on Corrosion Fatigue in Aerospace Aluminum Alloys
Benjamin K. Hoff, Daniel H, Henning, Sarah E. Collins, Timothy A. Reid, Ryan D. Young, Henry W. Binzer, and Sarah E. Galyon Dorman
United States Air Force Academy

The Center for Aircraft Structural Life Extension (CASiLE) at the USAF Academy has been investigating corrosion fatigue in these 7xxx series aluminum alloys. During corrosion fatigue testing of these alloys in 0.06 M NaCl bacteria growth was noted and appeared to affect the corrosion fatigue results. The bacteria were determined to be Ralstonia pickettii. The presence of R. pickettii in the salt water solution has been shown to decrease the fatigue crack growth rate from 3.4 x10^{-4} mm/cycle to as low as 9.0 x 10^{-5} mm/cycle at a stress intensity (\(\Delta K\)) of 6 MPa\(\sqrt{m}\), stress ratio (\(R\)) of 0.65 and loading frequency (\(f\)) of 0.05 Hz. The mechanism for how the bacteria are able to lower the fatigue crack growth rate is being investigated. Current theories include: copper sequestering, increasing the oxide layer of the crack surface, creating a polymeric film or desalination of the solution.
Poster 10

Synthesis of disubstituted 1,2,3-triazoles via copper (I) catalyzed cycloaddition
Marcus Calvin, Brayden Hamill, Joann Mueller, and Dr. Allen Schoffstall
University of Colorado Colorado Springs

Organic azides, synthesized from alkyl bromides, meta-fluorobenzyl bromide or glycidol by reaction with sodium azide, were allowed to react with meta-fluoroalkynylbenzene or a 3-aryl-2-alkynyl-carboxylic acid in the presence of copper sulfate pentahydrate and sodium ascorbate (Vitamin C) in a 1:1 tert-butyl alcohol/water solution. Decarboxylation of the 3-aryl-2-alkynylcarboxylic acids occurred under the conditions necessary to form 1,2,3-disubstituted triazoles by click chemistry. Compounds were purified from an ethanol/water solvent pair and analyzed using TLC, NMR, IR, and techniques. Data for several of the triazole derivatives are presented.

Poster 11

Exploration of the Fundamental Dimensions of Social Perception in the Legal Domain
Cobun Keegan and Keegan Cobun
Colorado College

This research represents an exploration of the fundamental dimensions of social perception (communion and agency) as they relate to the legal domain. These dimensions have been previously found to be the basis for most social judgment. A survey of attorneys was conducted to help establish the relevant factors of these dimensions in the legal context and found that communion-related traits were rated as more important than agency-related traits for the formation of impressions about clients. A follow-up experimental study exposed mock jurors to a trial summary with attorney opening statements that focused either on communion or agency characteristics of a defendant in a medical negligence case. Though there was no difference in the effect of the prosecutor argument depending on whether they focused on communion or agency, the effectiveness of the defense response in mitigating impressions of guilt differed depending on prosecutor and defense conditions. Findings from this research can add to the understanding of how the fundamental dimensions affect impression formation in the legal context, specifically with regards to juror and attorney decision-making. Future directions include the importance of research on perceptions of eyewitnesses as well as legal issues outside the courtroom.

Poster 12

Synthesis of Orthogonal Chain-Growth Polymers from Novel Tripodal Monomeric Structures
Caleb Cole and Timm A. 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, nanofabrication, and sensors. We are interested in employing polymeric materials constructed
around exploitable reactive handles that afford on-demand orthogonal elaboration. To achieve this goal, we present here the production of a tripodal monomer that has the capacity to be polymerized via polyamide or polyester condensation, leaving latent azide functionalities that possess a cross-linking capacity or more attractively for incorporation of sensing modalities as desired. Characterization of the resulting polymeric materials includes establishing the thermal characteristics of our architectures via thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). In addition, the molecular weight profile is determined via gel permeation chromatography (GPC). Molecular or ion recognition sensing events are assessed using isothermal titration calorimetry (ITC) to measure thermodynamic binding events and correlated binding constants.

**Poster 13**

**Development of Dispersed Liquid-Liquid Microextraction (DLLME) Method for the Quantitative Analysis of the Brominated Flame Retardant Tetrabromobisphenol-A on Consumer Electronics**

Gina Di Napoli-Davis and Janel Owens
University of Colorado Colorado Springs

Tetrabromobisphenol-A (TBBPA) is one of the most widely used brominated flame retardants worldwide. It is incorporated into items such as circuit boards and consumer electronics to prevent or retard the initial development of fires. Despite its widespread use, there is little data concerning the environmental presence or concentrations of TBBPA, its toxicity, or its environmental fate and transport. Thus, the objective of this work is to develop a “green” method, called dispersed liquid-liquid microextraction (DLLME), to analyze swabbed surfaces of consumer electronics to determine TBBPA concentrations. In DLLME, a ternary solvent system of aqueous sample, extraction solvent, and dispersive solvent is used to create microdroplets for ultra-concentration of the analyte. After concentrating TBBPA, it is derivatized with acetic anhydride and analyzed by gas chromatography-mass spectrometry (GC/MS). In preliminary work, chlorobenzene was shown to be the optimal extraction solvent at 15 µL, a 100 µL dispersive solvent mixture of 75% acetone and 25% methanol was ideal, and kimwipe was determined to be the optimal material to swab electronic surfaces. Using a 13C-labeled internal standard to improve precision and quantitation, TBBPA concentrations on electronic surfaces have been reported.

**Poster 14**

**Quantification of PBDE kinetics in rat tissue in a high-dose postnatal diet: Neurologic implications**

Bryce Ingram
Colorado College

Flame retardant polybrominated diphenyl ethers (PBDEs) are found in many consumer products. They bioaccumulate and can hinder nervous system development. Chronic low-doses similar to environmental levels or a single high dose are typically used in research. In conjunction with a neurobehavioral impact study, the loss of PBDEs in kidney, liver, brain, and adipose tissue was measured for PBDE mixture DE-71 with a control and two high-dose levels (0, 30, and 60 mg/kg administered over seven days postnatal) using
a modification of GC-MS EPA Method 1614. Our study provides new information about the distribution, kinetics, and neurobehavioral impact of PBDEs in tissues in high dose regimens.

**Poster 15**

**Security Vulnerabilities in the open source Moodle eLearning System**
Tyler Schultz and Capt. Colton Floyd

Moodle eLearning System is well known as a free web application e-learning platform used in many schools as a way to allow on-line student interaction. Institutions use Moodle for its flexibility, adaptability and ease of use. Moodle has an installation base of tens of thousands of institutions with millions of student users. Our institution uses Moodle for admission of timed on-line quizzes taken outside the classroom as well as a vehicle for students to submit homework assignments. This paper outlines well-known vulnerabilities for Moodle v. 1.9 and attempts to exploit these vulnerabilities as well as identify new vulnerabilities in Moodle v. 2.1. Surprisingly, many of these known vulnerabilities continue to exist following their identification suggesting possible vulnerabilities which can be exploited by students. Based on these known vulnerabilities, we made recommendations on how to correct these problems in future Moodle versions and individual Moodle configurations.

**Poster 16**

**DFT Analysis of the Substrate Assisted Mechanism of Human Protein Arginine Deiminase 4 and its Role in the Disease Rheumatoid Arthritis**
Luke Delzer, Sarah Lopez, and Dr. Sonja Braun-Sand
University of Colorado Colorado Springs

Protein Arginine Deiminase 4 (PAD4) is an enzyme used to convert arginine residues into ammonia and citrulline. Because citrullines accumulate in the synovial membranes of joints during hypercitrullination, PAD4 is suspected to play a role in the onset of the disease Rheumatoid Arthritis (RA) in humans. Computational studies have attempted to elucidate the precise enzymatic mechanism in hopes of finding a potential inhibitor of PAD4. Currently, there are two mechanisms proposed in the literature: a “substrate-assisted” and a “reverse protonation” mechanism. This experiment sets out to elucidate the substrate-assisted mechanism through density functional studies in order to aid in the definition of the precise enzymatic process. Computations were carried out on the PAD4 active site using the UB3LYP/6-31+G (d,p) basis set. Calculation of energetic barriers using the Gaussian09 software package along the reaction coordinate for the substrate-assisted mechanism will be presented.
Poster 17

Effects of DE-71 Exposure on the Acquisition and Retention of Reference Memory in Rats: Attenuation by Thyroid Hormone Supplementation
James B. Haran
Colorado College

Polybrominated diphenyl ethers (PBDEs) are flame retardants used in a variety of commercial products. Over time, PBDEs leech from the products into which they were mixed and bioaccumulate in both animals and humans. The present study explored the behavioral neurotoxicology of developmental exposure to DE-71, a commercial PBDE mixture, on reference memory. In addition, the possible ameliorative effects of thyroid hormone supplementation were explored as a method for attenuating memory deficits associated with DE-71 exposure. Rats were orally administered DE-71 dissolved in corn oil, 60 mg/kg/day or 30 mg/kg/day, or corn oil alone, on post-natal days 6-12. Half of the DE-71-exposed pups were also supplemented with 6 µg/kg/day levothyroxine on the same day as the DE-71 exposure. Reference memory was assessed at an age of 2 months using the Morris Water Maze. No effect of DE-71 exposure was found on memory, and thus it was not possible to determine if levothyroxine supplementation had a beneficial effect. Additional studies should continue to examine thyroid hormone as a method for offsetting PBDE induced hypothyroidism.

Poster 18

Head in the Clouds of feet on the Ground: a New Nature of War
Mary K. Bush and Lt Col John C. McCurdy
United States Air Force Academy

Many believe airpower could not change the basic nature of war, but simply the way war is conducted. Yet unlike previous micro-revolutions in warfare such as cavalry and gunpowder weaponry, the advent of airpower added a third dimension to a previously two-dimensional war. Taking feet off the ground, the aircraft made it possible to conquer a nation without destroying enemy’s land forces. Seizing on Italian General Giulio Douhet, General Billy Mitchell, and Colonel John Warden’s conceptions of centers of gravity, airpower has proven to break a country’s will by destroying their vital centers. Hence warfare has recently transferred to a battle for air superiority. Additionally, aircraft allows for parallel operations in war, overwhelming the enemy and forcing him to respond in an unplanned fashion. Indicative of this evidence, the advent and pursuit of airpower fundamentally changed the nature of war.
**Poster 19**

**Writing across the Curriculums**  
Evelyn Cruzat  
University of Colorado Colorado Springs

This is a study of writing across the curriculums in two different middle school settings. I observed and interviewed two teachers. One teacher taught music, and the other teacher taught language arts. After my observations, I created a transcript of the interviews. I wanted to discover what motivates students to write well in any classroom setting.

**Poster 20**

**Thermodynamic Investigation of the 4X2 Bulge of the Leadzyme**  
Arian Frost and Neena Grover  
Colorado College

The leadzyme is a small, double-stranded, artificially created ribozyme that contains an asymmetrical 4x2 bulge. The bulge region contains four unpaired bases, with at least one non-canonical base pair forming between C₆ and A₂₅. The bulge is catalytically cleaved by divalent lead ions between nucleotides C₆ and G₇. Three conserved bases C₆, G₉, and G₂₄ in the bulge region are implicated in divalent metal ion binding. Crystal structure suggests two lead ions are necessary for bond cleavage. Lead cleavage can be outcompeted by high concentrations of Mg²⁺. The leadzyme bulge is expected to be flexible and form different structures under different ionic and pH environments. The A₂₅•C₆ non-canonical pair forms two hydrogen bonds in NMR structure and only one hydrogen bond in the crystal structure. To examine bulge stability under various conditions, thermal denaturation experiments were performed on the wild type and various modified constructs in the presence of various concentrations of Mg²⁺ ions, 1 M KCl, and in two different pH conditions. A control helix construct was also examined. Our data shows that the second hydrogen bond between A₂₅•C₆ does not form under the conditions examined. The helix is more stable than the wild type with penalty for breaking the helical structure by adding a 4x2 bulge being ~4 kcal/mol. The G9A construct gains significant stability in pH 7.5 compared to pH 5.5, whereas the other constructs do not show a significant gain in stability. This work was supported by NSF grant MCB-0950582 to NG.

**Poster 21**

**Experiential Learning in International Business: Cadet Experiences**  
Lauren N. Bailey, Tory C. Brown and Dr. Cynthia S. Cy cyota  
United States Air Force Academy

As part of a study abroad semester, students gathered information related to their country’s political economy, culture, and trade policies, and business entry strategies as part on an international business independent study. Based upon experiences in Costa Rica and Japan, students will present the process of learning about, living and working in a foreign country from an international business perspective as well as
share experiences relating to military operations (or lack thereof), education, and living with a host family for an extended period of time.

**Poster 22**

**Rapid determination of a panel of neurotransmitters in human urine using capillary electrophoresis**
Sarah A. Gehrke, Elle Clarke, Pengxin Liu, Randy Robinson and Dr. David J. Weiss
University of Colorado Colorado Springs

Serotonin, dopamine, norepinephrine, and epinephrine have been linked to many neurological conditions. However, the relationship between these neurotransmitter concentrations and diseases is not well understood. A technique that offers rapid, non-invasive and quantitative analysis of neurotransmitters could aid physicians and researchers when studying neurological diseases. Capillary electrophoresis (CE), as opposed to liquid chromatography, yields higher peak efficiencies and is environmentally friendly due to its minimal use of organic solvents. This research will present a rapid method to identify and quantitate four neurotransmitters in human urine. First-morning urine samples were collected from a healthy adult male and solid-phase extraction was used for sample clean-up and preconcentration. CE with UV/Vis detection was utilized for analysis of urine samples with elution times of approximately 10 minutes. This research was supported by a Merck AAAS grant and the University of Colorado Colorado Springs LAS Scholar Award.

**Poster 23**

**Does Writing Invite Dialogue?**
Jason Henderson
Colorado College

The proposed study will be analyzing e-mails disseminated in the workplace, and will focus on the writing practices that are present in the e-mails of one particular company. The text will be analyzed to determine the rhetorical strategies employed by the authors of these texts, and to make judgements about the purpose and audience of these inter-work e-mails. What are their function? What can be determined about the audience? What rhetorical devices are consistent in the writing, and when does it deviate? What is the significance of these variations? By asking these questions I hope to gain insight as to how writing enables or inhibits communication in the workplace. Does writing invite dialogue, or is communication moving in one direction only? Since e-mails are a common way for companies to convey information, analyzing them may reveal the strengths of these types of texts, as well as identifying practices which may be improved upon. The e-mails being examined in this study are composed from an archive of a company wide daily e-mail that is sent at the beginning of the business day. Three months’ worth of e-mails will be examined. These have already been composed and archived; no new writing will be obtained. All information that could be used to identify the company or the employees of the company have been deidentified by the IT staff of the subject company. Pseudonyms have been substituted for real names, and no last names are used. The name of the company will not be named in the research. Using the methodology of Grounded Theory, the body of texts will be “coded;” this coding will identify and classify instances of writing which serve different purposes.
**Poster 24**

**Fluid Stream Momentum Transfer for High-Efficiency Propulsion of Lunar and Mars-Bound Spacecraft**
Xian Yang Calvin Tan, Wesley McVay, David Besson, Nolan Bader and Thomas B. Joslyn
Nanyang Technological University

This research evaluates momentum exchange through fluid streams as a means of propelling spacecraft without consumption of propellant. Ionic fluid streams projected through space from one spacecraft to another where it can be stored for future momentum exchange. Vacuum chamber testing of high-speed ionic fluid droplet streams confirms that they can be collected at high speed with minimal vaporization losses. High-speed fluid collection enables significant momentum transfer between spacecraft travelling at different speeds. Cost of launching a lunar spacecraft is reduced when momentum exchange technique is used as compared to conventional method. In-situ synthesis of ionic fluids on the moon would further lower launch costs while making it possible to supply momentum and propellant to spacecraft bound for other celestial bodies without the need for rendezvous. All of the applications presented are applicable to interplanetary missions and significantly reduce the amount of mass needed at launch.

