10:00-12:00 GENERAL SESSION  North Classroom 1130

10:00 OPENING REMARKS; Interim Associate Vice Chancellor, Dr Damrauer
Provost Mark Heckler

10:10 MORNING ADDRESS:
Finding Order in the Chaos: Navigating Your Research Career
Dr. Mary E. Coussons-Read, Ph.D.
Associate Dean for Curriculum and Research
College of Liberal Arts and Sciences

11:00 STUDENT PRESENTATIONS:
Outstanding Research and Creative Activity Award Winners.
Introduced by Dr. Joy Berrenberg

11:00: Mari Marsico: Psychology, College of Liberal Arts and Sciences
The Impact of Exercise on the Self-Esteem, Coping Skills and Wellness Choices of Single-Parent Females

11:15: Adam Kanold: Civil Engineering, College of Engineering & Applied Science
Kevin Harris: Electrical Engineering, College of Engineering & Applied Science
Particle Clogging in Saturated Porous Media using Light Scattering Measurements

11:30: Munira Albuthi: Biology, College of Liberal Arts and Sciences
Development of a Bacterial Mercury-Removal Method for Simulated Museum Materials

11:45: Stephen Hill: Music Performance, College of Arts and Media
The Music of Django Reinhardt

12:00-2:00 STUDENT EXHIBITS- North Classroom Atrium
Students will present their research and creative projects in an informal setting.
Light refreshments served

2:00-2:30 KEYNOTE ADDRESS North Classroom 1130
Opening Remarks:  Vice Chancellor, Richard Traystman

Mitch Morrissey, Denver District Attorney
DNA: from Crime Scene to Courtroom
Mr. Morrissey will describe how DNA evidence found at crime scenes is used to solve cases, prosecute criminals and exonerate innocent people in the criminal justice system. The scientific techniques involved in forensic DNA analysis will be explained.

2:30-3:00 AWARDS CEREMONY
Chancellor M. Roy Wilson
Provost Mark Heckler

• Outstanding Research and Creative Activities Awards
• Chancellor’s Awards for Excellence
• Faculty Award for Outstanding Student Mentoring
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Welcome

THE VALUE OF DISCOVERY AND CREATIVITY IN LEARNING

We welcome you to the 11th Annual Research and Creative Activity Symposium. You and we are here to celebrate our students’ accomplishments. Over 100 students are displaying sixty-five exhibits at this symposium today.

Learning by doing is by far the most efficient and effective way to engage students in their education and help them prepare for the future. The discovery-based and creative works on display today are representative of those kind of activities we want all students at UC Denver to experience.

As you listen to their talks and speak with students at their posters, we know that you will begin to understand the critical importance of such learning.

It is a particular pleasure to welcome our speakers today, Professor Mary Coussons-Read, who will share with us her research experiences in our morning talk called “Finding Order in the Chaos Navigating Your Research Career” and Denver District Attorney, Mitch Morrissey, who this afternoon will share with us his insight in a talk entitled “DNA: From Crime Scene to Courtroom.”

Many others have demonstrated strong support for the Symposium and are with us in various capacities. These include our Chancellor, Dr. M. Roy Wilson, the Provost, Mark A. Heckler, and our Vice Chancellor for Research, Richard Traystman. Their leadership and support recognizes the importance of “learning by doing.”

Enjoy yourself as you recognize the efforts of our undergraduate and graduate students. Stop them and engage in conversations about their topics. They will be thrilled as will you.

Finally we thank all those whose efforts have brought about this celebration of student discovery and creativity.

Best wishes,

Robert Damrauer
Interim Associate Vice Chancellor for Research

Lissa Gallagher
Director, Experiential Learning Center
COMMITTEE MEMBERS

Bob Damrauer  Office of Research (Co-chair)
Lissa Gallagher  Experiential Learning Center (Co-chair)
Leo Bruederle  Biology, College of Liberal Arts and Sciences
Joy Berrenberg  Psychology, College of Liberal Arts and Sciences
Ronald Ramirez  Business, College of Liberal Arts and Sciences
Cheryl Kaas  Learning Resources Center
Clark Strickland  College of Arts and Media
Lorraine Ward  Experiential Learning Center

SYMPOSIUM SPONSORS

Office of the Provost
Division of Student Affairs
Experiential Learning Center
Center for Faculty Development
Office of Undergraduate Experiences
Office of Research and Graduate Studies
Undergraduate Research Opportunities Program (UROP)
# Judges

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The Community Prototyping Lab is the place where UCD students and local small business entrepreneurs can collaborate on technological innovation. The Certificate in the Scientific Foundation of Technical Innovations curriculum, as developed by Dr. Randall Tagg and Dr. Arlen Meyers, focuses on two critical areas of physical prototyping: the effective assimilation of a wide variety of technical knowledge and hands-on experience in producing prototypes. Together with the nonprofit organization, Micro Business Development, they have created the Community Prototyping Lab which serves as the facility for students to participate in a service learning program and work directly with small business clients who are in need of low-cost prototypes.

In order for an entrepreneur to turn a great idea into a physical product, it is necessary to incorporate many types of technical knowledge into a working prototype that can be used to raise funds, present concept to manufacturers, and develop business plans to successfully market their product. Before a new product goes to market, it must proceed through a lengthy process of conceptual design, development, physical prototyping and testing that is both costly and requires a great deal of technical expertise to complete. The Community Prototyping Lab is an excellent resource to assist local businesses in this process.

The laboratory, which resides at the Micro Business Development’s Denver office, not only offers a physical location for the program to house its technical equipment, but also allows students to have one-on-one contact with entrepreneurs who need assistance with their physical prototypes and may not have the financial means to produce them. The lab consists of technology clusters covering areas such as: materials and fabrication, metrology, automation, electronics, optics, energy systems, and sustainable manufacturing. Scientific equipment, supplies and instructional materials are available for the students to use as they are working with local entrepreneurs to develop products and processes that are needed in business and health care. In exchange for prototypes, the businesses that use the service agree to donate a percentage of their profits back to the laboratory in order to keep the program functioning.

*UCD students and faculty are integral to meeting the Community Prototyping Lab’s goal to create a community resource and supportive atmosphere that fosters connections between learning, technological innovation, and economic development.*

*Dr. Randall Tagg*
## Undergraduate Abstracts

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Master Study Pushes Contemporary Artists

Theresa Anderson Painting, College of Arts and Media

Faculty Mentor: Ms. Mary Connelly, College of Arts and Media

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

Studying the four modern masters Braque, Kokoschka, Derain, and Bonnard to glean the effects of surface texture, paint application, color, line quality, mark making, choices of perspective, shallow flattening of space and fragmentation of form, I related these elements to my own artistic process. By making sketches and notes, I discovered the emphasis on individualized mark making, attention to process, and the use of a saturated palette. The contemporary painter has many choices concerning process that affect the perception of art. I incorporated many of these elements of art in autobiographical paintings encompassed in the show, The Veil. The viewer may access this work at theresaanderson.mosaicglobe.com. Braque’s used glazes, matte, and pebbly additions that highlight the process of painting. Braque’s use of fragmented form continues to describe a decentered and diverse world. Kokoschka’s roped painting surface describes, humanity, defined by an onslaught of degradations of flesh. Derain’s paint surface mimics stitching of an embroidered surface. Derain left a large area of this canvas blank yet defined a landscape. Bonnard’s subject is a typical bathing scene, but by choosing a saturated palette that obscures, Bonnard changed the content of the painting to include a political commentary on the state of women.

Successional Progression Following the 1988 Yellowstone Fires

Andrew Andrade Biology, College of Liberal Arts and Sciences

Stephanie Marvez Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Diana F. Tomback, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Proceeding the stand-replacing 1988 Yellowstone fires, data evaluating the successional progress of the understory herbaceous communities were collected by Tomback and students for subalpine study sites on Henderson Mountain, Gallatin National Forest, and Mt. Washburn, Yellowstone National Park for 1990, 1992, 1994, and 2001 (12 years of succession). Each study area was divided into two study sites, denoted xeric and mesic; 100 20m² plots (50 xeric, 50 mesic) were sampled per study area. Sampling in 1990 consisted only of presence/absence in plots, while subsequent years included stem counts in 5m² subplots and total plot herbaceous understory cover (forbs, graminoids, shrubs, mosses) using a modified Braun-Blanquet scale. Employing this data, we constructed a database, calculated the proportion of plots per study site per year in which each species was found, and determined successional changes through Morisita’s Index. Fire-weed (Epilobium angustifolium) was the predominant species on Henderson and Washburn, both xeric and mesic sites. A marked difference, however, was observed between xeric and mesic sites of both study areas, with xeric sites demonstrating a growing dominance by C3 graminoid species during succession, whereas mesic sites remained strongly dominated by C3 forbs, hinting at seral divergence possibly leading towards different end points.
**Flux Monitoring of Active Galactic Nuclei at Optical Wavelengths**

**John Apodaca** Physics, College of Liberal Arts and Sciences

**Anne Andrew** Physics, College of Liberal Arts and Sciences

**TomPayetta** Physics, College of Liberal Arts and Sciences

**Timothy Hatchett** Physics, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Alberto Sadun, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research

***2007-2008 UROP Award Winner***

Optical Microvariability is fundamental to understanding the origin and nature of these supermassive black holes and the creation and evolution of galaxies is the change in the luminosity and number of AGN. The purpose of the proposed project was to produce research quality data for light curves of Active Galactic Nuclei (AGN) using private resources available to the everyday citizen (i.e. non-academic and non-government). Data for the observation runs were calibrated and analyzed using desktop computers at the UC-Denver campus with MIRA Pro, a photometry data analysis program. In the performance of photometry of selected program objects such as Mrk421, Mrk501, OJ287, and others, we created derived light curves that were combined with additional data at other wavelengths from our international professional collaborators at WEBT, GLAST, and VERITAS. This international collaboration has led to a collection of data indicating spectral changes which subsequently provided information on the AGN emission mechanism and structure. The upper limits on the size and mass of the emitting region can be determined from luminosity variations as well.

