Brittany Atchison, '10 Northfield, MN
Majors: Politics, Ethnic Studies Sponsor: Carol Lacy-Salazar

Hunger, Poverty, Disaster and Hope:
My Internship with the UN World Food Programme in Bolivia

This presentation details the various projects and relief efforts conducted during my internship with the United Nations World Food Programme in Cochabamba, Bolivia, during the month of February, 2008.

The United Nations World Food Programme (WFP) is the largest humanitarian aid organization in the world and is the United Nations frontline agency in the fight against global hunger. WFP operations aim to save lives in refugee crises and other emergencies; improve nutrition and quality of life for the world's most vulnerable; and enable development by encouraging personal asset growth and self reliance in poor communities. Since it was founded in 1963, WFP has fed more than 1.4 billion of the world's poorest people, and has invested over $30 billion in development and emergency relief. In 2007, WFP aid assisted over 90 million people in 88 countries around the world.

Thaddeus Barry, '08 Charles City, IA
Major: Sports Management Sponsor: Carol Wightman

Un-Reality TV

The evolution of mass media and the constant display of ordinary people on television have revolutionized the programs that we now watch. Most of us question the "reality" of these programs, but we do not argue their entertainment values; this project examines the popular phenomenon of reality TV as a genre in popular culture. Specifically, it investigates the inherent plausibility and value of reality TV through an original reality TV production. By emulating current reality television shows, we sought to create a "successful" reality video production.

While researching we found that the number of reality shows had increased incredibly over the last ten years. We also discovered that these shows were in fact more popular than many traditional television shows. Our surveys suggested that people watched reality shows because they were entertaining and put ordinary people in extraordinary circumstances.

To test our theory that reality TV is far from "real," our group wrote, acted in, directed, and produced an original video production set on Cornell's campus. Our goal was to prove the assertion that the "reality" in the genre of "reality" TV is an artificial construction, for the majority of these productions are staged performances that are subject to the same scripting and editing procedures that traditional productions undergo. We plan to offer a running viewing of the video on a laptop computer while discussing our analytical conclusions regarding our own production and the genre of reality television.

Teresa M.J. Beary, '08 Lovilia, IA
Major: Chemistry
Yongbin Lee
Iowa State University
Bruce Harmon
Iowa State University Sponsor: Craig Teague

Computational Characterization of LuSb to Determine k-space Orientation

Within the local density approximation (LDA) the electronic structure of LuSb was calculated using the full potential linear augmented plane wave method in order to determine the kz coordinate of photoemission spectra from a sample of LuSb. The experimental data were visually compared with our computed electronic energy band plots and Fermi surface graphs, and a reasonable match occurred at kz = 0.95. A related computational study modeled the pressure induced phase transition of LuSb from the NaCl crystal structure to the CsCl crystal structure.

Brooke Bergantzel, '08 Council Bluffs, IA
Majors: History, Medieval and Early Modern Studies Sponsor: Christina McOmber

Self-inflicted Freedoms: Elisabetta Sirani and the Image of the Empowered Woman

The image of the female heroine in early modern art is one that varies greatly depending upon the artist portraying her. However, some of these works move beyond simple variation and into the exception. Many of these exceptions are those which show the heroine in not only a positive light, but as a woman empowered and in control of her own destiny; and these exceptions are often the work of artists who happen to be female.

As Mary Garrard has argued in her presentation of the work of Artemisia Gentileschi, women were restricted by and affected by the ideas of gender imposed upon them; therefore, their chosen topics may afford a closer glimpse into the lives of these painters. This paper will employ Garrard's methodology in an examination of the work of Elisabetta Sirani. By viewing the presentations of her subjects, we can better appreciate the woman who dared to paint them and understand how such women viewed themselves as active agents in a patriarchal world. This paper represents a portion of a larger study addressing the woman artist in the early modern era.

Nicholas Berry, '08 Swisher, IA
Major: Economics and Business Sponsor: Todd Knoop

Effects of World Oil Production on the U.S. Dollar/Euro Exchange Rate

Since the euro debuted, the value of the dollar has had a varied history in the world market. This presentation examines work in progress on a study of how world oil production affects the U.S. dollar's exchange rate. In my work I have pegged the dollar against the euro for statistical ease, each month from 2001 through fall 2007. By controlling for general determinants of exchange rates I have examined the marginal effects of world oil production on this exchange rate.

The presentation first looks at reasons why this type of analysis may be useful and to whom, and then looks through a brief literature review of material similar to this topic. A discussion of statistical methods and results will follow. Finally, implications of current results and directions of further research will be presented.

Lucy A. Boone, '08 Norman, OK
Major: Art Sponsor: Christina McOmber

The Saint and the Sinner:
The Ideology of Jean, duc de Berry as Understood by the Limbourg Brothers

The work of the early fifteenth-century artists collectively called "the Limbourg Brothers" is neither unknown to scholars of medieval history nor fully understood by them. Their first illuminated book of hours, the *Belles Heures*, was presented to Jean, Duc de Berry. In this book, we find an unusual and prominent portrayal of Saint Catherine of Alexandria. This popular medieval saint, whose image typically appealed to nuns and young women, does not appear to be an appropriate exemplar for a powerful male patron. Yet her portrayal cannot have been unintentional.