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**Poster 25**

**Placebo Effect: Perceived Sleep Quality Affects Cognitive Functioning**
Christina Draganich
Colorado College

The placebo effect is defined as any outcome that is not attributed to a specific treatment, but rather to an individual's mindset (Crum and Langer, 2007). While many instances of the placebo effect have been observed in tests of pharmaceutical drugs, the phenomenon can also extend beyond this context to involve aspects of everyday life. In a study examining whether perceived sleep quality affects cognitive functioning, 50 participants completed a questionnaire about their previous night's sleep quality. This questionnaire was used to measure their sleep judgments. They were then randomly assigned to one of two sleep quality conditions. Those in the “above average” sleep quality condition were informed that they had spent 28.7% of their total sleep time in REM, while those in the “below average” sleep quality condition were informed that they had only spent 16.2% of their time in REM sleep. Assigned sleep quality significantly predicted participants’ scores on the Paced Auditory Serial Addition Test (PASAT), a measure of auditory attention and memory, whereas self-reported sleep quality did not predict participants’ PASAT scores. These findings support the hypothesis that mindset influences physiological states, suggesting a means of controlling one’s health and cognition. If individuals are taught to alter their attitudes about sleep, it may be possible to alleviate some of the effects of poor sleep quality on cognitive functioning.
**Poster 26**

**Optimization and Characterization of Ball Lightning-Like Plasmas**
David M. Friday, Peter B. Broughton, Jeremiah N Betz and C. Michael Lindsay
United States Air Force Academy

Ball lightning is a natural phenomenon rarely observed in nature and is not well understood due to the difficulty of reproducing them in the lab. Recently, however, a technique has been developed to generate artificial ball lightning-like plasmas that are self-sustaining for nearly one second providing the opportunity for characterizing the chemical and physical properties of the plasmas. To optimize the plasma ball formation, we varied the pH and conductance of the electrolytic solution and the applied voltage and capacitance. The present work has used schlieren videography and open-air FTIR of the plasma environment to characterize the physical and chemical properties of the plasma.

**Poster 27**

**Creative Writer’s Peer Review Process**
Matthew Banfield
University of Colorado Colorado Springs

This study is to explore the connection between the first draft, and the final draft a creative writer submits after undergoing a peer review. The study intends to explore the importance of the Peer Review in the creative process of individual writers. This study garnishes its findings from willing participants through an exit survey that is completed by the participating student upon completion of the peer review. The participant will then submit a copy of their first and final drafts to me using an alpha numeric identifier, or pseudonym, which shall be on the exit survey. Stories submitted via e-mail will be matched with the exit survey and all identifying marks shall be eliminated. The files shall be stored on a portable hard drive that shall be password protected. All e-mails will be deleted from the server. The research completed would help to make writers more aware of how the peer review and subsequent editing affect the final draft of their stories, make them aware of the types of methods they employ to write a well-crafted story, and help them to see the benefit of a review before the writer desires to publish.

**Poster 28**

**Fabrication of Graphene and Application toward Cyclic Voltammetry**
James Park and Professor Murphy Brasuel
Colorado College

Graphene is sought after for electrochemical applications because of its high conductivity and low noise. However, efficient large scale methods of graphene production have yet to be established. To produce graphene for application to cyclic voltammetry, three methods of graphene production were explored: epitaxial growth on copper, micromechanical exfoliation, and combustion of magnesium in dry ice. XRD analysis showed successful synthesis of few layer graphene by the combustion of magnesium in dry ice.
The graphene was used to produce a carbon paste electrode. This performance of this graphene paste electrode was compared to a graphite paste electrode as the working electrodes in cyclic voltammetry.

**Poster 29**

**Defining and Exposing Privacy Issues with Social Media**  
Jacob Blasbalg and Ryan Cooney  
United States Air Force Academy

In the growing world of social media, privacy concerns have grown out of an explosion of usage. Millions take advantage of the convenience found in websites such as Twitter and Facebook. One concern about such sites is that there is limited understanding of the specific privacy issues associated with them. Recent changes to Google’s privacy rules are one such example. Many factors however, lead to the ignorance of users and therefore commonplace exploitation of the information which they knowingly or unknowingly share. This paper looks at freshmen university students who use social networking sites in an attempt to understand what expectations they have of privacy on social networking sites. Using a two phased process, the study first analyzes how well students understand privacy associated with their social networking posting and then identifies information from our students which may be of a personal nature that is publically available on social networking websites.

**Poster 30**

**Researching Learning Styles and the Writing Relationship**  
Keelind Baker  
University of Colorado Colorado Springs

This is a study on how or if learning styles, visual, kinesthetic and auditory, enable or disable a personal relationship to writing. To conduct this study I held interviews with students at the University of Colorado at Colorado Springs. The questions were intended to show what type of learner they are and what kind of relationship they had with writing. The goal of this study is to allow students to understand how they learn, why they do or do not have a personal connection with writing and what ways can teachers and students work together to learn how to build a better connection with writing.

**Poster 31**

**Optimization of Magnesium PEBBLE Nanosensors**  
Chris Dickinson and Rachel Wilson  
Colorado College

Magnesium is recognized as an important ion in biological processes because of its role in building nucleic acids, activating adenosine triphosphate and acting as a co-factor for hundreds of enzymatic reactions. Furthermore, magnesium deficiency has been associated with such diseases as hypertension and
diabetes. This has led to extensive attempts to correlate cellular magnesium homeostasis to its involvement in physiological processes. However, these attempts have provided little insight into cellular magnesium homeostasis due to inefficient analytical methods. We have utilized the PEBBLE (probes encapsulated by biologically localized embedding) nanosensor platform to give real-time, dynamic quantitative measurements of intracellular magnesium. PEBBLEs incorporate an analyte sensitive dye and a reference dye in a polymer matrix. This allows for an accurate ratiometric analyses while decreasing physical perturbations on the cell. Using *Dictyostelium discoideum* as a biological model, we are optimizing techniques to monitor and quantify concentration fluxes of cytoplasmic free magnesium during chemical stimulation of the cells.

**Poster 32**

EXOGRIP: ASSISTED HAND STRENGTH GLOVE
Joshua Bergman, Christina Cassabaum, Matthew Fryer, James Hill, Daniel Lee, Jared Morris, Michael Sattes and Capt Willie Mims
United States Air Force Academy

Many people have received injuries in their upper extremities leading to significant nerve damage and loss of strength. These injuries impair their ability to perform day-to-day tasks such as lifting a cup of coffee or opening a door. The ExoGrip is a glove designed to provide the necessary strength augmentation to perform everyday tasks. The ExoGrip consists primarily of pressure sensors, linear actuators, and a microcontroller to provide a force multiplier based on a person's own strength. The current phase of this project is to design and integrate a working prototype that manipulates all four fingers, while keeping the thumb in a fixed position. Verification tests will demonstrate the user’s ability to perform daily activities. Previous iterations of ExoGrip have demonstrated this ability in the glove. Our team is in the second year of the prototyping phase and plan on moving into production at the end of this prototyping cycle.

**Poster 33**

Manipulation of Electrostatic Fluid Accelerator Field
Michael Arnold
University of Colorado Colorado Springs

A high voltage potential between a sharp point and a flat plane creates an electron wind in which ions are pulled through a fluid, in this case air, towards the opposite potential and creating a subsequent fluid flow in the same direction. Also known as an electrostatic fluid accelerator, this kind of air flow is desirable in many different applications due to the simplicity of design. The lack of many moving parts allows this type of air flow to be installed into tight fitting and very compact places such as small tubes or ducts. The ability to manipulate the airflow in such a way as to make it spin also has multiple potential applications such as the removal of dust particles from air systems and use in the study of open flames in low gravity situations. These two examples could have significant impacts on our society in the further development and study of computers and combustion engines. In order to manipulate the air flow in such a way a prototype was designed and constructed to spin the flat electrode in a circle while keeping the sharp point electrode...
stationary. The distance between potentials was allowed to be adjustable in order to find the most productive distance from the moving plane. The circular motion of the disk produced an initial circular air flow due to the shear forces between the surface of the disk and the air. The electron wind was expected to increase the initial circular air flow enough to visually compare the difference between the initial and final flow.

**Poster 34**

Non-heme Iron Catalyzed Olefin cis-Dihydroxylation: Kinetics and the Effects of Additives
Jordan DeGayner
Colorado College

High-yield, highly selective biomimetic iron catalysis of olefin cis-dihydroxylation has attracted growing interest in past decades as a possible safe substitute for osmium tetroxide. Class B catalysts with α-substituted organic ligands (6-Me₃ TPA, 6-Me BQPA, Ph-NMe-DPAH) that promote high-spin Fe⁰ centers were shown to prevent H₂O₂ disproportionation. This finding allowed us to conduct novel kinetic studies for this class of catalyst. The effects of urea, 3-nitrobenzoic acid, and chloride ions on the rate and yield of the cis-dihydroxylation products of 1-octene and t-butyl acrylate were characterized. Urea and the acid were individually found to enhance rate and yield significantly, and to work synergistically together. Similar rate enhancement was found with tetramethyl urea, suggesting the urea carbonyl causes the rate increase. Given the chemically distinct pattern of hydroxylation from Class A catalysts and the lack of an initial lag phase in kinetic experiments, an Fe⁴(OH)₂ reaction intermediate is proposed.

**Poster 35**

Electronic Flight Bag - e781
Michael Winstead and Lt. Col. Delbert Christman (ret)
United States Air Force Academy

In support of the Air Force initiative towards an electronic flight bag for crews, the e781 project aims to cut down on the amount of hassle required for flight crews to maintain currency on their air frame. Primarily, the project leverages an iPad for the aircraft commander to quickly record task timings and in-flight activities for aircrews as they star current for their airframe. The project will alleviate the clerical overhead required by the current Aircrew Records Management process and provide record centralization on back end systems which will support the iPad frontend. The overall platform is designed to be abstract enough to be extended to any aircraft.
Poster 36

The Effects of Age and Cognitive Ability on Emotion Regulation
Lauren Hartt
University of Colorado Colorado Springs

Emotion regulation is considered to be the way in which certain emotions are regulated, and differences between younger and older adults’ use of emotion regulation strategies have been discovered, yet little research has been dedicated as to why. We administered tests of cognitive ability and measures of emotion regulation and expressivity to younger (17-36 years) and older (60-89 years) adults. For younger and older adults, auditory memory as measured by the CVLT-II was not correlated with emotion regulation or expressivity. There were no significant correlations between cognitive and emotion measures for younger adults. For older adults, results revealed several significant correlations. Category fluency was positively correlated with positive expressivity, indicating that with greater levels of functioning, positive expressions increase. Conversely, letter fluency and category fluency were negatively correlated with suppression for older adults, such that with better performance, participants report decreased use of suppression.

Poster 37

Synthesis and Evaluation of the Penipanoid Alkaloids
William Bowers, Kelsey Fowlkes and Sarah Mackey
Colorado College

Recently, four organic molecules were extracted from the deep-sea marine fungus, *Penicillium paneum* SD-44. The molecules obtained included a novel triazole Penipanoid A, two novel quinazolinone alkaloids, Penipanoids B and C, and a previously known and structurally related quinazolinone derivative, 5-hydroxy glycosminine. Penipanoid C was rapidly synthesized on gram-scale and its biosynthetic relationship to 5-hydroxy glycosminine was confirmed through oxidation. Efforts were made toward the total synthesis of Penipanoid A and its analogues. Once optimized, this synthetic route will be used to determine the biological significance of this alkaloid and determine the biological utility of its analogues.

Poster 38

Effects of Batching and Selective Staffing in Sick Call During Basic Cadet Training (BCT)
Mary C. Anderson, Lauren N. Bailey, Michael A. Estacion, Jordan K. Waiwaole, and Capt John Feely
United States Air Force Academy

Every summer, over 1000 basic cadets enter the Air Force Academy for six weeks of rigorous physical and mental military training. The strain of training often results in injuries or sickness, creating a need for an attentive medical staff to care for the basic cadets. Medical providers from the base clinic are temporarily reassigned every day to serve this training population, while normal base appointments are diverted to civilian clinics at great expense to the Air Force. This project examined the process in which basic cadets
were brought to sick call in an attempt to maximize server utilization and return medical providers to the base clinic as soon as possible. Using simulation techniques, server utilization, basic wait times (lost training time), and the number of servers needed were analyzed. Results indicate a split surge consumes less training time while maintaining medical provider utilization.

**Poster 39**

*Writing Through the Lens of College Freshman at USAFA and UCCS*

Aaron Thomas  
University of Colorado Colorado Springs

This research study will compare how college freshman at the United States Air Force Academy and the University of Colorado at Colorado Springs view writing within their institutions. It will compare the syllabi of freshman English courses at these two institutions. The purpose of this research is to display how college freshman at two different institutions view writing and to show the similarities and differences of their assignments. The research will be used to show the overall difference and similarities of college freshman writing within two separate schools with two separate career paths, based on the school they are attending.

**Poster 40**

*Determining caffeine pharmacokinetics in rat blood and brain using high-performance liquid chromatography*

Juan Arias and Professor Lori Driscoll  
Colorado College

The behavioral and pharmacokinetic profiles of caffeine have been well characterized in both human and animal models. Very little is known, however, about variations in caffeine concentrations within different brain structures over time. Knowing the duration and relative concentration of caffeine in different regions of the brain would allow for a deeper understanding of how caffeine conveys its stimulatory properties on specific behaviors and moods in humans. The existing reports on caffeine concentrations between brain regions have been inconclusive or contradictory, claiming greater concentrations in either cortical or subcortical areas, the most notable of the latter being the striatum. The present study sought to address such inconsistencies by measuring caffeine concentrations in five rat brain structures—medial prefrontal cortex, striatum, hippocampus, cerebellum, and brainstem—and blood plasma at four time points after administration of a behaviorally relevant 30 mg/kg dose of caffeine. The study revealed moderate significance between individual brain structures, with the medial prefrontal cortex and cerebellum having significantly higher caffeine concentrations than the striatum. The higher concentration in cortical areas may potentially be due to the short time period of the present study, as it most closely fits the window of other studies that found cortical caffeine to be higher than striatal caffeine levels. Future research could build on the discrepancies in time and observe caffeine metabolites during the same short time period to see what role caffeine metabolism has in the different concentrations seen between cortical and subcortical areas.
Poster 41

What I look like in ‘Real Life’: Treatment for Self-Objectification in Adolescent Girls through Wilderness Experiences
Marina Leith
Colorado College

Objectification Theory proposes that media and social influences sexualize views of the female body, and women and girls self-objectify by internalizing these views, becoming distanced from their own corporeal selves, and focusing attention on outward appearance. Wilderness Therapy is a relatively new form of psychological treatment designed to treat problem behaviors in youth populations. This paper proposes, based on empirical evidence and field observations at a Colorado-based wilderness therapy program, that the wilderness setting is uniquely positioned to treat self-objectification in adolescent girls because wilderness survival experiences necessitate body awareness and care. Observations also showed, however, that the opportunity to explicitly and effectively treat self-objectification in the wilderness is not being utilized by the majority of wilderness therapy programs, therefore this paper concludes with suggestions for objectification education, embodiment and other practices to improve the treatment of self-objectification in the wilderness.