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**Storytelling: Projecting the University’s Voice**

**Alycia Arnold** English Writing, College of Liberal Arts and Sciences

**Lydia Orth** English Writing, College of Liberal Arts and Sciences

**Lydia Evins** English Writing, College of Liberal Arts and Sciences

**Janae Reed** English Writing, College of Liberal Arts and Sciences

**Faculty Mentor:** Michelle Comstock, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research

Stories, photographs and websites blend and come to life in the UCD Office of Integrated University Communications. With growing multimedia options, the department offers many writing program interns the opportunity to reach beyond print text and experiment with photography and website content. One of the first things students learn from this experience is the importance of keeping in mind the audience and the key messages while writing. Interns learn to use diction, style and format as tools to give the reader a personalized experience with the text. Additionally, interns practice discovering news on their own and the importance of giving it to the campus community talk to peers, professors, and faculty to learn the stories the university has to tell in order to help integrate the campuses together. Some intern projects that will be presented at the symposium include: online master style guide for university publications; stories and interviews featuring diverse faculty, students and staff members for alumni publications; and news for the university’s “Network.”
CAM RECORDS

JARED BERGER MEIS, College of Arts and Media

FACULTY MENTOR: Mr. Storm Gloor, College of Arts and Media

Activity Type: Undergraduate Research

CAM Records is a student-run, independent label located in the Dept. of Music and Entertainment Industry Studies of the College of Arts and Media. Since its inception, CAM Records has released several albums including compilations featuring local talents, students, and faculty. CAM Records students found local artists and worked with them to select songs, create the artwork, and manage the mastering and manufacturing of “Put Your Ear To The Ground”. Two included artists were subsequently recognized by the local press as notable emerging artists in Denver and another artist has recently been signed to a major record label. Work is nearing completion on the latest CAM Records release with the working title, “These Dreams”, due out very soon.

LIVERPOOL SLAVE TRADE THEN AND NOW

GLADYS BROWN JONES Sociology, College of Liberal Arts and Sciences

KATHERINE LESTER Psychology, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Sharon Araji, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

We traveled to Europe in the summer of 2007, to participate in a study abroad opportunity through the TRiO/SSS program at the University of Liverpool, England. Our studies focused on diversity, socio-economic class issues, as well as the historical slave trade of the Liverpool area. We will present a video presentation of our travels and experiences to educate students, faculty, and staff of the importance of international diversity, the historical impact of slavery, and to gain a deeper understanding of ethnicity in today’s global society.
**Termiting with Bone Fragments in the Savanna: Early Evidence of Possible Tool Use by Australopithecines during the Pliocene**

Jamie Carpio  
Anthropology, College of Liberal Arts and Sciences

Amy Williamson  
Anthropology, College of Liberal Arts and Sciences

Michelle Wreiling  
Anthropology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Charles Musiba, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research  
**2007-2008 UROP Award Winner**

Taphonomic evidence of bone surface modification for tool use by early hominins has recently been recognized at Swartkrans in South Africa (Backwell and d’Errico, 2001, Shipman 2001); however, very little taphonomic research of this type has been conducted in East Africa Pliocene sites. During the 2007 UCD Tanzanian field school in anthropology at Laetoli, Tanzania, our team conducted an actualistic study to test whether bones recovered from recent death assemblages at Laetoli could be modified and used for fishing termites at termite mounds. Actualistic experiments were conducted in which bone tools were manufactured and used to puncture termite mounds, creating a use wear pattern that would be indicative of tool use and compared with fragmented fossil bones found at Locality 8 at Laetoli. Preliminary results indicate that vertebra spines, ribs, and long bones can easily be modified and successfully used for termiting. Furthermore, our study indicates that sediment consistency greatly affects the tool use utility and time spent termiting. We concluded that the use of bone fragments as tools in termite extraction is probably; however, termiting was more likely seasonal occurring shortly after the rain season as a fallback hominin foraging strategy.

**Optical Spectrometer**

Allan Caspe  
Electrical Engineering, College of Engineering

**Faculty Mentor:** Dr. Tim C. Lei, Robert Grabbe, College of Engineering

**Activity Type:** Undergraduate Research  
**2007-2008 UROP Award Winner**

Design of a high speed optical spectrometer for optical coherent tomography imaging. There is a need in the medical science to detect surface (oral/skin) cancers using rapid and non-invasive modalities. Optical coherence tomography (OCT) is a non-invasive optical method that acquires 3-dimensional tissue images in situ without tissue extraction needed. Our research goal is to design an optical coherence tomography apparatus that is compact, affordable, and highly accurate. Our objective is to acquire cross-section images of oral cavities with a penetration depth of 2 mm and a lateral resolution of 10µm. A super-luminous-photodiode (SLD) will be used as the optical source, and a linear InGaAs spectrometer in conjunction with a fiber based interferometer as the detection body. In this year, our focus is on designing a linear InGaAs spectrometer to have a fast data acquisition speed. We recently designed three printed circuit boards to control and process the optical signals that are gathered by the InGaAs photodiode array. After the optical signals are converted to electronic signals through a high-speed analog-to-digital convertor, the electronic signals are subsequently processed by a Field Programmable Gate Array (FPGA) logic chip. The data will finally be sent from the FPGA chip to the main computer through the USB peripheral for further data processing.
Friction of a Tippe Top

JOSEPH CAVALERI Mechanical Engineering, College of Engineering

Faculty Mentor: Dr. Ron Rorrer, College of Engineering

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

The friction of a tippe top or flip-over top was experimentally determined. The top is a truncated sphere with a shaft that protrudes from the truncation. When spun by the shaft, the top precesses until the center of mass, which is below the center of the sphere, flips. This dynamic behavior of the top has been modeled for over the last 50 years with assumed friction models. A test device was constructed with an infrared sensor attached to an air bearing that supports a tippe top with an attached encoder target. This device constrains the tippe top to rotate about the vertical axis in order for the infrared sensor, coupled with a data acquisition system, to measure the angular velocity as the tippe top spins down. This measurement of the angular velocity was used to estimate the friction coefficient as a function of the velocity between the top and a flat surface. Several different combinations of surfaces and tops were used. The experimental data does not support the popular linear friction models of the tippe top, but shows that the friction coefficient is a non-linear function of velocity.

Ecological Role of Treeline Whitebark Pine in the Northern Rocky Mountains: Implications of Global Warming

KATHRYN CHIPMAN Biology, College of Liberal Arts and Sciences

ASHLEY EAST Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Diana F. Tomback, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

Whitebark pine (Pinus albicaulis) is a high elevation keystone species throughout the northern Rocky Mountains, providing many ecosystem services. Its seeds are dispersed by Clark’s Nutcrackers (Nucifraga columbiana), and are an important food for grizzly (Ursus arctos) and black bears (Ursus americanus). Mountain pine beetle (Dendroctonus ponderosae) outbreaks, global warming, and the introduced pathogen Cronartium ribicola, which causes blister rust, threaten whitebark pine, and may result in severe ecological changes, especially at treeline. Previous work (Resler and Tomback 2008) in northern Montana shows that whitebark pine is critical to the development of tree islands and that blister rust is killing and damaging whitebark pine at treeline; consequently, treeline may not respond rapidly to global warming by moving upslope. We extended this research to examine whitebark pine at its northern and southern limits in the Rockies. Whitebark pine is still a dominant component of treeline communities in these areas, but is less important in the formation of tree islands, and less infected by blister rust at this time. However, if blister rust spreads at treeline in these regions, as it has in northern Montana, our results indicate that major changes in treeline communities will occur.
Comparative Analysis of Component Ratios in Medicinal Mushroom Extracts

Jennifer Daddow Chemistry, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Marc Donsky and Dr. Lisa Lanning, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

Mushrooms have been used for medicinal purposes for over 5000 years in China. Even in Western medicine some of the most important medicines are derived from fungi; examples include antibiotics, such as penicillin, immuno-suppressants and cholesterol lowering drugs. Recently more attention has been put on fungi because of discoveries linking these mushrooms to anti-cancer, anti-viral, and immuno-stimulatory effects. Many beneficial mushrooms such as Ganoderma lucidum, Cordyceps sinensis, and Grifola frondosa are now available as over-the-counter supplements or extracts. Only limited research is currently available characterizing the active constituents in these extracts, delaying their acceptance into western medicine. The goals of this research was to measure and compare the ratios of certain constituents in Cordyceps sinensis extracts of different over-the-counter brands, within different lot numbers of certain brands, and in lab cultivated mycelium and establish the degree of standardization available. The extracts were analyzed using high performance liquid chromatography (HPLC). The goal of the analysis was to identify nucleotides and nucleosides, and their derivatives, naturally found in the mushrooms. One of the nucleoside derivatives (3′deoxyadenosine commonly called cordycepin) identified is currently used in successful anti-viral agents for HIV/AIDS infections indicating the potential medicinal benefits available within these extracts.

Planetarium Audio

Peter Dougall Meis, College of Arts and Media
Curtis Connelly Meis, College of Arts and Media
Larry Ursini Meis, College of Arts and Media
Erick Thompson MRSA, College of Arts and Media
Andrew White MRSA, College of Arts and Media
Jeff Merkle MRSA, College of Arts and Media

Faculty Mentor: Ms. Leslie Gaston, College of Arts and Media

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

A research team of Undergraduate and Graduate students from the University of Colorado at Denver along with Gates Planetarium Operations Manager Dan Neafus have collaborated since May 2006 to explore the potential of current audio technology, and to discover what similarities and differences exist between planetariums. There is a demand for research on the transferability of surround sound audio from one planetarium to another, so that 1) audiences have similar experiences, and 2) audio engineers can easily create this experience. This research will consider: acoustics, production, delivery, equipment, and seating arrangements. Our recent survey of over 100 planetariums worldwide in the fall of 2007 provides a look at current practices.
“WITNESS I DIE A CHRISTIAN”-
CONVERTING JEWS IN ENGLISH RENAISSANCE NARRATIVE

KRISTINA FOWLER English Literature, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Pompa Banerjee, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

The trope of conversion of Jews to Christianity, whether voluntary or forced, recurs obsessively in English Renaissance drama and social commentary. My project centers on the tensions and anxieties inherent in such conversions. While “turning” suggested religious, racial, and cultural change, Jewish converts remained racially Jewish, inhibiting such transformation. Anxieties surrounding these unstable conversions included the relapse of newly converted Jews into their old religion and therefore a relapse into the monstrous stereotypes through which Jews were imagined in Christian Europe. The Jews’ tribal wandering translated into theological wandering among Jewish converts. Such conversions did not erase Jews’ racial attributes, complicating questions of race and creating fears of contamination through resistant Jewish blood. These texts manifested the chilling specter of the Jew that “passed” as a white Christian. The English stage also exploited economic and mercantile anxieties in the nightmarish figures of Shylock and Barabas, grasping moneylenders and merchants who operated without the vestige of Christian charity or morality. Social commentators such as John Foxe presented martyrdom as the surest way to cleanse the dark ambiguities attendant on Jewish conversions. For Foxe as well as the English dramatists, the surest way to cure Jews’ dangerous malleability and confirm their conversion was through martyrdom and death.