The cycle's inclusion and manner of depiction are products of both the artists and the patron. Although art historians have not ignored this book entirely, it has not received the same depth of analysis as the later *Très Riches Heures*. Jonathan Alexander recently challenged Erwin Panofsky's interpretation of the latter book as a "purely descriptive presentation of labor and leisure." Instead, Alexander argues that the images reflect the ideology of the patron, and this scholar's approach can be applied to the Catherine cycle of the *Belles Heures*. By comparing the cycles of a few other saints in the book to that of Catherine, we shall see how the Limbourgs tailored the work to the Duke through the themes of scholarship and temptation as well as the power of the mind over the body.

Kaleigh Boysen, '08 Murrieta, CA
Major: Elementary Education Sponsor: Stephanie Mackler

Empowering Minority Students: Lessons from Chicago and Beyond

After completing my student teaching in a second and third grade classroom in an inner-city elementary school in Chicago, Illinois, I developed many questions about the complexities of teaching poor, urban minority students. Through qualitative research, I discovered the importance of engaging in honest, open dialogue and establishing connections with parents in the community in order to gain students' trust and advocate for their success. In addition to my qualitative research, my experience in Chicago inspired me to examine the topic of urban education further through an independent study in which I researched alternative education methods through the lens of urban teaching. This study led me to create a syllabus for a college course on urban education that would sufficiently address the skills and knowledge required to succeed as a teacher in inner-city schools. Through a review of relevant literature and my own experiences, this presentation explores the challenges of urban school systems as well as strategies for empowering underprivileged students in primary grades to succeed in school by equipping future teachers with knowledge of the specific needs of urban students.

Leah Clemente, '09 Ripon, WI
Major: Sociology Sponsor: Aparna Thomas

Malnutrition in India: A White American's Perspective

When 13 other students and I chose to spend almost five months abroad in the ACM India Studies program, we did so for similar reasons, to challenge ourselves, to assess our individual coping skills, our potential for growth, and to see how much applied of what all of us only knew from the likes of books and movies. I hoped, more specifically, to deepen my understanding of patriarchy and its subordination of women and children in the environment of a "developing" country—awakening what one professor described as, a third-world mentality residing within a first-world infrastructure. Upon arriving in Pune, I therefore had the skeleton in place; now I needed the entrails, the meat to every bone and the flavor to every meal.

My paper, though grounded in research, derives from a real-world experience, beginning with the day a beggar tossed a starved, dead baby in my lap. Realizing emotional limits, but forever marked by the early experience, questions regarding malnutrition in the slums continued to assert themselves. Today, about 29% of India's population suffers from malnutrition, over half of that population being under five years of age. As a result, after briefly describing the ups and downs of defining my topic—a voyage which itself reveals a side of India no researcher should ever overlook—my paper explains how my readings and desires brought me into contact with the NGO, Uplift, an opportunity which allowed me to study my chosen topic first hand. Using the definition of malnutrition as a basis, my paper goes on to describe malnutrition's effects on women and children in the slums. Thanks to the strengths and benefits of NGO work, I began to uncover efforts in place to counteract the growing problem. In addition I will also discuss the work of Uplift within the context of other grassroots organizations while briefly considering the

likelihood of a future, malnutrition-free India. In the end I conclude that malnutrition is but a fragmented edge piece of the complex puzzle I have learned to comprehend as *India*. It is my belief that solutions to malnutrition cannot be isolated but must seek to penetrate the core of millennia-old cultural prescriptions and proscriptions, highlighting most specifically, the institutional subordination of women and children.

Adam Culberson, '08 Montevallo, AL
Major: Physics
Lucas Jorgensen, '08 Sioux City, IA
Majors: Physics, Economics and Business Sponsor: Derin Sherman

Wireless Power Transmission Using Magnetic Resonance

We experimented with wireless power transmission. Using copper coils, power can be transmitted several feet in all directions efficiently. A pair of coils will exchange energy while having little effect on other objects around them. Our project builds off the ideas of Nikola Tesla and a research team at MIT. This research may one day lead to laptops, cell phones, and other devices being powered wirelessly.

Garrett Feddersen, '08 Ida Grove, IA
Majors: Biochemistry and Molecular Biology, Politics
Jeffrey Cardon, Ph.D.
Cornell College Sponsor: Jeffrey Cardon

Use of Denaturing Gradient Gel Electrophoresis in Unknown Bacterial Identification

Denaturing gradient gel electrophoresis (DGGE) is a technique that has been used to estimate the diversity in bacterial samples based on the melting behaviors of DNA segments. DGGE may provide a new, more efficient manner to identify unknown bacteria, as current processes to identify unknown bacteria are time consuming and costly. The unknown bacterial PCR products of similar molecular weight but different base pair sequences are separated by the denaturing gradient. Different bacterial strains appear to form unique banding patterns when the DNA is amplified with multiple primer sets; this may eventually allow unknown bacteria to be identified solely by DGGE and comparison to a database.