Keywords: self-objectification, sexualization, wilderness therapy, Adolescence, females, media

Poster 42

Response to Microtubule Mayhem
Raul V Perez, Chris J Richey, Molly I Server and Tom D Wolkow
University of Colorado Colorado Springs

Rad26 is known to respond to microtubule damage and Ase1 is thought to cooperate in this pathway. The position of the nucleus is compared in WT and mutant strains, in mutant strains the nucleus is dramatically offset demonstrating the involvement of these proteins in the repair pathway. Ase1 has two known domains, but a third is thought to exist that interacts with Rad26. Ase1 rescues a Rad26 deletion. To prove the domain's existence, removal of this third domain should halt the Rad26 rescue by Ase1. ASE1/GFP shows two signals localized to opposite sides. MT damage produced by a low dose of MBC (10uL/15mL) one of these signals becomes lost; while higher doses of MBC (20-30uL/15mL) causes both signals to be lost. Through western blotting ASE1 appears to become phosphorylated when the MT's are damaged. These data suggest the cooperation of Ase1 and Rad26 in the MT repair pathway.
**Poster 43**

**Purification and primary characterization of MEX-5 protein involved in early development of C. elegans**
Katsiaryna Tarasava  
Colorado College

MEX-5 is a regulatory protein involved in cell fate specification in early development of *Caenorhabditis elegans*. The mechanism of its regulation is not well understood; however, MEX-5 has been shown to be absolutely mandatory for functional stability of MEX-3, another protein of the same class, involved in post-transcriptional regulation of PAL-1 expression. PAL-1 is required for specification of posterior blastomere fates. Full-length protein needs to be isolated in order to characterize it in terms of physical and chemical properties, self-association, and interaction with nucleic acids and MEX-5. This poster presents a summary of the development of a complete and optimized protocol for isolation of full-length MEX-5. The method involves construction of MEX-5-MBP (maltose-binding) fusion protein and subsequent purification of MEX-5. Successful purification of MEX-5 has allowed to determine its isoelectric point and is necessary for further characterization of MEX-5 RNA-binding properties, oligomerization state, and the mechanism of interaction with MEX-3.

**Poster 44**

**The Yurt: Identity through Architecture**
Mattias Bailey and Professor Scott Johnson  
Colorado College

A herd of sheep as it crosses the steppe plains, watched from a bluff by Turkic herdsmen. They are pastoral nomads. The man and his son watch intently for wolves and other predators that could endanger their livelihood. The man has herded sheep his entire life, just as his father before him, and his father before him. He uses tools that his father taught him to make and lives in a yurt that his father helped him build. The lifestyle of the pastoral nomads has changed little over the last thousand years. True, a century of government interference has affected millions of nomads, but for the millions remaining, they live a life that has been experienced in the same way for a thousand years. Traveling across the steppes of inner Asia, nomads depend on their livestock, family, and unique technology. The unique mobile dwelling of Central Asia, the yurt, has been a profound piece of the nomadic experience. Nomadic tribes of Central Asia have used yurts, in various incarnations, for over two thousand years. Nomadic identity and the yurt have developed together, almost inseparably. The practicality and success of its form have seen it recently migrate across the world as industrialized nations discover the applicability of the yurt. Various nomadic tribes use specialized yurts indicative of their unique identity. In this paper I specify what those differences are, and analyze why and how those differences exist.
Oral Session II
(1:00-2:20 pm)

Cornerstone 301 Room

Vision of Life

Breaking the Fourth Wall and Hybridity of Forms
Patrick Bohnen
University of Colorado Colorado Springs

I plan to discuss the progression in my work and practice as an artist and student over the last year. The two main developments I will be addressing are my continuation in making interactive works, and my experiments in painting as a sculptor. I will tie these together and show how they relate to past work while also becoming independent thoughts of their own.

Opportunists: a Sculptural Investigation of Individuals and Populations
Michelle K. Yates
Colorado College

This body of work explores how sculptural objects made from everyday materials can suggest animation and growth. Each piece investigates the relationship between individuals and their populations. The artworks present the challenge of creating forms that suggest life and growth from inorganic materials such as plastic, paper and nylon. This process began by researching beings in nature that populate in dense groups as well as organisms composed of multiple repeating components. I spent time exploring forests and shorelines in Washington State while photographing and sketching life forms such as ivy, barnacles and various types of fungi. Through research I discovered that many of these organisms are opportunistic in nature. For instance, different types of fungi lurk under the surface of the ground until it rains causing hundreds of fruiting bodies to emerge. When installing each piece, I established guidelines based upon the behavior observed in these real life beings.
Title- Indulgence: Toxic Desire
Elizabeth Raitz
University of Colorado Colorado Springs

My resent work is a study of the grotesque in the form of video. Simultaneously seductive and repulsive my pieces explore and expose the dichotomy between toxicity and desire. Body juxtaposes excessiveness—while, desire speaks in sweets; in other words, the subject of my work is a body that has been altered with frosting, glitter, and other sweet treats. As body and desert blur together subtle allusions to pornographic imagery begin to emerge. The complex interactions among objects within the given scenes discuss themes of isolation, sensuality, desire, and repulsion. These studies are an exploration of my voyeuristic attraction to the grotesque and the way in which others experience it.

Transformation
Edna Price
University of Colorado Colorado Springs

I will explore the chronology of my art practice over time, both formally in relationship to media, and color, and how this contributes to how I perceive myself as an artist both past and present. What is interesting about this transformation over time is my unawareness of how my experiences are the influence of this change. In my more recent work, my choice of materials has changed greatly, as have my color preferences, which have shifted strictly to red and black. I have also increased the use of materials outside of their usual context. As a result of these gradual changes over time, I have developed as an artist and as an individual.

Cornerstone 302 Room

Ecological & Environmental Studies

Roots, Rhiomes and Restoration: Growth and Biomass Allocation of Transplanted Zostera Marina
Ann M. Evankow and Dr. M. Shane Heschel
Colorado College
Valuable seagrass ecosystems are disappearing from coastal communities around the world. These marine flowering plants are substantial primary producers and provide sediment stabilization and habitat to
countless organisms. In order to enhance knowledge about restoration techniques, this study investigated the establishment of transplanted *Zostera marina* into the sediment using biodegradable and metal grids and compared biomass allocation of transplanted and undisturbed *Z. marina* individuals. Seagrass shoots were harvested, measured and transplanted attached to metal and biodegradable grids and subsequently, collected to measure root growth and biomass allocation. *Z. marina* sediment establishment did not vary significantly, indicating that both grid methods are effective transplant techniques. However, transplanted individuals had reduced aboveground biomass allocation relative to non-transplanted individuals, suggesting that future studies should investigate transplant stress to *Z. marina* shoots. Protection and rehabilitation of seagrass meadows is possible with a balance of population monitoring, anthropogenic threat mitigation and restoration strategies.

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**The Relationship Between Plant Characteristics and Watershed Restoration**
Matthew Cahalan
University of Colorado Colorado Springs

Watershed restoration is becoming increasingly important as urbanization, global climate change, and other human-induced changes alter the ecological functions and values of watersheds. Scientific study is fundamental in understanding the role watersheds have in various ecosystems, and their effect on our quality of life now and for future generations. The relationships between leaf hydrophobicity, leaf angle, and water droplet retention were the primary focuses of the research conducted, and are important to consider when planning watershed restoration projects in arid and semi-arid regions. By researching these plant characteristics, as well as analyzing the relationship between native versus exotic plant species, watershed restorationists can increase water availability to root systems during rainfall events. The study focused on 11 species in the arid and semi-arid, foothills-grassland environment of Colorado. The results proved that leaf angle is greater than water droplet retention in the majority of plant species. Due to this, intercepted rain droplets will most likely drain off the leaf surfaces in the canopy and contribute to water availability to root systems.

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**Biodecontamination with Ionic Liquids is Less Toxic to the Environment**
Joshua D. Stanley and Dr. Michael J. Wilcox
United States Air Force Academy

Ionic liquids, a new class of chemicals, are molten ionic salts at normal temperatures. They are chemically and thermally stable, recoverable and reusable and have low vapor pressures so are non-volatile. The research objective is to determine feasibility of ionic liquids as solvents in decontamination of vegetative bacteria and spores using *B. thuringiensis* and *B. cereus* as a surrogate for *B. anthracis*. The environmental friendliness of ionic liquids is of particular value. Of the ionic liquids, ethyl-methyl imidazolium, butyl-methyl imidizolium dipropyl-methyl imidizolium and dodecyl-triethyl phosphonium chloride only the latter showed antibacterial properties against vegetative cells. Hydrophobic ionic liquids inhibited spore germination.
However, if the ionic liquid was stripped from the spore with phosphatidylcholine or albumin the spores germinated. Peroxide treatment prevented spore germination but photooxidative dye and Lewis acid were less effective. Spores are resilient and aggregate when dehydrated, allowing some to survive treatment possibly by excluding active agents.

Cornerstone 302 Room

A Mindful Death

Emily Dickinson’s Walk with God
Maria Carriedo and Wilson Brissett

Emily Dickinson toys with religion and embarks on a spiritual journey in which she explores the topics of death and apocalypse, using the beauty and wonder of nature as a medium to express her lack of a need for a structured religion. Dickinson had a family history rich in traditions and practices which trace back to the first Puritans of England. Within her poetry, her manner of debating the reality and truth of God is never definite or conclusive. Along her journey, Dickinson progresses from doubt to a sense of security in which she has no need or use of an organized religion to help her realize a God or majestic and heavenly beauty. Poetry is Dickinson’s life and religion. Therefore, it is quite fitting that through her “religion,” Dickinson debates and illustrates her lack of need of a religion.

Death: The Adventure of a Lifetime
Amanda Rodriguez
United States Air Force Academy

Death is a constant consumption and saturation of Emily Dickinson’s poetry. Her poetry indicates that death, “a great dictator, and ever-present imperator” is a force human nature constantly battles with, and requires respect and reverence (McNaughton 203). While her poetry lacks chronology, it is undoubtedly evident that there are defining biographical moments in Emily Dickinson’s life that have charged her evolving understanding and perception of death. In turn, Emily Dickinson’s death poems can be classified into four classes: “those dealing with the physical fact of death, those dramatizing the pageantry of death, imaginative descriptions of the grave, and poems visioning immortality” (McNaughton 208). Her thematic obsession with death is best analyzed in her poems “I heard a Fly buzz—when I died—”, “Sweet - safe - Houses”, “I Felt a Funeral, in My Brain”, and “My life closed twice before its close”. Studying the life of Emily Dickinson is imperative to understanding the evolution she undergoes in her poetry from understanding death as a purely physical occurrence, to a homely event, to an elaborate and imaginative experience, to death as a vehicle of immortality.

~ 43 ~
David Lewis and Other Minds
Maggie Ruble
Colorado College

If personal experience is the only route to direct knowledge, how can we know that others are having similar encounters in life? Can we know that other minds are having similar experiences to ours? What do we have if we cannot obtain direct knowledge of others’ minds? David Lewis’s materialist theory of mind in his paper “Mad Pain, Martian Pain” is a starting point for this exploration. His paper has plausible insight into “minds” in general, and can be seen as a tool to explore and perhaps answer these questions about the minds of others. His materialist theory, which is a combination of functionalism and identity theory, is particularly useful because it allows for contingency on both ends of pain— the cause and the effect. Lewis’s idea is that for different populations, pain could be and IS defined differently. Through Lewis’s ideas concerning similar experience, indirect knowledge, cultural differences, and contingency, I have shown it is possible to extrapolate to ideas of how a person may be able to know another person has a mind, and potentially what they are experiencing. Overall, David Lewis’s theory can be successfully used to account for how one might be able to know that others have minds, as it is able to describe in a broad manner multiple types of contingency in the experience of pain.

Menschen
Sarah Lotfi
University of Colorado Colorado Springs

Menschen is short film on the consequences of the Nazi's T-4 euthanasia program and the value of life in the last days of WWII. "Menschen" is the German word for "human beings". Meticulously researched to fall in the very last week of the war, Menschen is the story Austrian captain guiding the remnants of his company past the advancing Russians to surrender the Americans. On the journey he takes under his wing a young man with Down Syndrome. Menschen is an expansive production collaborating with German and Austrian cultural societies, World War Two Living History Re-enactors, and disability awareness groups.
Brazil and Angola: a Comparative Study of Colonial Interacial Relationships and Economic Planning
Katherine R. Brock
United States Air Force Academy

The Portuguese established its colonial power in both Brazil and Angola in the fifteenth and sixteenth centuries seeking a new route to the Asian continent, yet both colonies developed into completely different modern states. Brazil has become a strong democracy with dominant global power, while Angola stagnated post colonialism and struggles with a weak, corrupt, personalist state. Although there are many factors, which contribute to state formation, the colonial economic and social conditions are the historical foundation that can either hinder or stimulate a state’s progress and future political, social, and economic environment. In the case of Portuguese colonialism, interracial relationships between the Portuguese and indigenous people and colonial economic planning explain the prosperity and stability in Brazil and the misfortune and disunity in Angola.

Transforming Supply Chain Logistics: Distribution Center Analysis
Colby D. Chaput, John R. Lepird, Mr. Santos Cerda Jr. and Dr. Jim K. Lowe
United States Air Force Academy

Walmart requested a Cadet for five weeks to analyze and optimize operations in their supply chain network. Data was gathered on Walmart’s 19 Batch Distribution Center PUT Modules. A PUT module is an individual subsystem, and the largest bottle neck, within the distribution center. Research was designed to optimize “store arrangement” inside a distribution center in order to improve throughput. After collecting data, a series of six unique computer programs were created, and thousands of iterations were performed to prove which “store arrangement” strategy is the most efficient for maximum inventory throughput. Ultimately, the research efforts proved to be a resounding success resulting in a 24.5% increase in volume within one month, which translates to an increase of hundreds of thousands of additional units of inventory that could be processed. Currently, the research has been implemented in two distribution centers and will be implemented throughout the entire Walmart network.
Lessons From a Comparison of Tunisia and Algeria: The Path to Democracy
Amanda M. Johnson
United States Air Force Academy

With Arab Spring Revolutions struggling to gain democracy and political freedom, it is essential to understand the factors that allow a third-world country the ability to forge a democratic future. This case study comparing the political development of Tunisia and Algeria outlines the importance of education, women's rights, and nation-supporting militaries to the success, and even initiation, of a democratic revolution. Since these two Maghreb countries have similar people, history, and resources, but profoundly different outcomes, they make an excellent case to examine in order to determine why Tunisia excelled at their quest for true democracy and Algeria still struggles under militant rule. This examination gives further insight to Tunisia’s current democratic status and provides the foundation necessary to predict the likelihood of a lasting Tunisian democracy. In summary, this relevant case study demonstrates how collective thought, women’s societal status, and role of the military can determine the success or failure of a democratic revolution.