COPPER NICKEL

SHARRON HARRIS English Writing, College of Liberal Arts and Sciences

CHRISTOPHER MCDERMOTT English Writing, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Jake Adam York, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

Copper Nickel is a national journal of art and literature produced collaboratively by the students and faculty at the University of Colorado Denver. Working with their faculty mentors, students in UCD’s undergraduate creative writing major select the contents of each issue from solicited and unsolicited submissions. They design, layout, finance, and publish each issue which presents undergraduate writers alongside professionals to produce an uncommon alloy. Now in our fifth year, we have published work by Bin Ramke, Matthew Cooperman, Anne Boyer, Tom Legendre, Christopher Merkner, Zachary Schomburg, Mathias Svalina, Hadara Bar-Nadav, Jen Lamb, Sandy Florian, Brenne Wysong, and many others. Through the Copper Nickel students experience learn hands-on the inner workings of a university press/literary journal and gain valuable experience that will prepare them for a future in editing, publishing, writing, journalism, teaching and much more.
**The Music of Django Reinhardt**

**Stephen Hill** Music Performance, College of Arts and Media

**Mhamed Elmenjra** Music Business, College of Arts and Media

**Faculty Mentor:** Mr. Sean McGowan, College of Arts and Media

**Activity Type:** Undergraduate Research

**2008 Outstanding RaCAS Award Winner**

Django Reinhardt was arguably the first great European jazz musician; his innovation on the guitar as a lead instrument has had a profound and lasting effect on musicians around the world. The reciprocal nature of Django's relationship with American jazz is of particular historical interest, as Django was able to absorb the swing articulation of jazz greats such as Louis Armstrong and Benny Goodman, and blend it seamlessly with the dark chromatic flavor and musical techniques of his Roma heritage. The style of music performed by Django Reinhardt, often known as “Hot Club” or “Gypsy Swing”, is characterized by aggressive right-hand picking techniques (with a predominance of down strokes and rest-stops) and a fast, fluid left-hand. Melodic playing is adorned with quick runs, grace notes, slurs, sweeps, hammer-ons, pull-offs, glissandos, rapid tremolo, and a pronounced vibrato. This musical style eventually made its way back from Paris to the United States. It continues to have an impact on the development of guitar within the realm of jazz and beyond, influencing guitarists from Joe Pass and Jim Hall to Jeff Beck and Jimi Hendrix.

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**Examining Climate Change and Malaria in Ngorongoro Conservation Area, Tanzania**

**Maria Amelia King** Anthropology, College of Liberal Arts and Sciences

**Anobha Gurung** Geography, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Charles Musiba & Dr Deborah Thomas, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research

**2007-2008 UROP Award Winner**

It is widely accepted that increased cases of malaria in many parts of Africa, particularly within highland regions (including the Ngorongoro Conservation Area – NCA in northern Tanzania) may be linked to long term climatic changes. However, geospatial based malaria-climate change data to support such assumptions so far has never been established in Tanzania. The NCA was the grounds of our research in understanding environmental changes and its relation to malaria. The purpose of the research was to pilot a field study by gathering data, using geographic information system and analyzing the results gained. In conclusion, we faced challenges in real-time field environment and found the importance of having an interdisciplinary approach to understand the complex relation that exists between ecology and health.
**Changes in Salivary Hormone Levels Induced by Cognitive Priming**

**Kayla Knopp** Psychology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. David Albeck, College of Liberal Arts and Sciences

*Activity Type: Undergraduate Research*

2007-2008 UROP Award Winner

Cortisol is a hormone associated with both stress and memory function. Varying levels of cortisol may alter memory performance. Subliminal priming can affect a wide range of human behavior, from physiology to cognition. This study investigates whether stress related or relaxation-related words, which are subtly embedded in a scrambled sentence task, can produce either elevated or lowered levels of salivary cortisol, and whether such an effect is related to subjects’ declarative memory ability. Participants complete one of three versions of a sentence-construction task, either embedded with stress-related, relaxation-related, or neutral words, although they are not aware that the task contains embedded priming words. They are then given 2 minutes to memorize a list of 20 common English nouns, and perform an immediate free recall of the words. Saliva samples are collected at baseline, after the sentence construction task, and at the conclusion of the study, and will be tested for cortisol levels. The data will be analyzed to compare the theme of the prime words with subjects’ cortisol levels, as well as with the number of words that they were able to correctly recall. Additionally, individual cortisol levels will be correlated with raw memory scores.

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**Metallurgical Analysis of a Military Knife**

**Daniel Koch** Mechanical Engineering, College of Engineering

**Faculty Mentor:** Dr. Ronald Rorrer, College of Engineering

*Activity Type: Undergraduate Research*

There is ever increasing demand for high performance weapons in the armed services. The knives that military personnel carry are no exception. The choice of material that goes into the making of a military knife will be discussed. Variation of the material constituents can tailor the knife properties in order to promote desired qualities. For example, the environment the knife is used in can be highly corrosive. Corrosion resistance can be affected by varying the amounts of added elements, such as adding chromium. The reason for tempering and tempering temperatures were examined. The manufacturing process of a manufacturer of military knives is examined and the reasons for the manufacturing process is discussed. The end result is a knife that not only has a sharp edge but can withstand the severe conditions of combat.
HER LIFE IS MY TEACHER

AARON KOPP Theatre, Film & Video, College of Arts and Media

FACULTY MENTOR: Mr. Craig Volk, College of Arts and Media

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

This short documentary film focuses on Abdul Salam a blind, yogi who twenty years ago created the HELPO foundation in rural India to empower women through microfinancing and educational opportunities. I, Aaron Kopp, traveled to southern India in the summer of 2007 and shot extensive footage and interviews for a short documentary being created on Mr. Salam’s life and work being created by Assistant Professor Volk and executive producer Stephanie Two Eagles.

CELL FLOW CYTOMETER PROTOTYPE DESIGN

SHANE LANDRY Physics, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Randall Tagg, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research
2007-2008 UROP Award Winner

A cell flow cytometer is a cell sorting device. It allows high throughput organization with simultaneous property measurements of a sample containing multiple cell types. A cell flow cytometer prototype is being constructed with a special purpose in mind: the sorting of quantum dot loaded liposomes for cell tracking purposes. This prototype is being funded in part by AETPL, the Auraria Emerging Prototyping Lab, and was a recipient of one of last years UROP grants.
**Irregular Colorings of Cycles and Paths**

**Christine Lee** Mathematics, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Ellen Gethner College of Engineering

*Activity Type:* Undergraduate Research

In graph theory, a graph is defined to be a collection of vertices connected by edges. A proper coloring of a graph $G$ is an assignment of colors to the vertices where adjacent vertices receive different colors, and the chromatic number is the minimum number of colors needed to properly color $G$. An irregular coloring is a proper coloring in which the multisets of colors adjacent to vertices of the same color are distinct. The irregular chromatic number of a graph $G$ is the minimum number of colors needed to irregularly color $G$. The chromatic number of cycles is easy to determine; it is either 2 for even number of vertices or 3 for odd number of vertices. We approach irregular coloring using a technique with a 3-letter overlap digraph in which each vertex is represented by a 3-letter string. Due to the additional constraint placed in irregular colorings, this type of coloring on cycles becomes difficult to produce. With the help of the 3-letter overlap digraph, we can determine the irregular chromatic number of cycles and paths.

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**Peptide Based Polymers & Self-Assembling Nanostructures**

**Jason MacDonald** Biology, College of Liberal Arts and Sciences

**Melissa Axen** Chemistry, College of Liberal Arts and Sciences

**Molly Hickey** Chemistry, College of Liberal Arts and Sciences

**Dashzeyeg Rentsenmyadag** Chemistry, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Hoyt Meyer, College of Liberal Arts and Sciences

*Activity Type:* Undergraduate Research

A series of amino acid derivatives is being prepared for use in peptide-based polymers and self-assembling nanostructures. A racemic synthesis of 4-amino-5-oxopyrrolidine-2-carboxylic acid methyl ester (1) has been completed. Cyclic oligomers of 1 are expected to assemble into a peptide nanotube (PNT) with a polar interior and non polar exterior. The preparation of 4-amino-3-oxo-2-azabicyclo[2.2.1]heptane-1-carboxylic acid (2) and 4-amino-3-oxo-2-azabicyclo[2.2.1]heptane-6-carboxylic acid (3) is in progress. Monomers 2 and 3 may enable the assembly of heteromeric PNTs or discs amenable to functionalization. The synthesis of 4-amino-3-oxo-2-azabicyclo[2.2.2]octane-1-carboxylic acid (4) has also been completed. This monomer is proposed to form rod-like oligomers or polymers capable of intermolecular hydrogen bonding. Self-assembly of PNTs derived from compounds 1, 2 and 3 could afford supramolecular structures with applications as optical switches, ion sensors, templates for nano wires, and ion channels with antibacterial activity.
Genocidal Vandalism: Defining Deliberate Destruction of Cultural Monuments in International Law

Simon Maghakyan Political Science, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Jana Everett, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Aiming to control the past, some modern governments intentionally wipe out cultural artifacts representing a people’s heritage. In December 2005, for instance, Azerbaijan’s army completely annihilated the world’s largest medieval Armenian cemetery – Djulfa. When asked about the vandalism, Azerbaijan’s president said the demolition news was an “absolute lie” because Armenians had never lived in Djulfa. In November of 2007, History Today magazine published my article on the destruction based on an independent research with Prof. Glenn Morris. Later, I organized the creation of the Djulfa Virtual Memorial and Museum, www.djulfa.org, a project that documents the devastation. Currently, I am working on my honors thesis with Prof. Jana Everett exploring how international law addresses deliberate cultural destruction. My ongoing studies suggest it does not, despite the condemnation of ‘cultural genocide’ in the first proposed draft of the U.N. Genocide convention. But even if ‘cultural genocide’ were prohibited, the vagueness of the concept would likely make the law ineffective. My thesis – drawing from the case of Djulfa – suggests that there should be specific criminalization of, what I call, ‘genocidal vandalism.’ That crime is the deliberate destruction of material culture calculated to erase the targeted community’s historical past and prospects for future existence.