Kate Freund, '10 Chicago, IL
Major: Special Studies Sponsor: Stephanie Mackler

Alternative Education: Comparing Montessori, Waldorf and Reggio

This year I undertook an independent study that researched Montessori, Waldorf and Reggio schools. These three styles of school represent alternatives to traditional public schooling. Many children come out of the public school system with very negative memories of their time there, and consequently have a great dislike for learning. I am interested in alternatives to the public school system because I feel that they create children who are lifelong learners, and that they make the educational process much more personal and meaningful than public school does. Montessori, Waldorf and Reggio schools are worth studying because they provide three unique alternatives to the problem of public school.

My final paper for my independent study compared these three schools, and argued that Montessori emphasizes the individual's intellect, Waldorf emphasizes the child's soul, and Reggio emphasizes the community. To come to this conclusion, I studied a variety of factors, ranging from instructional materials and classroom freedom to spiritual philosophy and the interactions between parents, teachers and students. I feel that my findings are relevant to all who are interested in improving the educational process – students, parents and teachers alike.

Dana Friend, '09 Centennial, CO
Major: Geology Sponsor: Benjamin Greenstein

**Skeletal Morphology of the Genus *Millepora*
Displays Phenotypic Plasticity**

The genus *Millepora*, commonly known as fire coral, is a calcareous hydrozoan common in tropical seas worldwide. In the western Atlantic, there exist two prominent morphologies that are presently being classified as separate species. *Millepora alcicornis* is defined by thin nodular branches; *Millepora complanata* has plate like, smooth blades. However, recent genetic data suggest that the separate morphologies exist because of phenotypic plasticity, and that two genetically isolated clades (including an intermediate form) cannot be distinguished from one another morphologically. Quantitative analysis of coral colony microstructure using thin sections, suggests that it is possible to differentiate between *M alcicornis*, *M complanata*, and the intermediate form from each other morphometrically. However, the distinctions aren't matched by the genetic data, indicating that current described species of Milleporids in the tropical Western Atlantic are not genetically isolated.

Fadzai Fungura, '10 Buhera, Zimbabwe
Majors: Mathematics, Physics Sponsors: Stephen Bean and James Freeman

Unfolding a Three Dimensional Sierpinski Gasket

Many mathematicians and scientists have tried to visualize four dimensional space. I tried to visualize a four dimensional sierpinski pyramid and construct a three dimensional projection of the four dimensional pyramid. I first worked on understanding how a three dimensional sierpinski pyramid is constructed and then I unfolded it into two dimensions to help me visualize how to take a four dimensional one into a lower dimension. I came up with several different ways of unfolding single pyramids and used these to unfold different levels of the pyramid. Using clay and sticks and Illustrator in the multimedia studio, I was able to show that a level two pyramid could be unwrapped into the plane, but the level three pyramid could not be symmetrically unwrapped into the plane without overlap. My result had interesting implications for understanding the 4 dimensional sierpinski pyramid. It is possible that 3-D representations of the 3 dimensional sierpinski pyramid would entail intersections, making them very difficult to interpret. This can be focused in future studies.

John R. Gammons, '08 Beaverton, OR
Majors: Biochemistry and Molecular Biology, Environmental Studies
Heather J. Axen, '06
Jessica Harrison, '05
Marty Condon, Ph.D.
Cornell College Sponsor: Marty Condon

Two mtDNA Lineages in *Strauzia longipennis* (Diptera: Tephritidae)

Strauzia longipennis (Wiedemann) is a notoriously variable species. Seven varieties were once recognized, all but three considered as synonyms by some authors. Other authors, based on host records, elevated two sympatric varieties to full species status. Such taxonomic instability, particularly when associated with variable patterns of host use, suggests that *S. longipennis* may represent a dynamic complex of host-associated populations in the process of divergence. To detect evidence of genetic differentiation within populations of *S. longipennis*, we sequenced a fragment of cytochrome oxidase subunit I of mitochondrial DNA of *S. longipennis* from two sites in eastern Iowa. At each site, we found two genetically and morphologically distinct sympatric populations: one corresponds to descriptions of *S. longipennis* var. *typica* (Loew); the other corresponds to *S. longipennis* var. *vittigera* (Loew). Our observations suggest that some gene flow occurs between these divergent sympatric populations, which might represent host-races or incipient host-races.

Jada Hallengren, '08 Estherville, IA
Majors: Biochemistry and Molecular Biology, Psychology
Christopher Davids, '10 Louisville, CO
Majors: Psychology, Spanish
Lindsey Carter, '09 North Liberty, IA
Major: Psychology
David Kugler, '09 Gering, NE
Majors: Psychology, Sociology
Katherine Read, '09 Cedar Rapids, IA
Major: Psychology
Amanda Jepson, '09 Wayland, IA
Major: Kinesiology Sponsor: Melinda Green

Eating Disorders and Depression: Comorbidity Revisited

Existing literature fails to comprehensively identify factors contributing to the comorbid relationship between eating disorders and unipolar depression. Maladaptive social comparison, body dissatisfaction, and low self-esteem are disruptive psychological patterns common to both diagnoses. It is unclear whether a unique relationship exists between depression and eating disorders beyond the effects exerted by this negative cognitive triad. The purpose of the present study is to examine whether a unique relationship exists between depression and eating disorders after controlling for maladaptive social comparison, body dissatisfaction, and low self-esteem. We predict minimal unique variance in eating disorders will be explained by depression after controlling for this negative cognitive triad.