Assigning Accurate and Effective Anti-Terrorism Measures for U.S. Military Installations
Karl Grosselin, Ryan Erickson, Mitchell Metzler, Capt Brian Lemay and Capt John Feely
United States Air Force Academy

Random Anti-terrorism Measures (RAMs) are an important part of every military base’s security plan and are implemented at random times to mitigate threats. RAMs are intended to be random to prevent adversaries from identifying security patterns and exploiting them. Currently RAM’s are scheduled by a person who just chooses RAMs from a list. This process is not very random, takes up time, and many of the RAMs are never selected. In order to improve the randomness of the scheduling process as well as ensure all RAMs are considered, an automated Microsoft Excel based scheduler was created. This tool allows the Force Protection office to offer a heightened level of security to the base while simplifying the RAM scheduling process. Initial results have shown that a greater variety of RAMs have been scheduled due to the fact that each and every base asset and threat is eligible to be selected.
Cornerstone Flex Room

Modeling & Mathematics II

Growth Functions of Increasing Integer Sequences
AJ Wallerstein, Dr. Micheal Brilleslyper and Dr. Bradley Cooper
United States Air Force Academy

Let \( a_1, a_2, a_3, \ldots \) be an increasing, infinite sequence of positive integers; for example the natural numbers, \( a_j = j \), or powers of 2, \( a_j = 2^j \). We are interested in how such sequences grow relative using a multiplicative metric. In particular, we define the following terms: For a given sequence \( \{a_j\} \) we let

\[
P(n) = \prod_{j=1}^{n} a_j = a_1 a_2 a_3 \cdots a_n.
\]

Then, for each value of \( n \), let the growth function, \( f(n) \geq 0 \) be the unique integer such that the product

\[
Q(n) = \prod_{j=n+1}^{n+f(n)} a_j = a_{n+1} a_{n+2} \cdots a_{n+f(n)}
\]

satisfies the following properties:

\[
P(n) \geq Q(n) \quad \text{and} \quad P(n) < Q(n) a_{n+f(n)+1}.
\]

If no such integer exists, then we define \( f(n) = 0 \).

This talk will outline some properties of this growth function for various integer sequences and also consider the existence of sequences that result in \( f \) having particular characteristics.

Location Based Criminal Assessment – Downtown Bars
Sara M. Bangert, Jonathan M. Chung, Jane M. Demkowicz, Nicholas R. Jernigan, and Capt. John P. Feely
United States Air Force Academy

An emerging concept in the police community is location based criminal assessment which was derived from the need to compare criminal activity at similar locations. The Colorado Springs Police Department (CSPD) has been developing a location based criminal assessment model for bars in the Colorado Springs area. The CSPD recognized the need to statistically validate their model and requested our help to use academic methods to analyze their model and suggest potential changes that would improve their ability to accomplish these goals. We reviewed and analyzed the weights for sources, the categories of crime, and the method for gathering intelligence by using different operations research and mathematical methods such as: simulations, sensitivity analysis, weighted model analysis, and quantification of qualitative data. We have created an academically supported model to assess location based criminal risk; successfully achieving the goals of the CSPD in regards to bars in the Colorado Springs area.
Transient Response of a Tethered Line in a Steady-State Free Stream
Phil Knodel
United States Air Force Academy

Previous work on a horizontally-deployed tethered line is extended to include deployment of the line until fully extended. Dynamic and buoyant fluid forces, added mass effects and inertial forces are combined at each time step to calculate accelerations, velocities, and displacements of each segment of the line; line segments are connected with spring and damping elements to aid in the simulation.

Worner 213 Room

Impact

Muqtada Al-Sadr and the Shia Movement in Post-Invasion Iraq
Emily K. Cronin and Robert Lee
Colorado College

In the aftermath of the US invasion in Iraq in 2003, Muqtada al-Sadr emerged as a major leader in the Shia movement. His movement spawned the Mahdi Army that became notorious for its violent clashes with Coalition forces and the spread of sectarian violence and fear among the Iraqi people. Throughout the past nine years, Sadr has employed varying tactics of contention from peaceful protests to military action to political involvement. This study examines the origins of his movement beginning in 1957 until 2003 with particular focus on Baqir al-Sadr, Sadiq al-Sadr, and events such as the Iran-Iraq war, the 1991 Shia uprising, and the UN sanctions of the 1990s. Using social movement theory, the paper outlines the effects of the decades before the invasion on Muqtada’s rise to power. It concludes with a discussion of the detrimental impact that his influence will have over the future of Shia and democracy in Iraq.

Video Stories: Unheard Voices of the Unemployed
Ivy Tyson, Christopher Hollander, John Palka and Lindsay Raymon
University of Colorado Colorado Springs

Structural unemployment is an immediate issue in America (and indeed the world) today. People of all ages, ethnicities and education levels are being impacted by the constricting job market. This is an increasingly pressing issue for Americans everywhere, but the realities and complexities of this widespread long-term unemployment is just starting to be addressed in the world of scholarship. The research undertaken by this group is on the cutting edge of understanding and confronting long-term, structural
unemployment and its impacts on unemployed individuals, the unemployed community, and America as a whole. Ethnography (socially applied anthropology) is the perfect field from which to begin this discussion on an academic level.

~

Spanish Civil War
Rosanna Caon
University of Colorado Colorado Springs

On July 18, 1936 the military’s most conservative Spanish Army took up arms against the Republic. This act marked the end of the democratic experiment carried out in Spain since April 1931. The fall of the dictatorship of General Miguel Primo de Rivera and the discrediting of the monarchy had made possible the proclamation of the Second Spanish Republic was intended as a panacea to the country out of its historicalbackwardness. However, the years from 1931 to 1936 became a true reflection of the contradictions of Spanish society. On one hand, many called for a profound social and economic change that definitive end to the oligarchic power in Spain. On the other, that same power, supported by the Army and the Church, fighting to defend their privileged position. The elections of February 1936 only served to further divide the Spanish and after the triumph of the oligarchy and the Popular Front had only faith inaction saving the army to free the Spain of anarchy and revolution. It gave way and the Spanish Civil War.

~

The Psychological Impact of the Fall of Vicksburg
Sam Ward
United States Air Force Academy

The paper I would like to present will analyze the significance of the fall of Vicksburg. The paper addresses the strategic location of the fortifications, the campaigns through the South that resulted from this Union victory, and the psychological impact for both sides. The strategic location segment will focus primarily on the commerce and regional control the fort protected. The paper will address how the fall of Vicksburg enabled Grant and Sherman subsequently to launch campaigns that brought the Confederacy to its knees. The psychological impact on both the armies and local population will also be analyzed.
New Stereotyping of the Humanized Female Role in Film
Vanessa Los
University of Colorado Colorado Springs

I will examine the state of the false ‘power’ assigned to women in three films directed by men since the turn of the century, in representations of mainstream entertainment, independent production, and low-budget exploitation film. My study will underscore the new stereotyping of the supposedly humanized female role to satisfy structures that relate to social and political instability in the U.S. The three films, in order are The Dark Knight, Black Swan, and The Core. Each of the individual films contributes their own versions of gender stereotyping.

Creation of an Electronic Database of Local Colorado Springs Artist Larry Heller’s Lifetime of Work
Nicole Dennis, Colette Richards, Elizabeth Turner and Perrin Cunningham
University of Colorado Colorado Springs

Larry and Dorothy Heller were well known and loved throughout the Colorado Springs Community from the 1930s through the 1980s. Larry was recognized and admired as a talented and prolific artist who produced work as a painter, sculptor, wartime and commercial illustrator, theatrical set designer, ceramicist, and photographer. His work has been compared to Norman Rockwell and Maxfield Parrish. Through extensive, ongoing research, it became evident that a wealth of historically relevant artifacts and documents relating to the Hellers and their life in Colorado Springs existed in archival collections throughout the Front Range Community. UCCS alone has a collection of over one thousand pieces of Larry Heller’s art that include sculptures, paintings, and sketches. Our team of interns has located and catalogued the Heller artifacts and documents into a centralized database that will be useful to future research of the Hellers and Colorado Springs history, as well as for the creation of future exhibits of Mr. Heller’s work. As interesting veins of Mr. Heller’s work are rediscovered and organized, exhibits are planned to reintroduce his work to the Colorado Springs Community. Our team of interns recently created and held an exhibit featuring Larry Heller’s WWII work in the area of propaganda art in January, 2012 at the Heller Center for Arts & Humanities.
In September 1863, as the American Civil War continued to rage, Union General William Rosecrans’ Army of the Cumberland struggled in the Western Theater against Confederate General Braxton Bragg’s Army of Tennessee. After a series of successes, Rosecrans had out-maneuvered Bragg into Georgia. Bragg, however, was reinforced by General James Longstreet and he decided to counterattack at Chickamauga on 19 September 1863. The battle lasted for two days, and on the second day Longstreet exploited a tactical error by Rosecrans and broke through the Union lines, scattering the Army of the Cumberland. This bloody and significant battle halted the Union advance into Georgia and tipped the balance of the Western Theater in the favor of the Confederacy.
Poster Session II  
(2:00-3:30 pm)

Cornerstone Atrium

Poster 1

Pikes Peak Math Teachers’ Circle Causes Surge in Mathematics Teachers’ Self-Efficacy
Audrey K. Szarka, Peter D. Marle, Lisa L. Decker, David H. Khaliqi and Dr. Gene A. Abrams
University of Colorado Colorado Springs

Research shows students’ performance in the United States in STEM (science, technology, engineering and mathematics) subjects has been declining. In an effort to boost students’ interest in mathematics, the University of Colorado Colorado Springs’ Center for STEM Education (CSTEME) Partnership in Innovative Preparation for Educators and Students (PIPES) program has offered professional development workshops such as the Pikes Peak Math Teachers’ Circle (PPMTC) aimed at increasing teachers’ self-efficacy in inquiry-based teaching, which has been linked to increased student performance and interest in STEM. PPMTC organizers train mathematics teachers throughout an academic school year to design inquiry-based lesson plans for classroom implementation. Sixteen teachers (13 female) completed the PPMTC academy. Repeated measures analysis of self-reported scores measuring Personal Mathematics, Teaching Efficacy, Pedagogical Preparedness, Guidance Preparedness, Investigative Culture and Investigative Practices constructs significantly increased over pre-survey scores, suggesting that teachers had increased confidence in implementing reform-based practices following PPMTC.

Poster 2

Bridging Theory and Evidence to Illuminate Future Directions of Mindfulness-Based Cognitive Therapy
Amrit T. Calhoun and Dr. Tricia Waters
Colorado College

Major Depressive Disorder (MDD) can be a chronic remitting and relapsing illness. Treatment strategies need to consider the durability of treatment responsiveness and the cognitive vulnerability for depression. This review focuses on Mindfulness-Based Cognitive Therapy (MBCT), which is a maintenance therapy that specifically targets depression relapse, and its evolution from Cognitive Therapy (CT) and mindfulness interventions. Theory and empirical support for CT and MBCT in connection with psychological constructs

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that predispose an individual to depression relapse illustrate how each is able to accomplish similar prophylactic effects with different mechanisms of change. Possible mechanisms of change for MBCT include facilitation of emotion regulation through decreased rumination and cognitive reactivity, and increased mindfulness. Future research requires use of a “dismantling” design to identify individual components of MBCT that are mediators of depression relapse prevention.

**Poster 3**

PERFLUOROPOLYETHER SEGMENTED POLY(URETHANE)S
Ryan C. Fantasia, Dr. Scott T. Iacono, Dr. Sharon C. Kettwich
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Fluoropolymers have long been known to act as chemically resistant polymer systems capable of increased weather resistance as coatings in aviation, automotives, and military hardware. Recent preparation of aluminum perfluoropolyether (PFPE) blends have served as the stepping stone to desired physical and thermal properties for reactive binders for munitions. In this work, PFPE segmented poly(urethane) copolymers with varying loadings of nanometer- and micrometer-sized aluminum powder were prepared to tailor the thermal response of the metal-induced degradation event. Characterization including TGA, DSC, and ATR−IR will also be presented in order to support these observations.

**Poster 4**

Effects of Personal Safety Programs on Preventing Subsequent Childhood Sexual Abuse: Replicating Gibson & Leitenberg (2000)
AnneMarie Saxon
University of Colorado Colorado Springs

**Objective:** To replicate previous research showing that (at least for women) school-based prevention programs are associated with a decreased occurrence of childhood sexual abuse. We sought to determine whether prevention programs have a similar effect on men.

**Method:** Four hundred and thirty men and women completed a “sexual experiences” questionnaire for extra credit or a cash reward. Respondents were asked detailed questions regarding their histories of childhood sexual abuse and participation in a school-based prevention program during childhood.

**Results:** A chi square analysis indicated that there were no differences found between participation in a prevention program and reported childhood sexual abuse, contrary to Gibson and Leitenberg’s (2000) findings.

**Discussion:** Findings from this study express the need for further research on the benefits of prevention programs.
Poster 5

Creating Melanin, Melatonin, and Monoamine Neurotransmitters: The Evolution of Enzymes in the Tyrosine and Tryptophan Metabolic Pathways
Katrina M. Kutchko
Colorado College

Although plants, fungi, and bacteria can create tyrosine and tryptophan de novo, these pathways have been lost in most metazoa, which must obtain these amino acids from food. Humans metabolize tyrosine into several biomolecules including melanin, dopamine, norepinephrine, and epinephrine. Tryptophan, on the other hand, is metabolized into other products that include serotonin and melatonin. This study investigated seven enzymes in these two metabolic pathways. The amino acid sequence of each enzyme in these pathways in humans was compared to other eukaryotes to find similar proteins in several organisms. These identified proteins were used to build phylogenetic trees for each enzyme, and the evolutionary pattern of each protein was analyzed. Overall, the further down the metabolic pathway an enzyme is, the more specific its phyletic distribution. The enzymes analyzed were all specific to either chordates or vertebrates. This investigation provides insight into cladistic differences in tyrosine and tryptophan metabolism. The results present a foundation for examining neurotransmitter systems throughout metazoa as well as exploring connections between diseases involving these pathways.