The Impact of Exercise on the Self-Esteem, Coping Skills and Wellness Choices of Single-Parent Females

Mari Marsico Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Mr. Eric G. Benotsch, Ph. D., College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

2008 Outstanding RaCAS Award Winner

Single mothers living in transitional housing face a number of notable challenges when it comes to improving their quality of life. Improving their self-esteem, coping skills, and their wellness choices are just a few of these challenges. This research assessed the impact of an exercise program, specifically marathon training, on mental health and health behaviors. Participants were low-income single mothers living at Warren Village who completed a marathon training program. The training program consisted of 5 months of weekly group runs, training in nutritional choices, supplemental exercises to improve performance, and methods for incorporating exercise into their daily lives. Participants completed measures assessing mental health variables (self-esteem, body image, hopelessness) and health behaviors before and after completing the program. A repeated measures MANOVA indicated that participating in the program significantly improved mental health (Wilk’s Lambda = 0.48, F = 19.66, p < .01). Univariate analyses indicated that participating in the program had the greatest benefits for self-esteem (F = 13.84, p < .01). Participants who completed the program also reported significantly better health behaviors (F = 6.46, p < .05). The findings suggest that an exercise program may be beneficial for low-income single mothers living in transitional housing.
MeSenchymal Stem Cell Potential of Lung Side Population Cells

Jessica Martin Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Susan Majka, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Many diverse cell types reside in the lung and a common stem cell has not yet been identified. We present data here to support the hypothesis that non-hematopoietic CD45neg lung side population (SP) cells contain mesenchymal stem cells (MSCs), single cells capable of multilineage differentiation. Expression of MSC markers was characterized in mouse CD45neg lung SP cells using flow cytometry. The property of self-renewal was confirmed by telomerase activity assessed by quantitative PCR. MSC differentiation potential was confirmed by the ability of single cell clones to differentiate into cells of three mesenchymal lineages. Functional differentiation was confirmed by immunohistochemical and histological analyses. All CD45neg lung SP populations analyzed expressed mesenchymal markers and lacked hematopoietic markers. The cultured and clonal CD45neg lung SP cells had normal chromosomal structure and expressed high levels of telomerase. After being expanded and cultured in differentiation medium, all populations of CD45neg lung SP cells demonstrated adipogenic, osteogenic, and chondrogenic potential. Therefore, we demonstrated that adult CD45neg lung SP cells are a source of adult resident MSCs. In defining this tissue-specific stem cell population in the lung, we are now able to better clarify a potential role for them in lung diseases and therapy.

Intersimple Sequence Repeat (ISSR) Molecular Markers and Their Use In the Study of the Rare Colorado Endemic, Penstemon degeneri

Mary McAllister Biology, College of Liberal Arts and Sciences

Tabitha Ting Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Leo P. Brueederle, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Intersimple Sequence Repeats (ISSRs) are molecular markers formed from single primer PCR reactions that contain di- or trinucleotide repeat sequences. ISSRs are present throughout the genome and, therefore, amplification probability is high between adjacent anchoring regions; this technique generates many polymorphic bands that are used for evolutionary research. Penstemon is the largest endemic genus in North America, comprising a relatively high number of closely related species. The objective of our study was to adapt an ISSR protocol to research being conducted on the rare Colorado endemic Penstemon degeneri. Specifically, we are examining species limits in P. degeneri and testing the hypothesis of hybridization with its putative sister species, P. griffinii. Protocol adaptation included formulating a master mix and determining PCR conditions appropriate for this study. PCR products were separated on a 1.5% agarose gel containing EtBr, and visualized using UV light. Thus far, we have successfully amplified ISSRs and found variation within and among populations. Future work will involve screening additional primers and identifying species specific markers to address our objectives.
**Gene Expression Analysis of Bacteria Resistant to Toxic Metals**

Jason Persichetti Biology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Timbereley Roane, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research

2007-2008 UROP Award Winner

This project examined the differential expression of genes by a novel, metal-resistant Pseudomonas isolate in response to various concentrations of cadmium. This isolate, Pseudomonas S8A, is of interest due to its resistance to the toxic metals cadmium and lead at 200 ppm and 300 ppm, respectively. In addition to biosurfactant and exopolymer production, S8A may utilize uncharacterized mechanisms to mitigate the toxicity of these metals. Proteomic analysis found the expression of a previously unidentified putative cadmium resistance gene which produces a 28 kDa protein linked to cadmium exposure greater than 10 ppm. S8A was grown in a minimal salts medium amended with 0, 10, and 50 ppm of cadmium. Bacterial culture data indicates a differential response by S8A to each level of cadmium exposure. cDNA-amplified fragment length polymorphism (cDNA-AFLP) was used to identify genes that were differentially regulated during cadmium stress. RNA isolated from these samples was reverse transcribed to cDNA and subjected to a double-restriction digest. Selective amplification resulted in products representative of differentially expressed genes. Fragments were separated by polyacrylamide gel electrophoresis, and bands of interest were excised and sequenced. This information will contribute to our understanding of and use of microorganisms in bioremediation and environmental restoration.

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**TCR Affinity and the Balance Between Tumor Immunity and Peripheral Tolerance.**

Nichole Racelis Biology, College of Liberal Arts and Sciences

**Faculty Mentor:** Aimee Bernard, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research

Tyrosinase related protein 2 (TRP2) is a melanoma differentiation antigen that has been identified as a tumor associated antigen (TAA) in the mouse B16 melanoma. Despite being a self-antigen, high affinity TRP2-specific T cells are evidently not deleted in the thymus because they can be generated in the periphery following immunization with the altered TRP2 peptide epitope, DeltaV. However, this T cell response does not protect mice from tumor challenge. Data from our lab and others have shown that while higher affinity tumor specific T cells may better recognize the tumor, they also may be more susceptible to becoming anergic or deleted in the periphery. The ability to study T cells with a range of TCR affinities for TRP2 may offer insight into the balance between antitumor immunity and peripheral self tolerance. We have cloned TCRs of low, intermediate, or high affinity for TRP2. Current work involves functional analysis of the cloned TCRs using a T cell hybridoma expressing the cloned TCRs. Once the functionality of the TCRs is validated, transgenic mice expressing each of the TCRs will be made to determine how TCR affinity affects control of tumor growth.
**El Centro Humanitario Project**

**Theodore Rinehart III** History and Political Science, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Tony Robinson, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research  
**2007-2008 UROP Award Winner**

The El Centro Humanitario project is a professionally printed, full-color community-based research report, outlining the history and programs of Denver's first center dedicated to the rights of immigrant day laborers. The project combines data about the life of immigrant day laborers, factual information about El Centro and its programs, interviews with city officials and El Centro staff, and personal histories from day laborers. The project is significant because it presents for the first time the history of El Centro (a nationally recognized program) from its inception in the late 1990s to its renovation in 2007. It also provides readers with information about El Centro programs, including: the employment program, a legal clinic, the woman's program, and the financial literacy program. Some of the most powerful aspects of the El Centro project are the testimonials provided by workers. A wide variety of stories are presented, like Anna who left Mexico when she was seventeen only to be abused by coyotes while traveling to the US and exploited by her Aunt who paid her $60 a week for work in a Mexican restaurant. Anna was one of many who found assistance and solidarity in El Centro's women's program.

**Web-based Spatial Information System using Open Source Software for the Armenian Forests**

**Jesse Rozelle** Geography, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Rafael Moreno, College of Liberal Arts and Sciences

**Activity Type:** Undergraduate Research  
**2007-2008 UROP Award Winner**

The extent and condition of forest ecosystems in Armenia have decreased drastically since the disintegration of the USSR in 1991. There has not been a national inventory of the Armenian forests since 1988. Recent projects in the University of Colorado at Denver have produced new estimates of the forest cover extent and deforestation rates. There is an urgent need to disseminate this information in Armenia and abroad to support scientists, forest managers, environmental NGO's, and education institutions from K-12 to universities. Armenian organizations have very limited human, technological, and financial resources. After considering several technological alternatives to create a web-based spatial information system, we decided that Open Source Software tools have the best characteristics to address the socio-economic and technological challenges we were facing to create this system for Armenia. We present the final product and our experiences in building the system.
INFANT ATTACHMENT AND MATERNAL DEPRESSION

Andrew Sall  Psychology, College of Liberal Arts and Sciences

Daniel Lemel  Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Peter Kaplan, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

2007-2008 UROP Award Winner

Postpartum depression affects 10-15% of women (Grace et al., 2003), and having a mother with postpartum depression has been shown to increase a child’s risk of later socio-emotional and psychiatric problems. The link between maternal depression and child outcomes is likely not direct, and that maternal interactions with the child may play a key role (Sohr-Preston & Scaramella, 2006). Research has shown that maternal depression increases the likelihood of insecure attachment, which is also associated with poorer socio-emotional development and mental health in toddlers and older children. The current study examined the effect of depression on infant attachment to mothers. Infants ranging from 11-14 months were scored on attachment using the Attachment Q-set method (AQS), and items were organized into subscales to assess for specific behaviors related to attachment. In addition, mothers of the infants were assessed for level of depression. Combining these variables assists in understanding the infant-mother relationship on the basis of attachment. Results are discussed in terms of clinical applications.

EVIDENCE FOR A FACULTATIVE OUTCROSSING BREEDING SYSTEM IN PENSTEMON DEGENERI

Angela Schultz  Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Leo P. Bruederle, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Pollen-ovule ratios are an important aspect of the pollination biology of a species, and can provide insight into the breeding system of a plant. A relationship exists between the number of ovules that a plant produces relative to the amount of pollen production. Flowering plants that rely solely on outcrossing (xenogamy) involve a vector – either abiotic (non-living) or biotic (living), such as wind or insects. They produce a large volume of pollen relative to the number of ovules – resulting in a high pollen-ovule ratio – to better ensure pollination. Penstemon degeneri is a rare species found only in Colorado, and calculation of pollen-ovule ratios in this species will help us determine how the species is pollinated. Ovule counts were performed for two populations of this species. Pollen grains from these individuals are being suspended in a known solution of alcohol. Three subsets of these samples are being counted to obtain an average pollen count per flower. Pollen-ovule ratios are then determined. The ratios calculated to date range from 857-1354 demonstrating that P. degeneri is a facultatively xenogamous species – predominately xenogamous, while still capable of self-pollination. Knowing the pollination strategies of this flower may be an integral part of future conservation efforts.
**Heterozygous Loss of PIK3R1 Protects Skeletal Muscle from Inflammation and Insulin Resistance during Short-term Exposure to Hypercaloric Diet in Mice**

**Timothy Shaw** Biology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Aimee Bernard, College of Liberal Arts and Sciences

*Activity Type: Undergraduate Research*

A hypercaloric diet is detrimental to skeletal muscle insulin sensitivity via activation of inflammatory pathways associated with increased serine phosphorylation of IRS-1, reduced insulin stimulated PI3K activity and impairments in glucose transport activity. Mice with a heterozygous loss of the p85a regulatory subunit of phosphatidylinositol 3-kinase (Pik3r1) are insulin sensitive and appear to be protected from the effects of high fat feeding. We proposed that 1. attenuation of insulin signaling in skeletal muscle in response to a hypercaloric diet occurs prior to changes in bodyweight and 2. restricting p85a abundance would attenuate signals that impact the inflammatory/insulin signaling cascade to maintain insulin sensitivity in pik3r1 heterozygous (HZ) mice. HZ and wild type (WT) littermates were exposed to either a control (Con) or high fat (HF) diet. Insulin stimulated 2-deoxyglucose uptake was significantly reduced in WT-HF vs. WT-Con. Also, a complete loss of insulin-stimulated PI3K activity was observed in WT animals on HF diet. Our study provides evidence that skeletal muscle is sensitive to a hypercaloric diet prior to changes in body weight and a reduction of Pik3r1 protects against early mediators of inflammation and insulin resistance in skeletal muscle.