Ewan Hamilton, '09 Iowa City, IA
Major: Biology
Heath Sienknecht, '08 Clutier, IA
Major: Biology
Charissa Kaspar, '08 Buffalo, NY
Majors: Biology, English
Ian McNish, '09 Sun Prairie, WI
Major: Biology
Joseph Eneboe, '08 Onawa, IA
Majors: Biology, Philosophy Sponsors: Robert Black and S. Andrew McCollum

Using Artificial Nests: Patterns and Prevention of Turtle Nest Depredation

This study was part of a long-term research program on the ecology of the ornate box turtle (*Terrapene ornata ornata*). Previous research revealed that predation on eggs is a major source of mortality in these turtles. We used artificial nests to document spatial patterns of depredation and examine the cues that predators use to locate nests. We also investigated the potential of hot pepper powder as a predator deterrent.

We conducted experiments in June, July and August, at two sites in Johnson County, Iowa. We constructed blocks of experimental nests along transects running from the edge toward the center of the sand prairie habitat, where ornate box turtles commonly nest. Each block contained four treatments, which varied in their contents, construction, and marking. The fate of each nest was monitored for one month. We compared patterns of predation among treatments, locations, and sites.

Treatments in which we dug a nest hole were almost all excavated by predators, while treatments with no disturbed soil were untouched. There were no statistically significant differences in depredation among treatments with disturbed soil.

In a second experiment, we investigated whether or not turtle nests could be protected from depredation with a capsicum pepper product (Squirrel Away). A grid of 100 artificial nests was constructed, and 50% of the nests were topped with a tablespoon of Squirrel Away. The fate of each nest was then monitored for several weeks. Squirrel Away had no effect on turtle nest predators, and is not a viable deterrent.

S. Leigh Heathcote, '09 Whitefish Bay, WI
Majors: Biochemistry and Molecular Biology, Chemistry
J. S. Josan
University of Arizona
J. Vagner
University of Arizona
L. Xu
University of Arizona
R.J. Gillies
University of Arizona
V. J. Hruby
University of Arizona Sponsor: Jeffrey Cardon

Targeting Cancer Cell Surfaces with Heteromultivalent Ligands

Multivalent ligands display multiple copies of one or more ligands that can simultaneously bind to multiple receptors contained on another entity. By combining multiple ligands into a multivalent construct, it should be possible to target them specifically to cancer cells that express all of their cognate receptors. These heteromultivalent ligands will have low binding affinities for normal cells which may express some but not all cognate receptors, permitting a high degree of specificity in targeting cancer cells. Based on the previous work done in the Hruby group, heterobivalent ligands, which contain one copy each of a melanocortin ligand and a cholecystokinin ligand, and with a combination of strong and weak ligands were synthesized. CCK(8) has a strong binding affinity to the human cholecystokinin-2 receptor, whereas MSH(4) has a weak binding affinity for the human melanocortin-4 receptor. As a proof-of-principle, heterobivalent ligands containing a weak MSH agonist or antagonist and a strong CCK(8) epitope were synthesized using Nα-Fmoc solid phase peptide synthesis and a Tentagel Rink amide resin. If these molecules bind to cells with both melanocortin and CCK receptors up to

1000 times more frequently than to cells expressing only one, it suggests that heterobivalent ligands could be specifically targeted to a combination of receptors. Potentially, these ligands could then further be modified for diagnostic and therapeutic purposes.

Elizabeth Hlibichuk, '08 Mount Vernon, IA
Major: Psychology Sponsor: Carolyn Zerbe Enns

Caring for the Elderly: The Risks, Stress, and Pain of Caregiver Burden

The typical lifespan of adults is extending into an age range when dementia disorders are likely to appear, and it has become increasingly likely that a person will be thrust into a position that involves caring for an elderly parent or demented spouse. This change in role is stressful for the new caregiver, creating a situation called "caregiver burden." This situation can be extremely risky for the caregiver, putting him or her at an increased risk for cardiovascular disease, anxiety disorders, or depression.

Research suggests that all caregivers will experience at least some burden during their time as caregivers. Even when care recipients only have mild cognitive disorders, caregivers often experience significant risk for psychological and physical distress. Certain personality traits are related to higher risk for caregiver burden, including family closeness, support, and cultural opinions about the elderly.

Treatment options and therapies are still being explored by researchers, and there is some indication which treatments are ineffective, including music therapy and holistic relaxation therapy. Therapies that are currently considered effective include networking therapy and support therapy, but all therapy types are still under scrutiny.