Poster 6

Daily and Seasonal Movement Patterns of Mule Deer (Odocoileus Hemionus) on the U.S. Air Force Academy
Kevin W. Weaver, David L. Riegelman, Justin J. Sleeter, Ryan D. James, Dr. Edward T. Unangst and Dr. Steve J. Gordon
United States Air Force Academy

In 1990, the Colorado Division of Wildlife and USAFA Natural Resources began a lethal management program to reduce the resident deer population to address ecological and deer-to-vehicle collision fatalities concerns on the 1800-acre USAFA reservation. A 70% reduction was achieved with deer numbers reduced for approximately 1000 in CY 1990 to 250-300 currently. A subsequent reduction in deer-to-vehicle collision fatalities also occurred ranging from a high of 118 in CY 1990 to a yearly average of 20 from CY 2000 to present. To date, no evaluation of “potential risk” of deer relative to vehicular roadways has been accomplished. Thus, in this one-year study, we monitored movement patterns of 14 radio-collared mule deer does to evaluate deer location in proximity to roadways. We quantified the number of times that a deer location identified using remotely-received GPS locations was within 10 meters of the roadway centerline on USAFA. This information allowed us to quantify potential risk to vehicular collisions based on deer locations near roads.
**Poster 7**

**The Quantitation of a Panel of Neurotransmitters through Microchip Electrophoresis**
Kathryn A. Prescott, Sarah A. Gehrke, Elle Clarke, Randy J. Robinson, Pengxin Liu and Dr. David J. Weiss
University of Colorado Colorado Springs

Neurological disorders, such as schizophrenia and Parkinson’s, as well as cerebrovascular disorders, such as stroke and cerebral edema, are believed to have causes related to the concentration of neurotransmitters in the blood resulting from an impairment of neurologic auto-regulatory response. Unfortunately, the techniques commonly used in researching cerebral auto-regulation are slow and expensive. A simple, fast, inexpensive method of analysis of neurotransmitters in physiological solutions is necessary. Microchip Electrophoresis offers fast analysis, low cost, disposability and portability. As of yet, quantitation of a panel of neurotransmitters, tested simultaneously, in physiological solutions has not been achieved through this method, due to the low concentrations of neurotransmitters in serum. We will present our approach to overcoming this problem. Limits of detection will be improved by adding a Pd decoupler in order to isolate the detection electrode from the high voltage power source, and by sample stacking with the addition of acetonitrile. The method we develop will also include sample preparation through solid phase extraction.

**Poster 8**

**Learn to Swim: A Comprehensive Drowning Prevention Program**
Malia Vitousek
Colorado College

Drowning is the second leading cause of accidental death worldwide (Knepel & Aemisegger, 2011). Children, males, people of low-socioeconomic and low levels of education are the most likely to drown (Lawrence, 2010; Nasrullah & Muazzam, 2010; WHO, 2010). African American children (ages 5-14) are 3.1 times more likely to drown than Caucasian children (CDC, 2011). This is one of the most dangerous and deadly achievement gaps in the world. Luckily, through increased awareness and effective water safety and swim instruction, we can close this gap and save lives. I have created a swimming education and water safety program targeting children who would not otherwise have the opportunity to learn how to swim. I have outlined strategies for fundraising, training instructors, recruiting participants, involving parents and providing multifaceted swimming lessons along with imparting knowledge on when, where and how to swim safely and avoid incidents in the water. My goal was to devise a program that could be recreated and enacted anywhere in the country to prevent drowning accidents and save lives. Through this program, children would receive free of cost swimming education and a chance to learn a new, valuable and enjoyable skill that can open up many opportunities in life as well as potentially save lives.
**Poster 9**

**Retroactive Study on Gunshot Residue Evidence Used in Investigative and Criminal Proceedings**

Anthony Robinson, David Shadoin, Dr. Candice Bridge and Dr. Michael Salyards  
United States Air Force Academy USAFA

The use of gunshot residue (GSR) evidence in the American legal system is controversial. After being collected by investigators and processed by criminal investigations laboratories, lawyers may attempt to use GSR evidence in a courtroom to prove who shot the gun. Research conducted during the summer of 2011 at the United States Army Criminal Investigation Lab (USACIL) consisted of collecting data on investigators and lawyers who had used GSR evidence. Research focused on how useful GSR evidence was to these users, with the goal of determining whether the GSR collection process is a misuse of law enforcement’s time and resources or whether further research should be conducted to make GSR more probative for investigations and in court.

**Poster 10**

**Determination of Carbamazepine, 17α-Ethynyl estradiol, and Diclofenac Bioaccumulation in Plants Using High Performance Liquid Chromatography with UV-Vis Detection**

Cynthia Ortega and Janel Owens  
University of Colorado Colorado Springs

The presence of pharmaceuticals in edible plants is a growing concern since the effects of consuming these contaminated plants are unknown. Thus, a method for determining the amounts of bioaccumulation of carbamazepine, 17α-ethynyl estradiol, and diclofenac in plants with high percent recovery was tested. Dispersive liquid liquid micro extraction (DLLME), which is known to be environmentally and experimentally effective, was utilized to extract the pharmaceutical components from a 50.0 μg/mL mixture of the three pharmaceuticals for analysis. Various parameters were tested on extraction efficiency, including pH, salt levels, and use of different solvents before analysis by high performance liquid chromatography (HPLC) with UV-Vis detection. The percent recoveries ranged from 12.9%-20.80% for carbamazepine and 1.71%-2.06% for diclofenac. The highest average percent recovery for all three pharmaceuticals was found at a pH of 4 with a range 2.76%-2.84% recovery. The results for the varying salt levels of carbamazepine were found to have highest percent recovery with 0.0050 g of NaCl, with an average percent recovery of 14.17%. The examination of effects on efficiency using various dispersive solvents was not very significant. Methanol was found to work well for all three pharmaceuticals in general compared to the other solvents with the following percent recoveries: 3.164% for carbamazepine, 3.046% for diclofenac, and 0.5926% for 17α-ethynyl estradiol.
**Poster 11**

Predictors of Appearance Contingent Self-Worth  
Shiho C. Ushijima and Dr. Emily Chan  
Colorado College

Researchers have found that basing one’s self-worth on physical appearance can lead to a variety of negative outcomes including depression and eating disorders. While numerous studies have investigated the consequences of appearance contingent self-worth, few studies have examined its predictors. In this study, we examine whether attachment anxiety, investment in gender ideals, appearance focused media exposure, and age predict appearance contingent self-worth in women. Results indicate that a regression model with these predictors was a good fit. Furthermore, investment in gender ideals and attachment anxiety were the best predictors of appearance contingent self-worth. In light of these findings, our study ends with a discussion of potential ways to decrease appearance contingent self-worth in women.

**Poster 12**

Removal and Recovery Studies of Hydrogen Sulfide and Alkylthiols from Raw Natural Gas using Organometallic Complexes  
Venessa Grove, Aaron Hendrix, Bethany Neighbors  
University of Colorado Colorado Springs

A common method of H$_2$S and alkylthiol removal from raw natural gas is by the amine process. These processes require large volumes of volatile amines, elevated pressures and temperatures. An organometallic complex would replace the need to use large volumes of amines, elevated pressure and temperatures currently used to remove acid gas contaminants. The primary research goals seek to 1) remove H$_2$S and alkylthiols, HSR, from natural gas sources and 2) recover these S containing compounds from the organometallic complex. The ligand of interest is N, N’, N”, N’’ 1,4,8,11 tetrakis (N-isopropyl acetamide) tetraazacyclotetradecane (TIAC). When the TIAC ligand is bound to a transition metal (M), the N atom can be protonated to form TIACH, allowing this system to form M-S bonds through hydrogen bonding stabilization. Recovery of the bound sulfur compounds involves de-protonation of the TIACH ligand, thus removing the stabilization effects of the hydrogen bonding. Preliminary synthetic results will be presented.

**Poster 13**

Comparative Neuromorphology of Florida Manatee, Giraffe, Human, and African Elephant Cerebellar Cortex  
Devin M. Wahl and Dr. Bob Jacobs  
Colorado College

Although the cerebellum has been widely studied, particularly with regards to its gross anatomy, neuron types, and their connections, little is known about quantitative and qualitative neuronal variation across
species. To this end, the current study provides the first documentation of cerebellar neuronal morphology across four species: (1) Florida manatee (*Trichechus manatus latirostris*), (2) giraffe (*Giraffa camelopardalis*), (3) human, and (4) African elephant (*Loxodonta africana*). Cerebellar tissue was stained with a modified Golgi technique. Granule, Golgi, Lugaro, stellate, and basket neurons, in addition to several cerebellar astrocytes, were quantified on a Neurolucida computer-assisted microscopy system (MBF Bioscience). Qualitatively, there were no distinct morphological differences in neurons across species. Quantitatively, dendritic complexity generally increased in the following manner: manatee < giraffe < human < elephant. Within the cerebellum, it has been suggested that the complexity of neurons may correlate with the total number of movements an animal is able to perform. Accordingly, the current results support the notion that the heightened complexity of elephant cerebellar neurons may, in part, suggest that the elephant is able to perform a higher number of complex movements than the human, giraffe, or manatee.

**Poster 14**

Investigation of Transit Timing Variations of WASP-12b
Samantha E. Latch, Gordon M. Spahr, and Devin J. Della-Rose
United States Air Force Academy

Previous research at the USAFA Observatory has demonstrated the ability to collect high-precision measurements of exoplanet transit light curves. The current work leverages this capability to make further observations of transit timing variations of the exoplanet Wasp-12b to help determine whether previously observed changes are due to the presence of an unknown body in the Wasp-12 system, or accretion of planetary matter by the parent star, or both.

**Poster 15**

A Cross-Sectional Study on the Development of Sharing Behavior: an Evolutionary Perspective
Eleanor S. Olson and Dr. John Horner
Colorado College

Infants have empirically shown innate preference for altruistic behavior. Environmental factors such as increased social exposure can influence the degree and direction of altruism with maturation. Kin selection predicts that the relationship between the giver and receiver, of a sharing act, greatly impacts altruistic behavior. This study tests the affect of genetic relatedness on sharing behavior in a cross-sectional study. Sixty-three participants aged 36 – 66 months and 66 – 89 months were included. Participants were asked to divide Monopoly dollars between themselves and three recipients - a sibling, a friend and a stranger - each represented by dolls. The results showed that sharing was significantly impacted by relatedness. Participants shared significantly more with kin than strangers, and unexpectedly shared as equally with friends as they did with siblings, and sharing behavior did not change across cohorts. A number of alternative hypotheses are discussed that could explain the non-kin based sharing behaviors.
**Poster 16**

Thermodynamic Examination of Small Symmetric and Asymmetric Loops Containing A•C and G•U Base Pairs in the Context of Group I Intron  
Evgenia Shishkova and Neena Grover  
Colorado College

Group I introns are large ribozymes capable of performing transesterification reactions to splice themselves out of an rRNA. Proper 3D assembly of the intron is crucial for its activation and formation of a correctly spliced product. Divalent metal ions, Mg2+ in particular, facilitate folding of the intron and are necessary for catalysis. Studies of RNA crystal structures report presence of metal ions in vicinity of highly conserved loops and bulges, suggesting that these regions play key role in functioning of the intron. We are examining the thermodynamic stability and metal ion binding properties of non-canonical base pairs in the context of group I intron of *Tetrahymena thermophile* using small RNA as model constructs. An asymmetric adenine-rich tetranucleotide, a 4x1 A•C loop construct, and a symmetric 4x4 A•C loop construct were equally stable in 1 M KCl at various pHs. The 4x4 A•C loop gained more stability upon addition of Mg2+, as compared to 4x0 and 4x1 constructs. Protonation of A and consequent formation of A+•C base pair is expected at pH 5.5, and corresponding increase of 0.8 kcal/mol in stability of the 4x4 A•C construct was observed at pH 5.5 over pH 7. In 1M KCl at pH 5.5 and pH 7, a symmetric 4x4 G•U construct was 3 kcal/mol more stable than an asymmetric 4x2 G•U construct. The G•U containing RNA gained no additional stability in 9.5 mM Mg2+. This work was funded by NSF Grant MCB-0950582 to NG.

**Poster 17**

Chocolate as Science: Producing Equitability Utilizing a Scenario-Based Stem Camp for Middle and High School Students  
Jonathan G. Pugh, Peter D. Marle, Lisa L. Decker and Dave H. Khaliqi  
University of Colorado Colorado Springs

One recent National Science Board (NSB) stipulation is that science, technology, engineering, and mathematics (STEM) programs should facilitate equitable outcomes. The Center for STEM Education is taking steps to improve STEM education by providing opportunities for underrepresented middle and high school students to attend STEM camps. The current study is an examination of a scenario-based camp, Jumpstart STEM: Chocolate Science Investigation (JSCSI). JSCSI lasted 4 days and included 9 workshops related to a variety of STEM fields such as Crime Scene Investigation, DNA Fingerprinting, and Cyber Security. Thirty-two students (19 males, 13 females) completed the post-event survey, which included self-reported items measuring perceived changes in science interest and interest in STEM careers. Data suggested that all students reported similar increases in STEM attitudes resultant of their participation in JSCSI, suggesting that JSCSI provided the improvement opportunities recommended by the NSB to work towards equitable outcomes from participation in STEM camps.
**Poster 18**

*Synthesis of Polyfunctional Ligand for use in Metal Ion Extraction*
Joann Mueller, Dr. Allen Schoffstall and Dr. Renee Henry
University of Colorado Colorado Springs

The goal of this project is the synthesis of an organic polyfunctional ligand as an agent for the extraction of heavy metals from contaminated waters. The target molecule is a highly substituted triazole. Synthesis of this compound is being carried out using Copper(I) catalysis. Once the molecule is synthesized it will be hydrolyzed to yield a tetrasubstituted carboxylic acid to be used for metal ion extraction.

**Poster 19**

*Effects of Processing Fluency on Readers’ Judgments*
Margaret Schott
Colorado College

Research suggests that participants rate authors of a text as more intelligent when that text is easy to read (fluent), regardless of writing genre (Oppenheimer, 2006). However, other research has demonstrated that participants’ expectations of fluency vary depending on genre (Galak & Nelson, 2011). When the fluency of a text matches expectations for a genre, participants rate it as higher quality writing. The present study examines how meeting or violating text fluency expectations influences participants’ judgments of writing quality as opposed to the judgments about the author. Participants read four passages presented as either fiction or informative writing in either fluent or disfluent font, and rated the writing quality or the author along several dimensions. Results revealed that participants judged writing quality as more interesting, likable, and intelligent when given a fluent font, and rated authors as more interesting and likable when their fluency expectations were not met.

**Poster 20**

*Characterization of Precipitation in 7XXX Aerospace Aluminum Alloys and Friction Stir Welds Using Differential Scanning Calorimetry*
Michelle H. Kiyota, Catherine M. Kiyota and Ralph W. Bush
United States Air Force Academy

Precipitate strengthening plays a major role in the strength and hardness of aluminum alloys. A technique to quantifiably measure the amount of precipitate in an alloy would be useful as it directly relates to the alloy’s mechanical properties such as strength and hardness. Differential scanning calorimetry (DSC) is an extensively used technique for qualitative precipitation analysis. If DSC Analysis could be shown to provide quantitative data on the amount (volume fraction) of precipitate present in an alloy, this could provide a quick and inexpensive technique to analyze and characterize different alloys. Currently, no direct proof of the proportionality of heat effect with volume fraction has been provided. One aim of this study is to determine if reproducible DSC data can be obtained and used for quantitative analysis of the precipitates...
in aluminum alloys (7050, 7075, 7055). This research attempts to develop a protocol to use DSC as well as previously published references to determine qualitatively what kinds of microstructures are present and quantitatively analyze how much of a particular microstructure is present. The second aim is to use the information gained from this DSC study described above to investigate the precipitate microstructures in samples taken at intervals across a friction stir weld (FSW). Due to the uneven temperature distribution caused by the FSW it is predicted that the precipitate microstructure of the material differs across the weld and affects the strength and hardness of the areas affected by the weld. DSC analysis will allow a comparative analysis of amounts of precipitates along the weld which will be used to determine if there is a correlation between the measured hardness and the amount of precipitates present. This may also provide information about the significance of precipitate strengthening in the weld or whether other factors, such as grain boundary size and formation also play a key role in determining the weld's mechanical characteristics.