**Recombination Bias Characteristic: ORFs 63 and 70 in Varicella-Zoster Virus/Human Herpes Virus Type 3(HHV-3)**

**Kyle Sorensen** Biology/Psychology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. David Albeck, College of Liberal Arts and Sciences

*Activity Type: Undergraduate Research*

Recombination Bias Characteristic: ORFs 63 and 70 in Varicella-Zoster Virus/Human Herpes Virus Type 3(HHV3) Kyle Sorensen, Psychology/Biology, College of Liberal Arts and Sciences Faculty Dr. David Albeck, Psychology, College of Liberal Arts and Sciences, and Dr. Randal Cohrs, University of Colorado Denver Health Sciences Center Varicella-Zoster Virus (VZV) is an exclusively human pathogenetic virus (BSL-2) that typically causes childhood varicella (chickenpox) – a highly contagious disease. Once established, VZV remains latent in cranial, spinal and trigeminal ganglia. Reactivation of VZV typically causes zoster (shingles), attributed to decreased immunity. Shingles can cause severe psychological distress. A novel characteristic of VZV exists between diploid genes encoded by open reading frames (ORFs) 63/70. A recombination bias between ORFs 63/70 was observed in sequential propagations of virus in tissue culture cells. VZV appeared to lose its partially diploid characteristic over several infection cycles. Quantitative polymerase chain reaction (qPCR) was used to amplify ORFs 63/70. Amplified genes of 63/70 were normalized to the total number of VZV genomes present. Normalized ratios of 63/70 indicated recombination bias does exist; the genetic stability of either ORF is not equal, implying an evolutionarily adaptive function. We hypothesize; competition on a molecular level between the ORFs is a function of advantageous loci which follow the competitive exclusion principle. ORFs 63/70 are important to VZV growth and maintenance of virus latency. Greater understanding of these genes may lead to the development of better therapeutic interventions designed to mitigate disease associated with virus reactivation.
Altruistic Behavior and 2D:4D Ratio

Carrie Thomas Psychology, College of Liberal Arts and Sciences

Krystal Rains Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Kevin Everhart, College of Liberal Arts and Sciences

Activity Type: Undergraduate Research

Previous research has indicated a relationship between prenatal testosterone and the 2nd to 4th digit ratio (2D:4D) on the right hand. In addition, this relationship has been linked to normative cooperative behavior and aggression. Research has also indicated a relationship between testosterone and perceived social status. The present study combines and expands previous research by specifically exploring the relationship between the 2D:4D ratio and altruistic behavior, hostile behavioral tendencies, perceived social status and males with a family history of heart disease. A total of 216 undergraduate students from the University of Colorado Denver Campus participated in the study. Participants were asked to fill out a series of questionnaires and to have their right hand scanned for measurement purposes. Individual hand scans were matched with questionnaire data to determine if a higher 2D:4D ratio would be indicative of more altruistic behaviors and a lower 2D:4D ratio would indicate more hostile behavioral tendencies and a higher perception of their socioeconomic status and social standing. In addition, further analysis was done on males with a low 2D:4D ratio in an attempt to correlate heightened levels of hostility and a history of heart disease in their family.
**Graduate Students**

**Third World Countries Model**

**Amgad Ahmed** Civil Engineering, College Engineering

**Faculty Mentor:** Mr. Lynn Johnson, College of Engineering  
**Activity Type:** Graduate Research

The goal behind this project is to build a model which I called “Third World Countries” utilizing the concepts of geographic information system (GIS) tools, functions, analysis and apply its contents to a specific region as a case study. The case study area is Darfur; western Sudan where humanitarian crises are presents with totally absence of environmental management and basic life of infrastructure. Applying these types of wide diversity objects such as politics, socio-economic, health, education, etc... to the model will be a challenge since GIS are just more than software to analyze based on spatial data. So the questions you might ask concerning this model are how can a GIS be capable of managing all of these datasets and objects in a single model to produce optimum feasible solutions? How can sustainable development achieved with the uses of Geographic Information System? The answer to these questions is behind this project, which I will discuss through out this report. For further explanations, an example of this model would be solving the problems of poverty in Rwanda, or access to clean and healthy water in Salvador.

**Development of a Bacterial Mercury-Removal Method for Simulated Museum Materials**

**Munira Albuthi** Biology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Timbereley Roane, College of Liberal Arts and Sciences  
**Activity Type:** Graduate Research  
**2008 Outstanding RaCAS Award Winner**

The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 has created a demand for a process to remediate mercury-contaminated cultural collections that is culturally-sensitive and minimally destructive. The objective of this research is to use mercury-resistant bacteria to remove mercury from various museum materials. Results indicated that two isolates were able to successfully convert dissolved and precipitated mercuric chloride into gaseous mercury. *Arthrobacter* sp. 2604 removed up to 20% of a 13.5ppm HgCl2 starting concentration from solid agar and paper within 10 days while *Cupriavidus* metallidurans CH34 removed up to 60% of the mercury. Treatments were incubated under specific humidities in a closed chamber. Zinc sulfate heptahydrate was used to maintain an average humidity of 76%, magnesium nitrate hexahydrate averaged 60% humidity and potassium acetate averaged 25% humidity. When *Cupriavidus* metallidurans CH34 was applied to filter paper treated with 13.5 ppm HgCl2, incubation at 28oC at each of the humidities resulted in mercury removal. Results indicated that *C. metallidurans* CH34 was able to remove 73% of the mercury at 76% humidity, 85% of the mercury at 60% humidity, and 79% of the mercury at 25% humidity within a 10 day period.
THE IMPACT OF RECRUITMENT TIMING ON PARTICIPATION VARIABLES IN A PSYCHOSOCIAL INTERVENTION FOR HEAD AND NECK CANCER PATIENTS

Derek Anderson Clinical Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Kristin Kilbourn, College of Liberal Arts and Sciences

Activity Type: Graduate Research

Recruitment of medical patients into psychosocial intervention studies tends to be extremely difficult. This study was conducted to better understand how timing of recruitment differentially influences the participation of a group of patients in a psychosocial intervention. Of special interest were patients diagnosed with head and neck cancer (HNC) because this is one of the most “traumatic” forms of cancer. The focus of investigation was the impact that time of recruitment had on various participation variables (e.g., number of counseling calls). Of the 26 recently diagnosed HNC patients approached, 24 agreed to participate in the study. Of the 24 recruited, 18 had at least one telephone counseling session. We found that the number of days from recruitment to the start of treatment was associated with the number of unsuccessful counseling attempts (r = .74, p < .01) and the number of days from recruitment to the first counseling call was associated with fewer overall counseling calls (r = -.58, p < .01). Additionally, the time from initial cancer diagnosis to recruitment was associated with the number of counseling sessions (r = .56, p < .05). These findings suggest that the timing of recruitment has an impact on patient’s participation in psychosocial interventions.

IRRATIONAL HEALTH BELIEFS AND WELLNESS BEHAVIORS IN HEALTHY ADULTS

Derek Anderson Clinical Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Eric Benotsch, College of Liberal Arts and Sciences

Activity Type: Graduate Research

Previous research has documented associations between irrational health beliefs and health behaviors in patients with chronic illness (e.g., Diabetes). Few studies have examined the relationship between irrational health beliefs and wellness behaviors in healthy individuals. In the present study, an ethnically diverse sample of young adults (N = 250) completed measures assessing demographic information, irrational health beliefs, and four broad dimensions of health behavior (wellness maintenance, accident control, substance risk, traffic risk) included in the Health Behavior Checklist (Vickers et al., 1990). Five items from the Irrational Health Beliefs Scale (Christensen et al., 1999) were used to assess the tendency to make illogical assumptions concerning one’s own health. Consistent with previous research, we found older age (ρ = 0.19, p < .01) and female gender (t = 3.38, p < .01) predicted healthier behaviors. In a hierarchical regression analysis, the relationship between irrational health beliefs and health behaviors remained significant (t = -6.87, p < .01), after accounting for the influence of demographic variables. Taken as a whole, findings suggest that health-related cognitive distortions were associated with less healthy lifestyles. An implication of these findings is that it may be important to add a cognitive component to health education programs.
The Role of Cuticular Hydrocarbon Relative Abundance in the Nestmate Recognition Cue of the Pavement Ant

Nathanael Bannon Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Michael Greene, College of Liberal Arts and Sciences

Activity Type: Graduate Research

Tetramorium caespitum is an invasive species whose habitat extends from Eurasia to North America. This species is a structural pest causing damage to building foundations, sidewalks, pavement, and housing structures. Group recognition in T. caespitum is informed by cues present in cuticular hydrocarbons. The aim of my research is to synthesize information obtained from behavioral bioassays, chemical analytical methods (GC), and manipulation of Tetramorium caespitum cuticular hydrocarbon profiles in order to determine how variation in cuticular hydrocarbon compounds elicits aggressive nestmate recognition responses in the ant. My specific aims are (1) to determine how variation in the relative abundance of cuticular hydrocarbons correlates to aggression against non-nestmate ants, (2) to determine which of the approximately 24 cuticular hydrocarbon compounds on the cuticle of T. caespitum elicit nestmate recognition responses, (3) To determine what level of cuticular hydrocarbon variation elicits a “threshold” response in the ants, triggering non-nestmate aggression, and (4) To determine if cuticular hydrocarbon profiles can be altered by diet using ingestible liposomes containing exogenous cuticular hydrocarbons.