Many caregivers are hostile to the notion that they might be having problems, and may resist the idea that their current ailments could be related to the health of their loved ones. Caregivers tend to feel that it is a duty and tend to be unwilling to consider other care options that might be associated with fewer health-related risks.

Elise Hogue, '09 Bend, OR
Major: Spanish Sponsor: Carol Lacy-Salazar

**El logro de la memoria argentina:
Haciendo frente al terrorismo del Estado de la última dictadura militar argentina
(The Achievement of Argentine Memory:
Coping with State Terrorism of the Last Argentine Military Dictatorship)**

My paper confronts the ways in which the Argentine people have chosen to cope with the atrocities committed against them by the government during the last military dictatorship, which racked the nation with fear and clandestine violence from 1976-1983. Since the end of those dark years, the Argentine public has established and put into action three main pillars of overall

justice: criminalization of all disappearances, murders, and torture; commemoration of the victims; and a specific form of protest. I argue that these components formulate a comprehensive plan to preserve memory and guarantee justice, and they allow the people to face the atrocious crimes of their shared history. I include a brief history of Argentina's recent turbulent past, followed by an explanation of the shared experiences that have created a profound link between all Argentines, and I then relate the specific ways in which the nation is carrying out the three pillars of justice. The majority of my information is drawn from Argentine newspaper articles from the last five years, so all citations represent a very current view.

Kristin Jauch, '09 Castle Rock, CO
Major: Psychology Sponsor: Robert Givens

The French Revolution and Marie Antoinette's Demise

During the French Revolution, Marie Antoinette was often portrayed as a vindictive and flirtatious harpy who was actively responsible for the fall of the French royal family. The French people viewed their queen as a "spy-whore" intent on ruining France and the Revolution from within. Most of the "evidence" against her that led to her eventual execution, however, was based on pure rumor that was fueled by anti-monarchy propaganda found in *libelles,* newspapers, and pamphlets. Scandalous events, such as the still infamous Diamond Necklace Affair, gave rise to the negative ideas about the queen. Marie Antoinette's public behavior and complete disregard for the royal traditions of France did nothing to boost public opinion of her. Even today questions surrounding this once prominent figure are left unanswered: Who was the real Marie Antoinette? What really led to her demise? Does contemporary pop-culture portray her accurately? Primary sources that are both sympathetic and unsympathetic toward the queen are weighed to answer these questions. This presentation attempts to show Marie Antoinette in a more accurate light. It also shows that neither Marie Antoinette nor the French people can be held completely responsible for her down fall. This presentation also looks at modern interpretations of Marie Antoinette in films such as Sofia Coppola's 2006 *Marie Antoinette.* By looking all of these sources, the true circumstances behind Marie Antoinette's demise and her role in the French Revolution can be seen.

Amanda J. Jepson, '09 Wayland, IA
Major: Kinesiology
Emily Decker, '07
Julia Moffitt, Ph.D.
Cornell College Sponsor: Steven DeVries

Acute Moderate Sleep Deprivation Attenuates Physiological and Psychological Function at Rest and During Exercise

Previous research indicates that total sleep deprivation may elicit a number of physiological and psychological deficits including mood disturbance and autonomic imbalance. Little is known regarding the effects of a single night of moderate sleep loss, a much more common occurrence.

The aim of this study was to determine the effects of acute moderate sleep deprivation (AMSD) on resting heart rate variability (HRV) and mood, as well as heart rate (HR), oxygen consumption (VO_2), peripheral blood lactate and subjects' ratings of perceived exertion (RPE) during steady state exercise. Thirteen healthy male subjects (age: 20$\pm$0.25 years; peak VO_2:=52.0$\pm$ 2.7 ml/kg/min) gave informed, written consent and underwent initial testing to determine peak VO_2 on a calibrated cycle ergometer. Following the AMSD (2-4 hours of sleep) or rested (8-10 hours of sleep) state, subjects completed submaximal exercise tests. Prior to the sub-maximal tests, subjects were administered the Profile of Mood States (POMS) inventory and resting heart rate variability (HRV) was recorded from a lead II ECG for 30 minutes. Submaximal exercise tests were completed at 40% (low workload) and 70% (high workload) of peak VO_2. Heart rate, VO_2, RPE and blood lactate was recorded during steady state levels (4-6 minutes) at each stage. Data were statistically analyzed using paired t-test with significance set at $p < 0.05$. Following AMSD, baseline HRV was significantly reduced (118$\pm$10.2 vs. 103$\pm$8.7 ms). Significantly elevated POMS scores of tension, anger, and fatigue contributed to a significant increase in the total mood disturbance score (2.5$\pm$5.6 vs. 24.2$\pm$7.8). Exercise HR was significantly higher during both the low (122$\pm$2.8 vs. 132$\pm$2.5 bpm) and high (161$\pm$2.9 vs. 171$\pm$2.5 bpm) workloads following AMSD as compared to the rested state. Although blood lactate was significantly greater during the high workload following AMSD (7.5$\pm$0.7 vs. 9.4$\pm$0.7mmol/L) no significant differences were found between VO_2, RPE, and blood lactate at any other workload following AMSD. These results indicate that AMSD elicits autonomic imbalance and impairments in both physiological and psychological function at rest and during exercise.