Poster 21

Study of Ionic Liquids in Forensics
Michelle Kiyota, Cynthia A. Corley, and Dr. John S. Wilkes
United States Air Force Academy

A major challenge of forensics is the collection and preservation of evidence for further analysis. A proposed solution of this problem is to absorb analytes of interest into swabs impregnated by an ionic liquid (IL) solvent. In this study, the application of ionic liquid impregnated swabs to collect, store and extract TNT, followed by high pressure liquid chromatography with UV detection coupled to an Electrospray Ionization-Time-of-Flight mass spectrometry (HPLC-UV/ESI-TOF) was investigated. Research had already been conducted to determine the suitable IL and swab combination which would be suitable for the collection of TNT and this study focused on determining which HPLC solvent and swab combination was suitable for extraction of the TNT and subsequent analysis. It was found that the rayon swabs were unstable and dissolved in multiple common HPLC solvents while the polyester swabs remained stable in all of the solvents. After this determination, an analysis of the ability of the solvents to extract TNT from IL impregnated polyester swabs was performed. In addition, a study of the ability of the IL impregnated polyester swab was conducted to determine the ability of the swab to store the TNT for later analysis for extended periods of time.

Poster 22

A Model Catecholate Siderophore with Fe³⁺: A Bioinorganic Chemistry Experiment
Stacey Moslet, Dylan Shuster and Dr. Renee M. Henry
University of Colorado Colorado Springs

At the University of Colorado at Colorado Springs a course on Bioinorganic chemistry is offered; however, a laboratory course is not currently offered in conjunction. Although there are several inorganic laboratory textbooks as well as literature articles that do offer bioinorganic laboratories, a laboratory experiment suitable to all areas taught in this course are not presently available. The topic of iron transport by catecholate siderophores is one area of study within the course that would benefit by the use of a matching
experiment. The multi-period laboratory experiment presented here uses a model catecholate siderophore and includes an introduction to siderophores, synthetic preparation and characterization techniques.

Poster 23

Does School Choice Lead to Educational Equality? A Study of the Colorado Springs District 11’s Open Enrollment System
Kaila A. Ryan
Colorado College

The purpose of this research is to determine the effect of open enrollment programs on socioeconomic and academic stratification within Colorado Springs School District 11, and to further analyze the effect of mobility on students’ academic achievement within these programs. Over the past fifteen years, both inter- and intra-district open enrollment have become increasingly popular in Colorado, and specifically within District 11. Proponents of school choice believe open enrollment programs lead to equity in the educational system by providing lower income students with the opportunity to attend a public school in a richer neighborhood; yet within District 11, open enrollment policies exemplify the existing socioeconomic stratification. This study reveals that more students in neighborhood schools participated in the free and reduced lunch program than in choice schools, and that the percentage of students using this service increased faster at neighborhood schools than choice schools. Moreover, competitive economic pressures do not force all schools to improve at equal rates in academic quality. Fifth grade students at choice schools consistently outperformed their neighborhood school counterparts on the mathematics portion of the Colorado School Assessment Program, and, yet, the test scores at choice schools improved more rapidly than at neighborhood schools. In conclusion, transferring schools does not produce positive results. Students who are mobile perform significantly worse on district assessments than their non-mobile peers in the first year after their move, even after controlling for both socio-economic factors and academic factors (disabilities and giftedness). Most importantly, students who remain in their neighborhood schools perform at similar levels to their peers who transfer to choice schools.

Poster 24

Synthesis and Optimization of Fluorinated Epoxy Resins
Bradley S. Kusel, Dr. Scott T. Iacono, and Dr. Sharon C. Kettwich
United States Air Force Academy

Epoxy resins possess robust mechanical properties and are desirable for preparing composites for high performance applications. Little work has been done on fluorinated epoxy resins as potential for enhancing properties for automotive, aerospace, biomedical and military technologies. In this work, fluorinated epoxy formulations made with perfluoropolyethers (PFPE) were investigated. The chemistry, characterization and properties involved in the synthesis, modification and classification of these fluorinated epoxy resins will be presented.
Brain Responses to Female Photographs as a Function of Confidence
Laura Morgan
University of Colorado Colorado Springs

The reasons why people are attracted to a specific other is a mystery that has not yet been fully examined. From early research, it is clear that physical appearance is an important factor in determining human attraction (Walster, Aronson, Darcy, & Rottmann, 1966). Even though much research has been done assessing various components of physical attraction (Thornhill & Grammer, 1999), few of these studies examine the biological responses associated with looking at another person and evaluating their initial physical attractiveness. I plan to investigate the influence of male confidence on perceived female attractiveness by manipulating the confidence a male perceives when asked to evaluate female facial attractiveness. An EEG machine with a 74-electrode cap that will collect electrical brain activity over the entire head. Participants will be subjected to an oddball paradigm using black and white photographs of female faces. To manipulate confidence, participants will be told they were rated on a 1-8 scale of attractiveness by the females they will view. Participants will be told they were rated as either 3/8 (low) or as 7/8 (high) on the scale by the females. Participants will rate the pictures as attractive or not by clicking yes or no on a mouse as their brain activity is recorded. Analysis is still in progress and the results will be presented at the forum.

The Power of Yucky: Can Disgust Embodiment be Desensitized?
Kathryn Post and Tomi-Ann Roberts
Colorado College

Disgust embodiment often has cognitive results that manifest as negative associations which can have significant social consequences. Disgust primes have corresponded with increased judgment severity and negative evaluations of others. This phenomenon is salient in moral judgment situations which are strongly influenced by affective input—particularly disgust. The present study sought to decouple disgust embodiment reactions via desensitization to a disgust stimulus. Participants desensitized to disgust were expected to rate moral vignettes less harshly than those in the control and disgust induction groups. Results demonstrated the opposite of what was expected: increased disgust exposure corresponded with harsher moral judgments. There were significant gender effects; females evaluated vignettes more severely than males but showed little difference in judgments between experimental groups. Males showed a positive correlation between amount of disgust exposure and perceptions of immorality. These findings illuminated differences in the influence of affective information between genders and emphasized the foundational relationship between disgust and morality.
**Poster 27**

Demonstration of Meteorological Instruments on Remotely Piloted Aircraft
Joseph S. Kohan, Lt Col Christian S. Wohlwend and Lt Col Victor B. Putz
United States Air Force Academy

The ultimate goal of this research project is to place a meteorological sensor package on a Remotely Piloted Aircraft (RPA) in operation at the United States Air Force Academy. They will be used to accurately collect data to assimilate into a mesoscale numerical weather model in complex terrain. The benefit of using an RPA platform is that no upper air data is currently collected on a routine basis over the Academy, but these aircraft have routine flights where data can be collected up to the flight level. In this research project, the team will develop a weather sensor package capable of installation on a RPA. The process of creating the instrument package will include electronics selection, assembly, programming, and testing. The sensors selected for use will be integrated into an Arduino Uno backbone with a data logging capability. The most crucial atmospheric variables are temperature, pressure, moisture content (relative humidity or dew point temperature), and geolocation of the system. Future research will attempt to collect wind speed and direction data through aircraft control inputs. The quality of the data is crucial to the output of the weather model. To ensure accuracy and precision, the sensor suites will be ground tested for each variable. To confirm the collected data corresponds to current data sources, radiosonde launches will be coordinated with the flights of the RPAs.

**Poster 28**

Expression and Characterization of GST-HK1 Fusion Protein
Jimi Miller, Dr. Sonja Braun-Sand and Wendy Haggren
University of Colorado Colorado Springs

Hexokinase Type I, HK1, is the main hexose kinase when grown on carbon sources other than glucose and is required for glucose-dependent catabolic repression of other genes. Using the yeast strain *Saccharomyces cerevisiae*, an expression plasmid encoding the fusion protein of GST to HK1 was transfected and overexpressed by inducing the Gal 1-10 promoter with galactose. A Western blot, using an antibody to GST, identified the protein of the predicted molecular size of the GST-HK1 fusion protein. The fusion protein was cleaved using thrombin and Western blot analysis determined the GST tag was cleaved using an antibody to HK1. The activity of the enzyme was measured to determine $K_m$ and $K_i$ values for a variety of substrates and inhibitors using UV-visible assays.


**Poster 29**

**Community Perceptions of Post-Traumatic Stress Disorder in Northern Uganda**
Charlotte C. Pfeffer and Kristi Erdal
Colorado College

In the aftermath of the recent war in northern Uganda, former soldiers from the Lord’s Resistance Army (LRA) faced many challenges reintegrating into their former communities. Former LRA soldiers often returned home with post-traumatic stress disorder (PTSD), which exacerbated the social stigma of being in the LRA. The present study examined community attitudes toward former LRA soldiers with post-traumatic stress disorder (PTSD) and compared them with attitudes toward victims with PTSD. It was hypothesized that there would be a greater negative bias towards former soldiers, due to their involvement with the LRA, particularly among lay participants who lacked education and information regarding the prognoses and treatment of the mentally ill. These attitudes could prevent successful reintegration of former LRA soldiers and pose a potential threat to peace and stability in northern Uganda. There was no significant difference in participants’ attitudes towards LRA soldiers and victims. Lay participants were less stigmatizing than medical and mental health professionals. These findings suggest that the bio-medical explanation of mental illness, utilized by medical and mental health professionals in Uganda, may have adverse effects on attitudes towards the mentally ill.

**Poster 30**

**Development of the Chamber for Atmospheric and Orbital Space Simulation (ChAOSS)**
Carlos Maldonado
University of Colorado at Colorado Springs

The Chamber for Atmospheric and Orbital Space Simulation (ChAOSS) is being developed at the University of Colorado Colorado Springs to simulate multiple conditions of the orbital environment. The key function of the facility is to study the combined effects of environmental elements absent in single element facilities. The ChAOSS facility will simulate ultra-high vacuum, charged particle interactions, extreme ultraviolet radiation, visible solar flux, and thermal cycling. The 2 m long x 1 m diameter vacuum environment is created using a clean pumping system composed of a CTI-20HP cryogenic pump and oil free turbo-molecular pumps, with a total specified pumping capacity of 13,000 l/s. The facility includes a transverse magnetic filter ion source developed at Colorado State University, capable of producing energetic ions of 5 eV with a low electron temperature of 0.2 eV. In addition to the ion source, two electron sources are also available, one consisting of a low energy flood gun and the other a high energy gun capable of producing electrons with energies ranging from 5 eV to 30 keV. The facility includes a deuterium lamp for the production of high VUV down to 115 nm radiation and a 300 W solar simulator to produce up to 200 mW/cm² using an ozone free xenon lamp over a broad spectral range from 250-2500 nm. A liquid nitrogen shroud is used to further remove water molecules and contaminants and reduce the thermal environment to cryogenic temperatures. In addition to these capabilities, an atomic oxygen source is also under development.
**Poster 31**

The Neuropsychological and Cognitive Impacts of Deep Brain Stimulation in Treating Parkinson’s Disease  
Jeffrey L. Nadel and Dr. Kristi Erdal  
Colorado College

Parkinson’s disease (PD), an idiopathic neurodegenerative disorder, affects approximately 1% of the world’s population over the age of 50. It is characterized by bradykinesia, akinesia, rigidity, and resting hand tremors. Historically, treating PD has involved the administration of pharmacologic compounds. However, a recently developed neurosurgical technique known as Deep Brain Stimulation (DBS) has shown to be effective in reducing the motor pathologies of the disease. A growing body of literature suggests that DBS may result in neuropsychological complications, such as impairments in executive functions, memory, and global cognitive ability. This research examined those complications, the validity of their claims, and whether DBS should continue to be used widely for PD patients. Ultimately, amidst inconsistencies in the literature, DBS seems a highly successful technique in attenuating the cardinal symptoms of PD. Furthermore, there is little substantial evidence suggesting that DBS contributes to neuropsychological impairment beyond the typical progression of the disease.

**Poster 32**

How the Rough Rule: Analysis of Squatters’ Rights and Solutions for Slum Development and Improvement  
Dayna A.M. Grant, LTC Jason Bell and Capt Hanna Yang  
United States Air Force Academy

The purpose of this project is to provide the government of the city of Monrovia with a viable solution for Addressing the overwhelming slum capacities in and around the metropolis of Monrovia, Republic of Liberia resulting from recent civil wars. This particular project stems from a five-year project with the United States Military Academy. The findings and recommendations will be in the book, “Rule of Law’s Evolution in Liberia” slated for publication in 2015. All of the research for this project was Accomplished through case studies and interviews in Monrovia. Those interviewed included UN Employees, US embassy employees, various NGO employees, University of Liberia School of Law Professors, township and city employees, tribal leaders and members of the West Point Township, Lower Johnsonville, Robertsport, and Mamba Point communities. The recommendations from this research Include relocation of inhabitants of the overpopulated West Point Township into “complete communities".
**Poster 33**

“How Writing in Certain Points of View Affects Writing Skills”
Kayla Hughes
University of Colorado Colorado Springs

This is a study of how writing in certain points of view affects writing skills. The research design will revolve around one college level English class. The procedures that will be used are interviews. The population that will be studied is one college professor and a small group of her students. I will interview them and audio record their answers. I will later transcribe their answers. Once I have obtained all of the data, I will look for trends and similarities between the teacher's answers and students' answers. I will use their answers to determine which writing skills are affected throughout writing in different points of view. I will determine which skills are strengthened and which are weakened. Lastly, I will determine which points of view strengthen or weaken each skill. In my research project, I will present the grading rubrics for the assignments regarding each point of view. I will analyze all of the rubrics to determine the differences in writing skills affected.

**Poster 34**

Thermodynamic Investigation of the Dinucleotide Bulge of Domain V of Group II Intron
Siphelele Mhlanga and Neena Grover
Colorado College

Group II introns are self-splicing ribozymes, found in RNA of organelles in fungi, plants, and protists, as well as in bacterial mRNA. Group II introns are composed of six structural domains, which are designated domain I to domain VI. Domain V (DV) is a short stem loop that contains a dinucleotide AC bulge; it is implicated in the catalytic function of the intron, as it is expected to bind the catalytic Mg$^{2+}$ ion(s). A crystal structure of a group II intron from *Oceanobacillus iheyensis* shows inner sphere interactions between two Mg$^{2+}$ ions and the phosphate oxygens of the cytosine of the dinucleotide bulge. In this study, we are examining the role of the dinucleotide sequence on RNA stability along with quantifying the contribution of RNA-magnesium interactions. Various RNA and DNA constructs of the dinucleotide bulge were designed and thermal denaturation experiments were performed on the wild type and the modified constructs in 1 M KCl and in varying concentrations of Mg$^{2+}$ ions. Comparative thermodynamic data will be presented on various dinucleotide RNA and DNA constructs and their ion interactions. This work was funded by NSF Grant MCB-0950582 to NG.
**Poster 35**

Changes in Total Hemoglobin Mass and Running Economy During De-Acclimatization and Re-Acclimatization of Moderate Altitude Residents With Varying Years Spent at Altitude

Zachary M. Schneider, Elvira N. Chiccarelli, Lane C. Thaut, Jeffrey L. Nelson, and David A. Welge

United States Air Force Academy

Previous studies of moderate altitude (MA) residents have suggested that neocytolysis occurs upon return to sea level (SL). This purpose of this study was to examine changes in total hemoglobin mass (THM) and running economy (RE) of MA-acclimatized subjects upon return to MA following a 21 day SL break in reference to residence years at altitude. A longer residence time may give advantage to individuals during physical fitness testing and athletics. Fifty subjects, mean age 20.6 years, had their THM determined via the optimized CO re-breathing protocol and RE was quantified by assessing steady state volume of oxygen utilized during treadmill-based exercise at three separate velocities (5.0, 6.0, and 7.0 mph) before (Phase 1), immediately following (Phase 2), and six weeks after the SL sojourn (Phase 3). We hypothesize that activity during SL sojourn will protect against neocytolysis. Results might be affected by the testing window (14 days), exercise at SL, short trips to SL, or the number of subjects.