Analyzing the Visual Impact of Bark Beetle Infestations in the Rocky Mountain National Park

Mekuria Assefa Geographical Information Systems, College Engineering

Faculty Mentor: Mr. Rafael Moreno, College of Liberal Arts and Sciences

Activity Type: Graduate Research

In this study visual exposure analysis is performed from selected points such as scenic overlooks and linear features such as roads in the Rocky Mountain National Park that will support the estimation of the visual impact of current and future expansions of pine beetle infestation in the park. This information can be used to prioritize preventive and remedial actions to control the bark beetle infestation in the park. Three dimensional views from different parts of the park as well as animations (as short video clips) that can model the area more closely to the real world are created in ArcGIS (ArcScene and ArcGlobe) to aid in the estimation of the visual impact, as well as in management and educational efforts carried out by the Rocky Mountain National Park.
**SRC AND PLC GAMMA ACTIVATION IN RESPONSE TO PA, SRC BINDS PA ON PIP STRIPS & PAN P-TYR RESPONSE TO IONOPHORES AND PA**

**Ryan Bates** Biology, College of Liberal Arts and Sciences  
**Josh Snyder** Biology, College of Liberal Arts and Sciences  
**Jason Ash** Biology, College of Liberal Arts and Sciences  

**Faculty Mentor:** Dr. Bradley J. Stith, College of Liberal Arts and Sciences  

**Activity Type:** Graduate Research  

Xenopus fertilization involves sperm activation of Src which activates phospholipase C gamma (PLCgamma), which in turn produces IP3 and releases calcium. Using phosphospecific antibodies to detect activated Src, and with Western blotting Odyssey laser detection, peak Src levels were achieved ~2 min after PA addition to oocytes (with a return to basal levels by 5 min). Results with anti-phospho PLCgamma also show a peak ~2 min after PA addition and return to basal levels by 5 min. Furthermore, we have utilized “fat blots” (PIP strips) to search for any lipids that bind Src. We added extracts from 60 Xenopus oocytes to the PIP strips and with Xenopus Src antibody obtained from K.-I. Sato (Kobe University) and the Odyssey system, two initial experiments show that PA bound to Src (with PtdIns(4), PtdIns(3,4)P2, and PtdIns showing reduced binding). PS (typically used as a control lipid for PA) and all other lipids did not show any Src binding. Sperm tyrosine phosphorylation (p-tyr) response was also evaluated with exposure to PA and ionophores: Ionomycin & A23187. An anti-p-tyr antibody was used to detect all p-tyr protein bands after selected time courses. Preliminary results of the phosphorylated tyrosine response will be presented.

**STUDY OF SEM MICROSCOPE AND BIOMEMS ADVANCEMENTS**

**Sunny Bhayani** Electrical Engineering, College of Engineering  

**Faculty Mentor:** Dr. Hamid Fardi, College of Engineering  

**Activity Type:** Graduate Research  

The goal of this research is to study the SEM (Scanning Electron Microscope) which is highly useful for the observations of the MEMS (Micro Electro Mechanical Systems). The second step in research is to study the new methods used for the BioMEMS. Some of the MEMS components and devices include microreservoirs, micropumps, cantilevers, rotors, channels, valves, sensors, and other structures, which are designed for in vitro diagnostics. And this interest for the in vivo applications in growing and the industry for BIO – MEMS is also in a developing stage. The main reason for this is that MEMS can be aseptically fabricated and hermetically sealed. The biocompatibility of materials used in MEMS fabrication is being investigated. MEMS offer great potential advantages over other types of implantable systems for certain applications due to their small size scale, electrical nature, and ability to operate on short time scales. The development of retinal implants to treat blindness, neural implants for stimulation and recording from the central nervous system, and microneedles for painless vaccination are examples of applications in which features unique to MEMS, such as optical and electrical sensitivity or feature size comparable to relevant biological structures, are being leveraged for maximum impact.
**SOCIAL BEHAVIOR: CHEMICAL RECOGNITION AND SWARMING IN BATS**

**AMY ENGLERT** Biology, College of Liberal Arts and Sciences

**FACULTY MENTOR:** Dr. Michael Greene, College of Liberal Arts and Sciences

*Activity Type: Graduate Research*

Little is known about the social behavior in temperate Microchiropteran bats, especially in regards to chemical communication and autumn swarming. The purpose of this study is to use an assimilation of data from controlled and field studies to draw relationships between roosting behavior, chemical communication, and environmental conditions. Captive studies were designed to test the response of captive Tadarida brasiliensis to odors produced by conspecifics. Though bats did not respond to odors on swabs, and showed little roosting preferences for individuals within established colonies, they did show a strong preference for choosing to enter roosting pouches emitting the odors of familiar individuals as compared to neutral roosting pouches and roosting pouches emitting the odors of unfamiliar bats. Field studies were designed to gather observational data to elucidate the variations in autumn swarming behavior at one site in Garfield County, Colorado. Variations in bat activity throughout each night and the season were calculated, and correlated with environmental variables such as temperature, humidity, light intensity, and cloud cover. These data are important because there have been no previous studies of swarming behavior at this site, and they help to counter the paucity of swarming data in the Rocky Mountain region.

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**POLLINATION BIOLOGY OF THE RARE COLORADO ENDEMIC, PENSTEMON DEGENERI**

**CAROL ENGLISCH** Biology, College of Liberal Arts and Sciences

**FACULTY MENTOR:** Dr. Leo Bruederle, College of Liberal Arts and Sciences

*Activity Type: Graduate Research*

Penstemon degeneri Crosswhite (Plantaginaceae) is a rare Colorado endemic about which little is known. Because pollinators are essential for reproduction, we asked if this plant can self pollinate, do the reproductive structures mature at different times, and who are the effective pollinators? Field research confirmed that P. degeneri is capable of self pollination, but that the stigma becomes receptive after the male anthers have released their pollen. Observations on insect visitation suggest that effective pollinators include several bumblebee species in family Apidae, and mason bee species in family Megachilidae. Two Apids: Bombus centralis and B. huntii were the most abundant pollinators. A high percentage of these individuals were more than 80% faithful to P. degeneri flowers, and carried moderate to copious amounts of pollen. Megachilids were less abundant, yet two species: Osmia brevis, and Osmia penstemonis were 100% faithful to P. degeneri flowers, and a higher percentage of Megachilid individuals carried copious amounts of P. degeneri pollen. Megachilids visit fewer flowers and inflorescences per plant per visit as compared to Apids. This suggests Megachilid behavior may promote outcrossing, whereas Apid behavior may promote self pollination. Understanding the pollination biology will help guide future conservation plans regarding this rare endemic plant.
**The Predictive and Incremental Validity of the Frontal Assessment Battery (FAB) in On-road Driving Performance After Brain Injury**

**David Hargrave** Clinical Psychology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Elizabeth Allen, College of Liberal Arts and Sciences

**Activity Type:** Graduate Research

The question of fitness to drive often arises after a patient has suffered a brain injury or been diagnosed with neurological disorder. Pre-driving assessments are usually performed prior to on-road assessments but there is no uniformity as to the instruments employed. One functional domain that has been suggested to be critical to driving is executive functioning. The Frontal Assessment Battery (FAB) is a brief collection of items which seeks to measure this function. The present study utilized archival data from medical records of patients with TBI, acquired brain injury, and neurological disorders to examine the validity of the FAB to predict on-road driving assessment outcome and determine if it would uniquely predict on-road driving assessment outcome when analyzed in conjunction with the Trail Making Test Part B (TMTB). Simple logistic regression analysis showed that for every point decrease in performance on the FAB, a given patient was significantly (OR = 1.60, p < 0.001) more likely to fail the on-road driving test. In addition, the FAB uniquely and significantly contributed to the prediction of driving assessment outcome when analyzed in conjunction with the TMTB. The present study provides evidence of a novel use of the FAB.

**Wiki Technology as an Effective Knowledge Management System**

**Andrea Hester** Computer Science and Information Systems, Business School

**Faculty Mentor:** Dr. Judy Scott, Business School

**Activity Type:** Graduate Research

Knowledge Management is a key concern of organizations striving for sustained competitive advantage. Knowledge management initiatives must continually strive to overcome problems of ineffective knowledge sharing and transfer, ineffective knowledge management systems, and knowledge acquisition bottlenecks. Wiki technology is an emerging collaborative knowledge management system featuring the unique characteristics of open editing and an environment of social computing and sharing of collective wisdom. Wiki technology improves upon previous methods of conversational technologies by providing an enhanced mode of communication along with up-to-date knowledge as well as the history and revisions to the content and can provide benefits of improved work processes, improved communication and collaboration, and improved knowledge sharing. Wiki technology presents a shift from standard collaboration and knowledge management tools thus motivating the approach of viewing the technology as an innovation warranting special consideration. With organized and usable knowledge being a key ingredient to organizational success, ensuring productive creation and sharing of knowledge can be deemed advantageous for organizations. This study involves a survey of knowledge workers and their experiences with knowledge management systems. This study will advance the research encompassing Wiki technology by investigating the underlying circumstances fostering adoption, as well as increased wiki usage.
COMPUTING GREENHOUSE GAS FOOTPRINTS FOR CITIES: RESULTS FROM 8 U.S. CITIES

TIM HILLMAN Civil Engineering, College of Engineering

FACULTY MENTOR: Dr. Anu Ramaswami, College of Engineering

Activity Type: Graduate Research

This poster will describe the application of the core methods of industrial ecology—a material flow analysis (MFA) and life-cycle assessment (LCA)—in developing more holistic, demand-centered, life cycle-based greenhouse gas (GHG) inventories for eight cities in the US. The method builds upon traditional accounting of energy consumed within the city boundaries (natural gas, electricity, vehicle tailpipe emissions) by further incorporating: 1) Spatial allocation of surface and airline travel across co-located cities in larger metropolitan regions; and, 2) Life cycle assessment (LCA) to quantify the embodied energy of key urban materials—food, water, fuel and concrete. Application of this hybrid methodology to Denver, Colorado, yielded a more holistic GHG inventory that approaches a GHG footprint computation, with consistency of inclusions across spatial scale as well as convergence of city-scale per capita GHG emissions (~25 mt CO2e/person/year) with state and national data. Currently, research is underway to repeat this analysis in 7 other U.S. cities (Seattle, WA; Portland, OR; Boulder, CO; Fort Collins, CO; Arvada, CO; Austin, TX; Minneapolis, MN). The method is shown to have significant policy impacts evident in Denver’s climate action plan, which incorporates green concrete initiatives as well as promoting airline travel carbon offsets.