Amanda J. Jepson, '09 Wayland, IA
Major: Kinesiology
Nate Olafsen, '08 Monona, IA
Major: Biochemistry and Molecular Biology Sponsor: Barbara Christie-Pope

Operation Walk: Peru

Operation Walk is a nonprofit organization that provides free hip and knee replacement surgeries to patients in underdeveloped countries. Each year, Cornell students have the opportunity to travel with Operation Walk and founder Dr. Larry Dorr ('63) to assist with every aspect of the surgery process. Students gain first-hand experiences through patient screening, working alongside anesthesiologists, observing and scrubbing in for surgeries, assisting the nursing staff, and working with the physical therapists during the recovery process. We will reflect on our experiences with Operation Walk, and how we have benefited from these experiences.

Jessica Jones, '08 Kansas City, MO
Major: English Sponsor: Shannon Reed

Things Unattempted Yet in Style or Subject: An Exploration of Milton's *Paradise Lost* as a Multi-Genre Masterpiece and Satan's Role within It

When reading the timeless verse of John Milton's *Paradise Lost*, perhaps the most illustrious poem in the English language, questions arise as to whether it is truly an epic poem. Many aspects of a traditional tragic drama are prevalent within *Paradise Lost*, while many common aspects of an epic are absent — most notably the lack of a defined hero. This raises questions as to which genre the tale truly belongs to, and if it is necessary for it to belong to any certain genre at all. By examining *Paradise Lost* structurally, the evidence shows that the strong presence of the classic dramatic features such as the soliloquy and its origins as a theatrical play aid in investigating the piece as a drama, while its narrative style and overall characteristics fit the description of a traditional epic. However, the most important and intriguing aspect of the genre debate for *Paradise Lost* occurs within the characterization of Satan. In looking at several definitions of what a true epic hero is, and in contrast to what a traditional tragic hero is, the result is that Satan's characterization (featuring a fall due to pride, an encouraged vice in definition) makes him the perfect embodiment of the tragic epic hero. Since Satan embodies the qualities of a tragic hero, we can argue that *Paradise Lost* is a tragic drama presented as an epic poem.

Lucas Jorgensen, '08 Sioux City, IA
Major: Physics, Economics and Business Sponsors: Kara Beauchamp and Leon Tabak

Importing, Organizing, and Analyzing Wind Data

My work took previously gathered wind speed, direction, temperature, and pressure data collected in the Mount Vernon area and input it into a database. I then published that database on the internet. The data was collected and stored in a proprietary format which then needed to be translated. A part of our summer was dedicated to the incorporation of tools used to analyze data. These tools included everything from calculating long-term averages to drawing graphs of the data. I used the Java language developed by Sun Microsystems to manipulate the data and then publish our results on the internet.

Sheila Jung, '08 Mount Vernon, IA
Major: Art Sponsor: Christina McOmber

Confronting the Mirror: Leibovitz, Goldin, and Sherman

In confronting the mirror in their photographs, contemporary women artists have addressed the boundaries that have historically limited women to over-sexualization or objectification. These artists have not only confronted the mirror but also the male gaze. Laura Mulvey explains the male gaze as "woman as image or spectacle", and man as the "bearer of the look" in her

"Narrative Cinema and Visual Pleasure." This means that historically, men have been active agents in looking, while the female is expected to remain passive. John Berger simplifies the concept of the male gaze by writing, "Men act and women appear. Men look at women. Women watch themselves being looked at."

The male gaze plays a central role in some of the work Annie Leibovitz, Nan Goldin, and Cindy Sherman. Through their photographs these women have opened up a dialogue about the male gaze and developed a different method of negotiating the female image. Leibovitz's *Self-portrait* of 1991 disputes the standard presentation of women, as she stands bare-breasted in front of a bathroom mirror and holds firm to her camera. Goldin's *Self-portrait* also appears in a mirror. She documents herself, battered and bruised, and the mirror is unapologetic in its reflection. Sherman, with her *Film Still # 13*, confronts stereotypes about women and femininity and exposes their deceptive nature. These women photographers, in confronting the mirror and the image of woman as object, have also confronted the male gaze.

Julia Kamenetzky, '08 Bettendorf, IA
Major: Physics Sponsor: Kara Beauchamp

SPIFI Submillimeter Astronomy and the Carina Nebula

The submillimeter wavelength band of the electromagnetic spectrum is the last unexplored territory of ground-based astronomy. This summer, I worked with the Submillimeter Astrophysics Group at Cornell University, under the direction of Professor Gordon Stacey, as part of the National Science Foundation Research Experience for Undergraduates (REU) program. I will first present a brief overview of submillimeter astronomy and the unique challenges posed by observing a wavelength that is minimally transmitted through the atmosphere. Next, I will introduce the two instruments used by the Submillimeter Group, the South Pole Imaging Fabry-Perot Interferometer (SPIFI) and the High-Redshift (Z) Early Universe Spectrometer (ZEUS). Finally, I will discuss the fantastic star forming region known as the Carina Nebula, which was the focus of my study over the summer. We were working on creating a full map of the nebula in the first ground-based observation of the 205 micron [NII] spectral line. The ratios of this line to other previous published submillimeter lines provide valuable information regarding the density, structure, and relative chemical abundance of the star forming region.