**Poster 36**

Spared and Impaired Aspects of Motivated Cognitive Control in Schizophrenia

Claire L. Mann and Dr. Lori L. Driscoll

Colorado College

The ability to upregulate cognitive control in motivationally salient situations was examined in individuals with schizophrenia (patients) and healthy controls. Forty-five patients and thirty-five healthy controls were recruited. A monetary response conflict task required participants to identify a picture, over which was printed a matching (congruent), neutral, or incongruent word. After a baseline section, an incentive section initially informed participants that they could win money. In addition, each incentive trial was immediately preceded by a monetary visual cue. Patients and controls responded robustly to monetary incentives with decreased reaction times (RTs) overall during the incentive trials. Controls’ RTs changed more dramatically to the general context of reward (demonstrated by a decrease in RTs between baseline and incentive sections), suggesting a reliance on efficient proactive control strategies. In contrast, patients’ RTs were more strongly affected by individual reward-cued trials, implying the use of “just-intime,” reactive control strategies. These findings may indicate a proactive control strategy deficit in schizophrenia.
**Poster 37**

Undergraduate Student Team Develops Undergraduate Fuel Cell Lab  
Philip Knodel, Joel Noble, Nathan Seibt, and Kevin A. Gibbons  
United States Air Force Academy

A senior-level mechanical engineering student team in an instrumentation and measurements course at USAFA was tasked to develop an engaging, relevant laboratory experience for other undergraduate students while meeting the learning objectives of their instrumentation course. The intention was to use this student-designed hydrogen fuel cell lab in a future offering of a newly implemented undergraduate renewable energy course. The development process, benefits, as well as difficulties encountered in this approach are discussed and recommendations provided.

**Poster 38**

Handedness as a product of cerebral lateralization: the evolutionary adaptations behind hand preference in gorillas, siamangs and ring-tailed lemurs in captive and wild populations  
Kyleen Breslin and Krista Fish  
Colorado College

In humans, a species-wide right hand bias is well documented but hand preference is not well understood in other primate species. Many studies have examined handedness within individual primates populations but few have compared the levels of handedness between species. This study explored whether there is a spectrum of handedness in primates. Similar to Peter MacNeilage’s (1987) “postural origins” theory, this study investigated the hypothesis that handedness developed alongside neurological capabilities. I hypothesize that the degree of right handedness will increase in species that rely heavily on kinship and communication for survival. For this reason, gorillas (Gorilla gorilla) and ring-tailed lemurs (Lemur catta) should show a higher degree of handedness than siamangs (Symphalangus syndactylus), whose brains are more specialized for locomotion. Data were collected on captive gorillas, siamangs, and ring-tailed lemurs over a 1 month period at the Cheyenne Mountain Zoo in Colorado Springs, Colorado. Wild ring-tail lemurs were observed over a period of 1.5 months at Beza Mahafaly Special Reserve in Madagascar. All of these populations were observed for hand preference using continuous focal sampling. Population-wide handedness trends were found. Gorillas demonstrated the most pronounced right handed bias using their right hand for 55.6% of hand usages. Siamangs did not show a handedness bias and used both of their hands for 38.6% of actions. The wild ring-tailed lemur population showed a left hand biases, using their left hand for 39.1% of actions. This study was funded by the Colorado College Venture Grand Fund as well as a contribution from the Colorado College Department of Anthropology’s Kathleen A. Jones Memorial Fund.
**Poster 39**

**Gender and Gender Stereotypy in Classroom Interactions**
Allison Lurie and Dr. Patricia L. Waters
Colorado College

The current study seeks to elucidate whether gendered speech is elicited by sex or gender stereotypy within the classroom. Prior research has demonstrated that gendered speech affects the way individuals communicate within all domains. Within a classroom, students are expected to perform and assertively demonstrate their knowledge; a performance upon which they are evaluated by peers and teachers. Embodied gendered speech may be indicative of the sex of a participant or the power dynamic in a given situation. Hour long classroom conversations in a First Year Experience class were video recorded and coded for specific gendered speech markers. Results showed that males tended to engage in more masculine forms of speech. Further, results demonstrated that gender stereotypy also affected gendered speech. Specifically, androgynous males tended to engage in more assertive speeches than feminine males, masculine females, feminine females, and androgynous females. The results of this study have limited generalizability, but suggest that expressed gender roles that are socialized into individuals are more salient than the physical sex of the individual.

**Poster 40**

**Effects of Exposure to DE-71 on Visual Discrimination Learning in Rats and the Attenuation Effects of Levothyroxine**
Megan Lieb and Dr. Lori Driscoll
Colorado College

Polybrominated diphenyl ethers (PBDE) are a class of ubiquitous flame-retardants that bioaccumulate in lipid tissues. Exposure to PBDEs can cause complications in neurobehavioral functions in both animal models and humans. One mechanism by which PBDE causes these disruptions is through its interference with the thyroid hormone system. In the present study, 50 male Long Evans rats were exposed to 30 or 60 mg/kg/day of DE-71 or vehicle from postnatal days 6-12. Half of exposed rats were also treated with levothyroxine (6μg/kg/day), with the intention of attenuating the adverse effects caused by DE-71. Beginning on postnatal day 30, subjects were tested on measures of associative learning using a 5-choice serial reaction chamber visual learning task. All subjects were tested on measures of associative learning using a 5-choice serial reaction chamber visual learning task. All dependent measures indicated that significant learning occurred across sessions but there was no effect of DE-71 or levothyroxine treatment. Further research is warranted, both on the effects of DE-71 on associative learning, and on the use of levothyroxine as a potential rescue treatment.

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**Poster 41**

Visualization of Uncertainty in Cyber Situational Awareness  
Austin Lan  
United States Air Force Academy

Cyber situational awareness involves being aware of the activity that is occurring in a network, understanding their meaning, and the ability to predict future events based on the comprehension of current patterns. Visualization takes advantage of the human visual system to allow the user to process and understand large quantities of data in a consolidated form. Network monitoring tools, such as NetGrok and tvn, apply visualization to increase the ability to analyze network traffic. When encountering suspicious activity or behavior on a network, a level of error, or uncertainty, is always present. It is simply not possible to interpret a potential adversary’s behavior with total accuracy. Uncertainty visualization aims to include this component in its visualization, thus giving the user another tool through which to filter data. Tools such as Nagios and Walrus already have the ability to monitor networks for continuity and reliability. Tools that can visualize security risks along with their uncertainty levels, however, have not yet been documented in the literature. The goal of this research is to experiment with the application of uncertainty visualization principles in the existing network visualization tool, tvn. Existing visualization graphs are modified to include an uncertainty component. Comparative graphs are shown for known attack data to compare the two approaches. Through this work, we hope to improve state of network monitoring and cyber situational awareness.

**Poster 42**

Robotic Telepresence with Microsoft Kinect  
Kody O’Connell, Michael Rubanka and John J. Wood  
United States Air Force Academy

A robotics telepresence system was created using Microsoft’s Kinect sensor device. The Kinect measures positions of joints on a human body in three dimensional space and this information can be used in many creative ways. Transmitting this information to a remotely located robot would allow the user to operate it remotely and naturally. Microsoft has made a software development kit available for the Kinect and a community of developers and enthusiasts has sprung up around the device offering many online resources to help advance the project. An affordable robotic arm was integrated into the system to serve as the robot that will mimic the movement of a human arm. Goals of the project include demonstrating effective telepresence operation between the Kinect and the robot arm while gaining a better understanding of control systems and programming. The Kinect sensor has successfully registered the joint positions of the right hand, arm, wrist, elbow, and shoulder. A connection between a C# program and a Python server has been maintained in order to transmit joint position from the Kinect at high frequencies. The robot arm is controlled through a proprietary software package or hardwired to an Arduino microcontroller to receive control information from a computer.
**Poster 43**

**Effects of RALSTONIA PICKETTII on a Fatigue Life of Aluminum alloys**
Timothy A. Reid, Sarah E. Galyon Dorman, Ryan D. Young, Benjamin K. Hoff and Daniel H. Henning  
United States Air Force Academy

The purpose of this study was to determine if the bacteria *Ralstonia pickettii* has any effect on increasing the corrosion fatigue life of the aluminum alloy AA7475. Preliminary data from the Department of Engineering Mechanics at the United States Air Force Academy revealed that the corrosion fatigue life of AA7475 was increased after exposure to the bacteria *R. pickettii*. Fatigue life was tested on AA7475 at a stress ratio of 0.65 and at three different frequencies: 1Hz, 10Hz, and 0.02Hz. The tests were conducted in 0.06M salt water, both with and without the presence of a known concentration of *R. pickettii*. Scanning electron microscopy and energy-dispersive X-ray spectroscopy were employed to explore possible methods by which *R. pickettii* may inhibit corrosion. Results indicate the sequestering of metals and the formation of a biofilm by the bacteria, which is consistent with *R. pickettii* acting as a corrosion inhibitor.

**Poster 44**

**Attitudes toward Writing in Elementary School: Charting Progress from Kindergarten to 3rd Grade**
Catherine Watson  
University of Colorado Colorado Springs

This study reports on elementary students' attitudes towards writing. Children in kindergarten, first grade, and third grade were interviewed about their experiences writing at school and at home. The students were asked what they found most difficult about writing, what they most enjoyed, and what they understood as the purpose of writing. The interviews were coded and themes were identified across the different ages of elementary students.

**Poster 45**

**Detection of Mule Deer Odocoileus hemionus Fawning Areas by Fusing Multiphenomenological Data**
Shoshana Shellans  
United States Air Force Academy

The Sonoran pronghorn *Antilocapra americana sonoriensis* are a severely endangered species that live in the Sonoran desert in the southwestern portion of the United States. Preservation of the Sonoran pronghorn is dependent upon protecting their fawning areas, yet the study of fawning areas itself could pose potential harm to the species via human-contact occurring as a result of research methodology. This study utilizes mule deer *Odocoileus hemionus* as a surrogate species for study due to the commonalities between mule deer and Sonoran pronghorn fawn-preservation tactics. We primarily use QuickBird imagery (supplemented by Landsat imagery) to explore the advantages and challenges of using remote sensing to assess habitat and landscape use by mule deer. Known fawning site coordinates were determined using the Starky

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method to analyze the GPS transponder outputs of collared mule deer. With these points, we conducted a 200m buffer analysis in order to characterize fawning sites (FS) vs. non-fawning sites (NFS) as determined through the use of a Digital Elevation Model (DEM) of the study area and the QuickBird imagery. The Normalized Difference Vegetation Index (NDVI) is employed to further analyze the biomass in the study area, and its significance with regard to mule deer habitat and landscape use. Though the terrain in Fort Carson may differ from the terrain in the Sonoran desert, we explore here the utility of the methodology for identifying potential fawning areas of Sonoran pronghorn while simultaneously reducing the likelihood of human-wildlife interaction (direct or otherwise).
Oral Session III
(3:00-4:20 pm)

Cornerstone 301 Room

Guiding Principles

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The Effects of John Winthrop’s Beliefs in New England
Daniel Frymire and Lt Col Seeling
United States Air Force Academy

In 1630, John Winthrop and the original colonists of the Massachusetts Bay Colony arrived on the shores of the New World looking to establish their city on the hill. As a devout Puritan, John Winthrop firmly believed in Christianity’s Calvinist principles and often used them to guide him in his decisions as governor. The result of these beliefs in the decision making of the colony led to the development of unique characteristics in the colony. The three main areas of colonial life where this could be seen were the relationships between the culture, economy, and expansion of the population. Whether it is seen as a success or failure, the Massachusetts Bay Colony truly was a city upon a hill.

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The Curiosity of Pretty Women
Maria Tobin and Dr. Paul Harvey
University of Colorado Colorado Springs

In historical study of human behavior and society, prostitution as an occupation is considered a degenerate and shameful career that is uniquely feminine. In different time eras, specifically the American Antebellum, Civil War and Reconstruction eras, prostitution, though still perceived as a degenerate occupation, is also viewed with a level of interest and curiosity. Focusing directly on New York City, the social and behavioral acceptability of prostitution remained stagnant, but a perverse curiosity of how women fell into the lifestyle and men’s open promiscuity in frequenting a “house of ill repute” and its occupants did emerge. This societal behavior derives from an aristocratic male perspective with the emergence of the Bourgeoisie and further driven by the conservative Victorian lifestyle.
Giuseppe Arcimboldo: More than the Mannerist Grotesque
Krithika Vachali and Lauren Kinnee
Colorado College

Giuseppe Arcimboldo, a 16th century Mannerist artist, painted exquisite portrait heads composed entirely out of fruits, flowers and animals. These 'composite portraits' were first thought to embody the Mannerist Grotesque, which was less a style than a formalistic exercise. However, upon closer examination it becomes clear that Arcimboldo's composite portraits are far more complex and compelling than scholars once thought. This paper demonstrates this complexity through a nuanced discussion of the artist's Portrait of Rudolf II as Vertumnus, which is steeped in humanist thought as well as social critique. This portrait is an allegory related to the Habsburg family that affirms their imperial and intellectual power, illustrating both the Habsburg's and Archimboldo's extensive knowledge of contemporary philosophy and classical literature. Bizarre though they appear, such portraits are much more than interesting collages, and this portrait in particular is a striking testament to the artist's loyalty to Rudolf II.

The Art of Subversion and Theatricality in Kitagawa Utamaro's Kansei-Era (1789-1801) Ukiyo-e
Jennifer Myers
Colorado College

The era name ‘Kansei’ meant ‘lenient rule.’ Paradoxically, however, the Kansei era (1789-1801) was marked by a series of strict moral and economic reforms. Through these restrictions, the Tokugawa shogunate sought to restore its authoritative image and clamp down on the decadence and unruliness of the bourgeoisie chōnin (townspeople). In particular, prohibitions were aimed at the chōnin cultural art of ukiyo-e woodblock prints. These images embodied the Edo aesthetic of ukiyo (the Floating World) with its pleasure-seeking entertainments, fashionable tastes, and passion for spectacle. I look at the prints of Kitagawa Utamaro (1753-1806), renown as the connoisseur of women, and examine how prohibitions served to increase the creativity of Utamaro and fellow artists/literati. By adopting the practice of mitate, loosely defined as parody, Utamaro created layers of meanings in his artwork that both celebrated chōnin culture and covertly refuted the shogunate’s Confucian ideology through inverted political structures. Edoites love for play and taste for the fantastical and erotic allowed Utamaro and other artists to develop prints with coded interpretations only intelligible to their chōnin clientele. The conflict between the shogunate’s aspirations for a well-ordered society and the urbane realm of the chōnin sets up the fault line which Utamaro cleverly exploits in his prints. Building on Mikhail Bakhtin’s idea of carnival and post-modern ‘safety-valve’ theories, I argue in this thesis that Kitagawa Utamaro uses the art of spectacle and literary appropriations to negotiate shogunal powers. I will not only examine political imagery, but reinvented allusions to classical texts (mitate) and popular forms of theatricality (kabuki and bunraku puppet theater) as well. Utamaro’s utilization of popular literary and theatrical tragic love, particularly giri-ninjō (the conflict between one’s duty to society and one’s true feelings), suggests resistance to the shogunate’s
Cornerstone 302 Room

Energy Applications

Analysis of Solar Flux Impact of Campus Architecture using Terrestrial LIDAR
Matthew Sidor
University of Colorado Colorado Springs

Three-dimensional computer reconstructions of physical space have become an increasingly important component to the field of GIS. One application of 3D GIS data is to produce a mathematical model of seasonal changes to solar flux within a certain area. Solar flux is a measurement of the amount of energy being received from the sun, in units of watts per square meter. By collection precise, close-range measurements of the physical configuration of the terrain, buildings and vegetation in an area, it is possible to construct a computer model that accurately simulates solar flux. For this research, a terrestrial laser scanner (TLS) or lidar system was used to measure several buildings on campus in a spatially-explicit manner in order to produce a solar flux model in ArcGIS.