SUPERCONDUCTING READOUT SYSTEM, WARM ELECTRONICS, AND SOFTWARE FOR THE CRYOGENIC DARK MATTER SEARCH

BRUCE HINES Electrical Engineering, College of Engineering

KEVIN HARRIS Electrical Engineering, College of Engineering

SHILO SMITH Biology, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Martin E. Huber, College of Liberal Arts and Sciences

Activity Type: Graduate Research

The Cryogenic Dark Matter Search (CDMS) is an experiment conducted by multiple institutions with the purpose of detecting Weakly Interacting Massive Particles (WIMPs), a likely candidate for the composition of the dark matter in the universe. This experiment utilizes special detectors at ultra-low temperatures (~50 mK) and is located in a mine about a half-mile below the surface of the earth. The UCD group contributes to the superconducting readout system for these detectors and to associated room-temperature electronics. A modernized and significantly more versatile warm electronics system has been designed and fabricated at Fermilab, and is in the prototype development phase. The system is operated over Ethernet by means of LabVIEW software. We have conducted tests on this prototype to verify its specifications, isolate bugs, and measure its performance. The results of this testing, performed in the Low Temperature Physics and Superconducting Electronics Laboratory at UCD and at the University of California at Berkeley, have provided valuable data for the next version of the prototype and for the eventual warm electronics upon which the experiment depends.
Particle Clogging in Saturated Porous Media Using Light Scattering Measurements

Adam Kanold Civil Engineering, College of Engineering

Kevin Harris Electrical Engineering, College of Engineering

Faculty Mentor: Dr. David C. Mays, College of Engineering

Activity Type: Graduate Research

2008 Outstanding RaCAS Award Winner

We present a novel approach for measuring particle deposits, which cause clogging in saturated porous media, using a custom fabricated static light scattering apparatus and transparent granular media. Particle deposits between porous media in aquifers disrupt the natural flow of groundwater by reducing aquifer permeability. These deposits are measured with light scattering, which is possible because the granular media has been index matched with the carrier fluid (40% isopropanol and 60% water), minimizing multiple scattering effects caused by water-granular media interfaces. The static light scattering apparatus is a custom-built optical system that measures, with high accuracy, the intensity of scattered light as a function of scattering angle. The sample cuvette, with nanoparticles suspended in the carrier fluid, is positioned along the rotational axis of the apparatus. An optical laser beam, generated from a frequency-stabilized 633 nm Helium:Neon laser, is incident on the sample cuvette and is scattered by the nanoparticles. Following the Mie scattering, the structure of the particle deposits – expressed as a fractal dimension – is contained in the angular intensity distribution of the scattered light. By collecting the angular intensity with an imaging system around the rotational axis, particle deposition can be systematically studied.

The Study of Soil Bacteria as Signals of Metal Toxicity

Matthew Kester Biology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Timbereley Roane, College of Liberal Arts and Sciences

Activity Type: Graduate Research

Ascertaining the impact of biologically available metal on an ecosystem is a multifaceted challenge, which has become increasingly more relevant as the prevalence of metal-impacted sites has increased. Microorganisms, due to their small size and ubiquity, are especially well suited to the task of acting as biological indicators of environmental toxicity, thus providing a means to assess the impact of a metal-impacted site. This study employed cultural and molecular methods to compare the microbial profiles of known metal-impacted sites with those of unimpacted sites within the Colorado mineral belt. Metal-impacted sediments were found to have levels of metals such as Al, Cd, Co, Cu, Fe, Th, Pb and Zn at the ppb and ppm levels. Denaturing gradient gel electrophoretic (DGGE) analysis on sediment extracted DNA resulted in different banding patterns among the sediments indicative of unique bacterial identities. While the final culturable numbers from the metal-impacted sediments were comparable to the unimpacted sediments, greater diversity was apparent in the unimpacted sediments. Representative genera including Pseudomonas, Mycobacterium, and Agrobacterium spp. have been isolated from the sediments with Agrobacterium spp. unique to the metal-impacted sediments. Consistent community profiles will contribute to the identification of specific bacteria indicative of metal toxicity.
INFLUENCE OF MERCURY CONTROL TECHNOLOGIES ON THE BENEFICIAL USE OF FLY ASH

RUI LIU Civil Engineering, College Engineering

FACTOR MENTOR: Dr. Kevin L. Rens, College of Engineering

Activity Type: Graduate Research

Fly ash is a by-product of heat generation from thermal coal-fired power plants, which can replace portland cement on a one-to-one mass basis. Fly ash concrete can provide equal or superior performance up to certain replacement limits, such as improved workability, decreased water demand, reduced heat of hydration, increased ultimate strength, reduced permeability, and improved durability. Also the Greenhouse Gas (GHG) is reduced by including fly ash into the concrete. Concrete is a large contributor to urban GHG footprint due to the impact of cement in the large amounts of concrete used in the urban built environment. However, mercury regulations, such as the Clean Air Mercury Rule (CAMR), have caused power plants to change their processes and produce a fly ash that is no longer able to meet ASTM C 618 specifications. This paper summarizes the latest mercury emission control technologies and discusses the potential use of fly ash concrete derived from these technologies.
Development of Habitat Suitability Indices for Black-tailed Prairie Dog (Cynomys ludovicianus) in Colorado: An Application of Geospatial Modeling

Adel Milt MSEs Program, College of Liberal Arts and Sciences

Faculty Mentor: Dr. John W. Wyckoff, College of Liberal Arts and Sciences

Activity Type: Graduate Research

The HSI model for the black-tailed prairie dog was developed using the geospatial modeling capabilities of ArcGIS®9.2 Software and multi-criteria evaluation models. The modeling procedure was based on habitat variables that cover the most essential habitat characteristics of a species preferred habitats as described in the peer-reviewed literature and including personal contacts with species experts in Colorado. In the models, key variables that apply to the respective species are analyzed and the results are displayed on the computer monitor or printed in hardcopy format. Habitat for a species is rated from zero (unsuitable) to five (highly suitable) on the map. The variables used in the models include land cover class, elevation limits, slope, and hydrology data. GIS data of the black-tailed prairie dog colonies for the 1998 and 2000 years were used to verify the ability to accurately predict the HSI model output between the suitable habitats areas and the breeding site localities of the species. Validation of the HSI model provided evidence that the model works effectively. The HSI model provides important information for conservation biologists and land managers concerned with preserving the black-tailed prairie dog on the Comanche National Grassland, Colorado.

Computational Simulations of Metformin Binding to Activated Insulin Receptor

Phani Morisetti Chemistry, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Hai Lin, College of Liberal Arts and Sciences

Activity Type: Graduate Research
2007-2008 UROP Award Winner

Metformin is an oral drug that is used worldwide for the treatment of type 2 diabetes. The details on its action mechanism are yet to elucidate. This work uses computational simulations to investigate metformin binding to activated insulin receptor (PDB code 1R3). We hypothesize that metformin can interact with the insulin receptor at its activation loop and stabilizes the activated state. The docking calculations were done by employing the program SYBYL 7.2, which searches for the optimal binding position via genetic algorithm whose scoring function incorporates torsional, van der Waals, and electrostatic energy terms. Our results reveal a favorable binding site for metformin binding to the activation loop, where metformin H-bonds to the backbone oxygen atoms of Arg1159 and of Ptr1162 (Ptr1162 is one of the two phosphotyrosine residues in the activation loop). Furthermore, hydrophobic interaction between metformin’s methyl group and Ptr1162’s phenyl group adds to the stability.
**Low Frequency Noise Characterization of Magnetoresistive Magnetic Field Sensors**

**Teresa Osminar** Electrical Engineering, College of Engineering

**Faculty Mentor:** Dr. Hamid Fardi, College of Engineering

**Activity Type:** Graduate Research

A series of experiments are in progress on a set of Magnetoresistive Magnetic Field Sensors (MR sensors) in order to verify and corroborate the findings of a similar experiment performed in the fall of 2007. The purpose of the series of measurements is to investigate defining and standardizing the characteristics of MR sensors. Such sensors are commonly used in automotive products, magnetic encoder detection, sensing current between components within an integrated circuit board, and detecting other magnetic fields such as that which emanates from the earth’s poles. The National Institute of Standards and Technology (NIST), a division of the Department of Commerce, is researching parameters for standardizing MR sensors. Several revisions were made to the electronic circuit board with the intent of focusing the function of the circuitry on specific measurements required for characterizing MR sensors. In addition, specific attention was focused on minimizing intrinsic noise within the circuit board and its components. Results of testing with this second-generation electronic system are still under analysis. Methods and status of former and current analyses will be presented at the Research and Creative Activities Symposium.

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**An Analysis of Policy Pathways to Reduce Energy Consumption and Greenhouse Gas Emissions in Residential Buildings**

**Andrew Pattison** PhD, Graduate School of Public Affairs

**Faculty Mentor:** Dr. Anu Ramaswami, College of Engineering

**Activity Type:** Graduate Research

This study will examine the policy pathways available to reduce energy consumption and greenhouse gas emissions from buildings. This research will discuss supply side tactics as a way to reduce GHG emissions but will emphasize demand side tactics as a means to reducing both GHG emissions and energy consumption from buildings. One commonly used example of demand side tactics, typically referred to as demand side management or DSM is accomplished by increasing the energy efficiency of buildings through the use of more efficient devices. A second example of a demand side tactic is differential energy pricing. A tier rate for energy use is a progressive cost of energy based on tiers or blocks of increased energy consumption over a period of time. A third example of a demand side tactic would be the use of energy display meters. These information display devices provide home energy consumption and cost information to residents. This feedback to customers can help inform their behavior choices at home relating to energy use. My research will focus on an investigation of the effectiveness of these three demand side tactics as policy pathways to reduce energy consumption and resulting GHG emissions from the building sector.
CHILDREN’S PHYSICAL ACTIVITY AND ACTIVE COMMUTING TO SCHOOL: THE ROLE OF FAMILY MEMBERS

Stacy Salomonsen-Sautel Health and Behavioral sciences, College of Liberal Arts and Sciences

Faculty Mentor: Dr. John Brett, College of Liberal Arts and Sciences

Activity Type: Graduate Research

To reduce the risk of obesity and related chronic illnesses, children need to develop and maintain healthy lifestyles that include physical activity. Family members may assist with fostering healthy lifestyles by being physical activity role models and by creating an environment conducive to physical activity. In addition to regular forms of physical activity, active commuting to school (walking or bicycling to and from school) is an important, but frequently overlooked, source of physical activity. The following hypothesis tested the Observational Learning construct of Bandura’s Social Cognitive Theory: if family members exhibit particular characteristics (e.g., high physical activity levels) then children will be physically active. This hypothesis was tested using data from the Colorado Department of Public Health and Environment’s 2005 Behavioral Risk Factor Surveillance System and Child Health Survey. Forward multiple regressions were completed to assess the joint association of family member’s physical activity, body mass index, age, sex, education, and income on children’s physical activity and active commuting to school, while controlling for children’s characteristics. Family member’s characteristics were not related to children’s physical activity. Families with less income had children who actively commuted to school more days per week. In conclusion, the Observational Learning construct was not supported.