Julia Kamenetzky, '08 Bettendorf, IA
Major: Physics Sponsor: Derin Sherman

Detection of Extrasolar Planets

Amateur astronomers are making great contributions to the detection and monitoring of extrasolar planets, which are planets orbiting stars other than our own sun. With a moderately sized telescope and commercially available CCD camera, it is possible to detect the periodic 1% drop in a star's brightness caused by a planet crossing in front of its star. Despite the frigid

February weather, I have attempted to detect such planets by using the Meade 16" telescope at the new Eastern Iowa Observatory and Learning Center, part of the Cedar Amateur Astronomer's Palisades-Dows Observatory. I have used differential photometry to analyze the CCD images, produce precise light curves, and model the planet's orbital parameters and size.

Antonia E. Krupicka, '08 Niobrara, NE
Majors: Psychology, Sociology Sponsor: Erin Davis

Association between Family Structure and Alcohol/Cigarette Use Among Adolescents

A review of current research regarding adolescent alcohol and cigarette use and family structure was conducted. The current research states a higher likelihood of substance use in adolescents in non-traditional family structures. It is hypothesized in this study that non-traditional family structure will not have an effect on alcohol and/or cigarette use among adolescents but that there will be an association between the types of interactions between adolescents and their parent/s and alcohol and/or cigarette use. The study analyzed data from the *Monitoring the Future: A Continuing Study of American Youth Study* conducted in 2006. There was a significance found between familial fighting and if the adolescent had siblings or not and cigarette use. Overall, the study did not support the current research on the topic and found no significance between non-traditional family structure and adolescent alcohol and cigarette use. These findings are noteworthy and may provide a starting point for further research.

Rachel Leach '08 Boulder, CO
Major: Elementary Education, Spanish Sponsor: Gayle Luck

"She Looks Like English-Only": A Caucasian Teacher's Experience as "The Other" in a Mexican-American Classroom

A Caucasian teacher occupies a unique position within a classroom composed entirely of Mexican-American students. The issue of ethnicity, while often not overtly apparent, has implications that extend to all aspects of the classroom environment. This research draws upon examples from a classroom in which Latino students seemed reluctant to bring elements of Mexican culture, including Spanish language, into the classroom setting. This paper explores the effects that the presence of a member of the dominant culture may have on students' willingness to share elements of their subordinate culture within the classroom.

Sean Lehman, '10 Nevada, IA
Majors: Biochemistry and Molecular Biology, Integrated Psychosocial Theory
Emmanuel Koli, '08 Accra, Ghana
Major: Biochemistry and Molecular Biology Sponsor: Cynthia Strong

In Vitro Mutagenesis and Metal-Binding Studies of Human Copper-Zinc Superoxide Dismutase

Amyotrophic lateral sclerosis (ALS), more commonly known as Lou Gehrig's disease, is a neurodegenerative disease that usually causes eventual respiratory failure due to motor neuron death. Approximately 90% of all ALS cases are classified as sporadic ALS, meaning that there is no known cause. The remaining 10% of cases are classified as familial ALS, and of these, 2% have been linked to the gene for SOD1. This gene encodes the copper-zinc superoxide dismutase protein, an antioxidant enzyme which catalyzes the reduction of the superoxide radical (O_2^-) to hydrogen peroxide, which can then be further broken down into water and diatomic oxygen via hydrogen peroxidases. *In vivo*, metals bound to the wild-type protein are the catalyst for the reduction of superoxide, but certain mutants exhibit different metal-binding properties. In our experiments, we explored these properties through a variety of applications. We produced the human wild-type, A4V and G93A mutants in the bacterium *E. coli*, and then purified the proteins using phenyl-sepharose hydrophobic interaction column chromatography and DEAE Sephadex ion exchange chromatography. Metals were removed from SOD1 via IDA-Sepharose ion exchange column chromatography, as well as by the standard EDTA dialysis method. The protein demetallated by the EDTA dialysis method was later remetallated, and a spectroscopic analysis performed. *In vitro* mutagenesis was performed to create the D101N and L38V mutants of SOD1. The L38V mutant was then sequenced to confirm that the correct amino acid change took place.

Peter Lehr, '08 West Des Moines, IA
Major: Biochemistry and Molecular Biology
Pavla Brachova, '09 Ames, IA
Major: Biology
Dana Friend, '09 Centennial, CO
Major: Geology
Benjamin Greenstein, Ph.D.
Cornell College
Robert Black, Ph.D.
Cornell College
Craig Tepper, Ph.D.
Cornell College Sponsor: Craig Tepper

Speciation in the *Millepora* Complex: What Constitutes a Species?