Model-Based Application for Leak Testing of Buried Fuel Lines
Michael R. Maixner, Michael O'Donnell and Timothy Smith
United States Air Force Academy

Isobaric and isometric test procedures are typically used in lieu of more conventional hydrostatic tests on buried airport fuel hydrant systems; using currently installed equipment, the isometric test is implemented in a spreadsheet-style application, designed for ease-of-use by operating and maintenance personnel on-site who may not have a knowledge of fluid flow, heat transfer, and thermodynamics. Visual Basic for Application™ (VBA) program execution is initiated through buttons provided on data worksheets. Final analysis results in a recommendation that the test may be considered satisfactory (i.e., the likelihood of a leak is small), or that a leak (or leaks) exist(s) with an estimate of the magnitude of the leak. Model design was conducted using the REFPROP program from the National Institute of Standards; REFPROP calculations were validated against a simple one-dimensional heat transfer simulation. On-site testing and validation of the leak testing program will be performed during summer 2012.
Solar ATV Trailer
Michael Alvarez and Lt. Col Richard T. Buckley
United States Air Force Academy

Sunlight is a source of energy that can be harnessed and stored through the use of Solar Panels. Solar panels are typically mounted on top of a building’s roof or out in an open field where sunlight is abundant. As the sun travels through the course of day, a sun tracking system is attached to the solar panels and follows the sun, thereby becoming more efficient. The solar panels along with the tracking system have become mobile and can be easily collapsed and set up in a timely manner. Through the use of SolidWorks, the solar panels mounts can be modeled to optimize weight by using different materials properties. The result of this independent study is to create a rugged yet light weight mobile power system mounted on a trailer that can operate unattended and supply conventional power to users. A trailer, panel mounting system and sun tracking system were integrated together to develop a stand-alone unit.

Renewable Power System for an Electric Trike
Bill S. Song
United States Air Force Academy

This project involved replacing the power system of an electric trike from a lead acid battery system to a polymer electrolyte membrane fuel cell (PEMFC) system. The purpose of the project was to demonstrate the feasibility of fuel cell systems for portable power generation, to model and simulate fuel cell operation using MATLAB, and to highlight obstacles for fuel cell implementation in the transportation industry. A PEMFC, which consists of an electrolyte bounded by two electrodes, takes hydrogen gas from a storage tank and oxygen gas from the surroundings to produce electricity with water and heat as the only byproducts. The high power density, solid electrolyte, long cell life, and low corrosion make PEMFC systems relatively more suitable for ground vehicle applications than other forms of renewable power production. The ground vehicle application in this project was an electric trike. A 100W PEMFC was installed on this platform and several tests were conducted. In addition to actual testing, the computer software program, MATLAB, was used to generate a steady-state model and simulate the PEMFC operation. Using the gathered test data as well as the MATLAB model data, expected versus observed performance parameters and efficiencies were calculated. Lastly, the project included a simple cost and performance analysis that compares PEMFC systems with battery power and internal combustion engines.
The Family Model in Michael Haneke’s *Funny Games*
Aaron Hartshorn
University of Colorado Colorado Springs

In my presentation I will examine the role the family model plays in the 1997 film *Funny Games*, written and directed by the Austrian filmmaker, Michael Haneke. The film follows a family as they arrive to vacation in their summer home, only to be met with two killers who are terrorizing the area. The film is continuously being analyzed for its commentary on violence in modern film and for its radical juxtapositions, freely exercising applications involving psychoanalytic theory. These topics, in regards to the film, are fascinating to say the least, however, rarely does one look at the family as a unit, in *Funny Games*. What makes this topic so interesting is how it parallels obvious gender roles and conventions. Considering the family, and presumably the killers, are both upper class, one can see in the film (and in other Haneke films) the social criticism arising from Haneke regarding the upper class. However, the most intriguing area in this topic comes with the role reversal each family member undergoes. During the film, each family member undergoes a role change, or in other words, conventions of a traditional family, which are established in the beginning of the film, are mixed around and reassigned. What makes this switch so blatant is the fact that the killers don’t treat the members of the family any different. They consistently refer to the father as the “captain of the ship,” even when he clearly has given up his role as the head of the household. The film is nearly unbearable (intentionally) to watch for a number of reasons, but in my opinion, and as I will present, one element of the film that frequently goes unnoticed, is the part the family model plays in the film, and how it is ultimately destroyed.

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Emily Dickinson
Taylor Warren
United States Air Force Academy

Emily Dickinson is a great American poet who wrote about a number of interesting topics. Her family and biographical background both contribute to her foundation of religious education. While Dickinson set herself apart quite quickly from others, she possessed extreme intellect and passion. Religion is the founding topic that consumes her life’s works and is affected by many variables such as nature, intelligence, truth, and death. These facets of Dickinson’s life are responsible for the interaction, or lack thereof, that she had with religion throughout her life. Unable to commit to one definitive belief system, Dickinson explores the need for religion, the aspects of faith, and how truth and death sync with religious convictions. Although her poetry provides a kaleidoscopic view of her mind, no one can say for certain what Dickinson truly believed, only that she constantly struggled in search for the truth about God and above all else, the truth about herself.
A Focus on Minimalism, Loss of Time, Spiritual Tear and Postmodernity  
Andrew H. Drescher and Professor Robert von Dassanowsky  
University of Colorado, Colorado Springs

By analyzing the films and reading published works from experts, this presentation furthers understanding of the director, Carl Dreyer. Because he was such a minimalist, audiences gain the ability to create their own environment of time and space. Such an open film calls for criticism on the human condition and religious ideologies in tandem with this suspension of time and place. These are basic principles that establish the groundwork for post-modernism. The following illustrates his contribution to Danish cinema, his style and his influence on postmodern film makers of his time.

Cornerstone 308 Room  

Modeling and Mathematics III

Mitigation of Weight in Firearm Suppression Systems Through the Application of Composite Materials  
Thomas J. Pitcher, Andrew D. Durkee and Lt. Col Richard T. Buckley  
United States Air Force Academy

The addition of a sound suppressing device (suppressor) to a firearm adds a multitude of benefits to include the reduction of sound, the mitigation of muzzle rise and the reduction of light and dust signatures. As the suppressor is generally attached to the end of a barrel, weight and the moment it causes is of primary concern. Through effective geometric design using computer aided design (CAD) and analysis using computational fluid dynamics (CFD) and physical tests, the geometry of the suppressor was optimized to limit max pressure at the outlet. Using the optimized geometry, and known loading, temperature and corrosive conditions a composite structure and manufacturing regime are designed to balance the optimized geometry and ease of fabrication. This project is expected to result in suppressor allowing for hearing safe operation (less than 140dB) of a 16 in barrel 5.56x45mm rifle firing 55gr and heavier ammo. This suppressor should also be significantly lighter than any equivalent suppressor available today.
Modeling the Falcon Telescope Network
Brandon Mueller
United States Air Force Academy

With more nations building and launching satellites, space has become more congested, contested, and competitive. Space situational awareness is a vital component of U.S. national security due to the role space and cyberspace play in our military operations. This requires a migration from catalog maintenance to full characterization and assessment of space objects. The Falcon Telescope Network (FTN) and Cadet Space Operations Center (CSpOC) allow development of new techniques and algorithms for satellite characterization and data fusion in assessing potential threats in the space domain. This paper presents modeling of the FTN which is a global network of small aperture telescopes focused on providing research capability in non-resolvable space object identification.

Spin-Rate Analysis of Space Debris
Eli Garduno, Joseph Silverio, Dr. Michael Dearborn, Dr. Roger Tippets, and Dr. Francis Chun
United States Air Force Academy

There are currently over 22,000 space objects in orbit around the earth in which the U.S. keeps orbit information on a routine basis. Since only about 1,000 of those objects are active satellites, the majority of the objects are space debris. These objects are typically larger than 10 centimeters in size; however we know based on radar and optical observations that there are much smaller objects in orbit. NASA estimates that there are hundreds of thousands of space debris objects and their population is growing exponentially in time. This research supports a NASA active debris removal program by determining the spin rate and spin axis orientation of large space debris objects such as Russian upper-stage rocket bodies. We observed these rocket bodies with a 16-inch telescope, compared their reflected intensities to catalog stars and produced a light curve depicting how their signature varies as a function of time. To date, we have over 300 light curves and are analyzing them with Fourier techniques to determine their synodic spin rate. From the synodic period, we will be able to determine an object’s sidereal spin rate and thus be able to identify the slow-tumbling rocket bodies as viable candidates for de-orbiting.
Recent operations in Afghanistan and Iraq have proven that unmanned vehicles (UxVs) are invaluable to the U.S. military and their joint operations are critical to mission success. UxVs provide greater time on station, superior cost effectiveness, and enhanced physical security for operators as compared to their manned counterparts. A tighter integration among Unmanned Ground Vehicles (UGVs), Unmanned Surface Vehicles (USVs) and Unmanned Aerial Vehicles (UAVs) allows all services to leverage their specific capabilities in a joint environment. Our research, conducted in cooperation with the U.S. Military Academy and U.S. Naval Academy, focuses upon cooperative patrol and autonomous asset defense, using a combination of ground, surface, and aerial platforms. Using two UAVs, a USV, and two UGVs, we cooperatively patrol a harbor with the aim of identifying, tracking, and intercepting both an intruder vessel and a human intruder. Human operators are in the loop purely for safety reasons and target confirmation.

As a result of the United States’ wars in Iraq and Afghanistan, the demand for Remotely Piloted Aircraft (RPA) has significantly increased. Currently, RPA transit through controlled airspace is workload intense for pilots because of the demands of increased control and communication. To enhance RPA pilot success in dealing with airspace information overload, this research presents the Airspace Coordination Tool (ACT). The ACT integrates with two systems currently in development, Dynamic Airspace Data Sharing and Dynamic Auto-Routing Tool, to automatically route the aircraft from an initial point to a target location given relevant weather and ground track data. The ACT will also request and receive airspace transit approval. ACT is defined using three primary use cases, and is further refined by 5 secondary use cases that will set the foundation for future study and the development of ACT as a software tool.
Analytical Verification of Compressor-Driven TIP Jet for IED-Detection UAV
Jacob A. Daniels and Capt. Joseph A. Wahlquist
United States Air Force Academy

Small rotary air vehicles are an ideal choice for improvised explosive device (IED) detection. They allow for a compact, slow-moving vehicle that can be used to sweep any given area, regardless of terrain. The use of tip jets to provide the rotational force on a rotary wing craft eliminates the counter torque which must be resolved by a tail rotor. Using a centralized compressor to duct air through hollow wings to create thrust at the rotor tips will allow for IED detection. Research was done on this concept vehicle to determine flow characteristics and power requirements. Simulation software and real-world testing revealed large amounts of flow loss and power limitations. However, for missions which require only short range and low altitude operation, the inefficiencies and power limitations inherent with tip-jet vehicles may be outweighed by the benefits of its compact design and application to the warfighter.

Charge Exchange Containment Cell
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Highly energetic ionized particles are used in a variety of situations, from propulsion to material testing. But, sometimes it is beneficial to have highly energetic neutral particles instead of ionized particles. One such use for this is for a new propulsion concept called an Electrodeless Lorentz Force thruster that creates a plasmoid and then collides that plasmoid into neutral particles. Through the charge exchange process, the ionized particles transfer their energy into the neutral particles. These neutral particles are then exhumed out of a nozzle and propel a system forward. In order to study these highly energetic neutral particles, we have designed a charge exchange containment cell. This cell will be used in a vacuum environment and will be differentially pumped, in order to have a pressure differential between the vacuum chamber and the inside of the containment cell. The pressure of the neutral gas within the cell will be able to be varied to optimize charge exchange. We have also experimentally tested this charge exchange containment cell.
Development of a Landspeed Racing Vehicle Dynamic Analysis Tool
Rebecca Bailey, Robert Larsen and Lt Col Buckley
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This purpose of this project was to create a tool which could be used to assist racers at the Bonneville Salt Flats attempting to set land speed records. These racers habitually run into two problems: the inability to go faster regardless of increases in power and loss of vehicle stability in the lateral and/or vertical directions. Correcting these two issues first requires an understanding of the forces on the vehicle as its velocity increases. Therefore the creation of the tool began with calculating forces on the tires, static and dynamic weight distributions, drag forces, and lift forces. With a completed dynamic model of the vehicle it was possible to determine the causes of problems and provide possible solutions.

Meshing Computational and Experimental Data Using Modern Design of Experiments to Solve Transonic Behavior of a Fighter Aircraft
Alex J. Hutcheson and Dr. Steven A. Brandt
United States Air Force Academy
A low cost, aerodynamically stable platform capable of representing fifth generation fighter aircraft is needed to test US weapons systems. The Fifth Generation Aerial Target (5GAT) was designed to serve this purpose. Wind tunnel tests were conducted in the USAFA subsonic wind tunnel and a computational fluid dynamics analysis was used to replicate the true range of 5GAT flight conditions. The experiment characterized the 5GAT’s stability by analyzing pitching moments at various angles of attack. These results will be used for future design development in the 5GAT project. Since the experiment collected data from multiple types of sources, Modern Design of Experiments was used to decrease test matrix size, increase accuracy, and compile both experimental and computational data into a single response surface. Results show the 5GAT design is stable and the experimental methods used can be applied to future multi-data source experiments in the future.
Rolling Road
Jeffrey Albert DesRoches and Jane Evelyn Kaufmann
United States Air Force Academy

The purpose of this project is to create a testing apparatus with the intent of measuring lift and drag coefficients from a model as accurately as possible. When testing model cars the fluid interaction between the road and the vehicle creates a challenge for accurate testing. In our design we have attempted to eliminate inaccuracies due to the formation of a boundary layer on the surfaces of the wind tunnel. Boundary layers, which are due to the viscous forces within the fluid being greater than inertial forces, create a difference in air velocities throughout the test section. In an ideal situation the velocity difference between the road and the air is zero. Therefore, no boundary layers form. To simulate a moving vehicle we need to eliminate the formation of the boundary layer where the land vehicle is tested. The objective of this project is to see if applying a rolling road system will provide more accurate data during wind tunnel testing of a land vehicle. Other components of this project include: designing and applying load cells, understanding and manipulating electronics within an AC motor, machine design of a custom test section, and testing procedures for our new test section.