TRADITIONAL MASCULINE ATTITUDES, SUBSTANCE USE AND SEXUAL RISK BEHAVIOR

Anne Pentygraft Clinical Psychology, College of Liberal Arts and Sciences

Faculty Mentor: Dr. Eric Benotsch, College of Liberal Arts and Sciences

Activity Type: Graduate Research

The association between traditional masculine attitudes (TMA), substance use, and high-risk sexual activity has not been thoroughly examined. The present study examined associations between TMAs and sexual risk behavior, substance use, and psychosocial factors in 157 heterosexual men. Men expressing more TMAs had higher perceptions of power in intimate relationships (F(2,155)=3.17, p<.05) and scored higher on sensation seeking (r=0.28, p<.05). Higher expression of TMAs was also associated with higher rates of the use of alcohol (r=0.19), marijuana (r=0.18), poppers (r=0.19), ecstasy (r=0.24) and injection drugs (r=0.35), ps<.05. TMAs were associated with a greater likelihood of having sex after having too much to drink (r=0.36), having more female vaginal sex partners (r=0.25), having more female anal sex partners (r=0.17), and having more oral sex (r=0.20), ps<.05. The correlation between TMA, sexual risk behaviors, and other psychosocial factors suggests these attitudes could result in higher rates of STD transmission. Interventions could focus on enhancing the protective aspects of masculine attitudes in order to reduce high-risk behaviors, indicating a key focus point for intervention with heterosexual men. Future research should examine factors such as intergenerational attitude transmission, disease transmission rates, and possible underlying pathological patterns (e.g. substance abuse) in heterosexual men.
**College Football Games and Crime**

**Kevin Schnepel** Economics, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Daniel Rees, College of Liberal Arts and Sciences

*Activity Type:* Graduate Research

There is a great deal of anecdotal evidence that college football games can lead to aggressive and destructive behavior by fans. However, to date, no empirical study has attempted to document the magnitude of this phenomenon. We match daily data on offenses from the NIBRS to 26 Division I-A college football programs in order to estimate the relationship between college football games and crime. Our results suggest that the host community registers sharp increases in assaults, vandalism, arrests for disorderly conduct, and arrests for alcohol-related offenses on game days. Upsets are associated with the largest increases in the number of expected offenses. These estimates are discussed in the context of psychological theories of fan aggression.

**Sustainability Standards in Public Private Water Infrastructure Partnerships in Developing Countries**

**Saba Siddiki** Public Affairs, Graduate School of Public Affairs

**Faculty Mentor:** Dr. Anu Ramaswami, College of Engineering

*Activity Type:* Graduate Research

The concept of sustainability has become increasingly important in relation to development. This research adds to the discourse of sustainable development by viewing sustainable infrastructure development through Public-Private Partnerships as a pathway toward sustainability in developing countries. The focus of the research is on water infrastructure, which is a critical need in the developing world. Sustainable infrastructure development through PPPs requires a comprehensive definition against which to define and measure sustainability. My research objective is to provide metrics for sustainable water infrastructure development in the context of relevant science and technology, as well as, policy and managerial considerations. I argue that in today’s complex development environments, establishing sustainable infrastructure through public-private partnerships, necessitates an approach whereby policy makers and stakeholders must consider the following six sustainability evaluatives: Performance, Economics/Finance, Environment, Ecosystem, Social/Cultural, and Resiliency/Vulnerability.
ELECTROPHYSIOLOGY AND KINASE ACTIVATION AT FERTILIZATION

JOSHUA SNYDER Biology, College of Liberal Arts and Sciences

RYAN BATES Biology, College of Liberal Arts and Sciences

HELEN ROH Biology, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Bradley J Stith, College of Liberal Arts and Sciences

Activity Type: Graduate Research

Beginning with undergraduate projects, we study fertilization using the African Frog Xenopus laevis. At fertilization, when the sperm binds to the egg, there is a release of calcium ion inside the cell. This calcium turns on a chloride channel (like the one in cystic fibrosis) that causes a change in the electrical potential at the plasma membrane. We record the membrane potential to study how the sperm and egg combine. Our model is that a lipid, called PA, helps cause the calcium release by turning on the Src tyrosine kinase. We present data on PA activation of this kinase and also a phospholipase.

LAETOLI ANIMAL TRACKWAYS: PRESERVATION EFFORTS OF A RARE PLIOCENE ICHNOFOSSIL RECORD

BETHANY WILLIAMS Anthropology, College of Liberal Arts and Sciences

JAMIE CARPIO Anthropology, College of Liberal Arts and Sciences

FACULTY MENTOR: Dr. Charles Musiba, College of Liberal Arts and Sciences

Activity Type: Graduate Research

The Laetoli paleoanthropological site in northern Tanzania contains some spectacular trace fossils in the form of 3.56 million year old animal trackways consisting of animals, birds, and hominin footprints embedded in volcanic tuffs. Despite the importance of the animal trackways in understanding the paleoecology of Pliocene Laetoli, documentation and conservation efforts have been at a standstill since M.D. Leakey (1987:451) systematically mapped nine of the Laetoli footprint sites. The Laetoli Footprint Tuffs provide a snapshot of the Pliocene environment as well as allowing for the testing of different ecological hypotheses as animal trackways provide time-averaged paleoecological data which are important in inferring the taxonal composition of the fauna that inhabited a region. Although the volcanic ash has preserved the prints to an astounding degree, the trackways remain susceptible to erosion and other damaging factors. This preliminary study focused on documenting the animal trackways at Sites D (Locality 11) and J (Locality 10 East) with an eventual goal of documenting the Footprint Tuffs throughout the Laetoli region using systematic mapping, latex molds, and photogrammetry in order to obtain data which will be used in paleoecological research and conservation efforts.
**Neuromuscular Neutral Zones Response to Static Lumbar Flexion**

**Jimmy Youssef** Electrical Engineering, College of Engineering

**Faculty Mentor:** Dr. Moshe Siolomonow, College of Engineering

*Activity Type:* Graduate Research

The objective of this thesis was to study the effect of static lumbar flexion at moderate load on the spine’s stability. Eight preparations of in vivo feline models were subjected to 40N static loading in a series of 6 periods of 10 minutes of work spaced by 10 minutes of rest, followed by a seven hours recovery period. Electromyogram (EMG) initiation and cessation thresholds that trigger reflexive muscular activity in the multifidus muscle along with Displacement and Tension Neuromuscular Neutral Zones (NNZs) were recorded. An increase in the Displacement NNZs was observed after the static loading period followed by an exponential decrease to its normal value. Similarly, the Tension NNZs showed an increase followed by a decrease below baseline after 1 to 2 hours of recovery. A decrease in the peak MAV occurred and was then followed by an increase that exceeded baseline. No variability in the median frequency was detected throughout the recovery period. The results suggest that laxity in the ligaments and decreased reflexive muscular activity in the first 2 hours of recovery following the static loading period, leaves the spine unprotected and under risk of injury. During the remaining recovery time, a compensatory muscle activity takes over, lending an increased protection to the spine, and resulting in limited motion and muscle stiffness. Workers exposed to static loading of their spine should protect it for the first 2 hours after work since spinal stability is compromised in this period.

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**Pollination Biology of Epipactis Gigantea, the Stream Orchid, at Three Elevations in Colorado**

**Denise C Wilson** Biology, College of Liberal Arts and Sciences

**Faculty Mentor:** Dr. Leo Bruederle, College of Liberal Arts and Sciences

*Activity Type:* Graduate Research

Pollination Biology of Epipactis gigantea, the Stream Orchid, at Three Elevations in Colorado Denise C Wilson, Biology, College of Liberal Arts and Sciences Breeding system and pollination biology for the rare riparian orchid, Epipactis gigantea, (Douglas ex Hook) was studied at three Colorado sites differing in elevation: 5700 ft, 6800 ft, and 8750 ft. Overall percentages of fruit set in response to autogamy, geitonogamy, xenogamy and null experimental treatments (n=388) were compared to control group (n=171). Epipactis gigantea was observed to have a mixed-mating system with different levels of xenogamy (both natural and manipulated) and self-compatibility for each elevation. Autogamy and geitonogamy treatments produced similar fruit set levels at all three locations, and the overall percentage of successful fruit set was 32% to 39%. A sample of 559 flowers revealed that E. gigantea has a normal rate of fruit set for orchids, around 34%, but seemingly different pollination syndromes. Syrphid flies were observed pollinating these orchids at the hot springs middle elevation, but these were rarely seen at the other two sites. At the lowest elevation cold-seep, ants’ larvae laid in leaf folds attracted numerous insect predators causing incidental pollination. Pollinator limitation may cause a higher rate of facultative autogamy.
Six of the brightest local middle school students who placed in the top tier of the junior division categories at the Denver Metropolitan Science and Engineering Fair are showcasing their posters at the Symposium today. More than 270 middle and high school students from the Denver area competed at the fair in February. The College of Liberal Arts and Sciences (CLAS) sponsored the first, second, and third place junior division category awards. The student winners were invited by Interim Dean Hageman to have lunch with CLAS professors and students prior to today’s proceedings for the opportunity to learn more about what they hope to study in college, as well as discover more about the University of Colorado Denver.

**Brendan Broderick** Booth # 46
7th Grade Our Lady of Fatima Catholic School
Project: (Chemistry) Proton Exchange Membrane Fuel Cells

**Stephen Dewhurst** Booth # 48
8th Grade Most Precious Blood Catholic School
Project: (Physical Sciences) Are Magnets Affected By Temperature?

**Austin Jensen** Booth # 56
7th Grade Mackintosh Academy
Project: (Engineering) Solar Cooker

**Dirk Marshall** Booth # 58
7th Grade Cherry Creek Challenge School
Project: (Behavioral and Social Sciences) The Eyes Have It

**Luke Summar** Booth # 68
6th Grade West Jefferson Middle School
Project: (Animal Sciences) Chim-Chim-Cheree: Is a CSL as Luck as Lucky Can Be

**Katheryn Weidemann** Booth # 70
7th Grade Bromley East Charter School
Project: (Animal Sciences) The Burrowing Owl - Digging on the Path to Extinction?
WHAT IS UROP?

The Undergraduate Research Opportunities Program (UROP) enhances undergraduate education by funding students engaged in research, creative, and entrepreneurial activities in collaboration with faculty at UCDHSC, downtown Denver campus.

WHY PARTICIPATE?

Students engaged in undergraduate research:

• Integrate academic knowledge with hands-on experience
• Enhance their creativity, confidence, and communication
• Develop professional skills sought by graduates schools and employers
• Sharpen analytical and critical skills

Conducting research through UROP can be a great way to get to know faculty, researchers, graduate students, and other undergraduates who share similar academic and career interests.
The road to success begins with EXPERIENCE

EXPERIENTIAL LEARNING

- Internships
- Study Abroad
- Undergraduate Research
- Service Learning

Experiential learning activities promote professional exploration, intellectual development, cultural awareness, civic engagement and personal growth.