Fire coral from the genus *Millepora* are ubiquitous in tropical western Atlantic reefs. Two distinct morphologies of *Millepora*, currently classified as separate species, exist off the coast of the Bahamas. *M. complanata* have broad, smooth blades and prefer shallow waters whereas *M.*

alcicornis have knobby branches and prefer deeper waters. After an intermediate morphology was discovered, the question arose as to whether these different morphologies represent different species or whether the differences result from ecophenotypic plasticity. Reef survey analyses have revealed the appearance of both the branching and blade morphs at the same depth at some reef locations. The occurrence of these two forms in mutual proximity supports the contention that morphologic variation of this genus is not primarily a response of a single species to environmental differences and suggests that they possess distinct genetic differences. Quantitative analysis of coral colony microstructure suggests that it is possible to differentiate the forms.

DNA was collected from all morphs and the internal transcribed spacer regions (ITS) of rDNA were examined. All PCR amplification products of the rDNA ITS regions contained DNA fragments at approximately 824 bp regardless of species or reef location. DNA sequence analysis showed specific differences in nucleotide sequence between Milleporid specimens at five identical nucleotide positions at for all samples. These single nucleotide polymorphisms (SNPs) fit into two separate groups or clades. Each clade is independent of depth, reef location or morphology. This suggests that Milleporids may be reproductively isolated cryptic species, and that traditional features used for classification may be of little value.

Beth Lueck, '08 Westminster, CO
Major: English Sponsor: Devan Baty

Une Voix Forte pour Une Femme Idéale:
A discussion of feminine representations in George Sand's *La Petite Fadette*

In 1849 the ideal French woman was often depicted in the artwork of the recent Impressionist movement as beautiful, idolized, and silent. In that same year George Sand's work *La Petite Fadette* presented an alternative image of a woman; one who was strong and intelligent. La petite Fadette is a multi-faceted character who both embodies traditional female roles and puts them into question, most notably the role of beauty. However, through these critiques and representations one must question whether Sand is truly liberating women from traditional roles, or reaffirming the belief that it will always be the beautiful who are most accepted in society. Regardless, Sand illustrates that an ideal woman should not be one put upon a pedestal, but instead an intelligent woman worthy of a voice, a voice which she gives.

Udai Malhotra, '09 New York, NY
Majors: Sociology, History Sponsor: Richard Thomas

Justice Denied: The ACLU during World War II

The American Civil Liberties Union had formed during World War I, quickly establishing itself as the premier group dedicated to protecting constitutional rights and civil liberties in this country. At this same time, with the onset of World War II and for a period of over four years,

the United States put its constitution to its most severe test in history, denying rights to 120,000 Japanese Americans on the basis of their race.

The response of the ACLU was complex and contradictory. The national branch, based in New York City, discouraged resistance to the government policies that denied basic constitutional rights to Japanese-American citizens. The Northern California branch, however, lived up to the legacy of the organization by not only challenging the internment of Japanese Americans but continuing to do so in direct violation of ACLU policies as had been established by the National Board. This presentation explores the response of the ACLU during wartime and assesses the discrepancy between its philosophy and actions.

James J. Martin, '08 Bellingham, MA
Major: Kinesiology
Aaron Bartels, '08 Olathe, KS
Major: Kinesiology
Christopher Heilman, '08 Colorado Springs, CO
Majors: Physical Education, Education
Patrick McAuley, '08 Austin, TX
Major: Kinesiology
Reuben Zacharakis-Jutz, '08 Solon, IA
Majors: Economics and Business, Kinesiology Sponsor: Steven DeVries

Wrestlers' Versus Non-Wrestlers' Performance Responses to Thermal Stress

Our group did a research experiment on how athletes who train in different types of environments and how the athletes' bodies adjust to the conditions. The focus of the experiment was on the performance of exercise within heat acclimated wrestlers versus non-heat acclimated athletes. The test involved the heat acclimated wrestlers and non-acclimated athletes riding a recumbent bike in a high temperature environment. This research project found correlating research which was linked with our environmental condition training research. The results of the experiment showed that the wrestlers were benefiting from an average of 14.5 heart beats per minute less than the non-wrestlers, while the rates of perceived exertion and VO2 Max were comparable.

Ian McNish, '09 Sun Prairie, WI
Major: Biology Sponsor: Marty Condon

Differential Host Use of Helianthus by Two mtDNA Lineages of *Strauzia longipennis*

Host race formation is believed to be an important step in the formation of new species. Several varieties of *Strauzia longipennis* may exhibit differential host use, either by being host-taxon specific or by being host-tissue specific. Data already collected at Cornell College revealed two distinct populations of *S. longipennis*, which differ both morphologically and genetically. One

population corresponds to descriptions of *S. longipennis*, and the other corresponds to descriptions of *S. longipennis* var. *vittigera*. I collected larvae from the stems of host plants in late summer, and measured the diameters of stems at the point of infestation. The population of larvae formed a bimodal distribution with respect to stem diameter. Once the identities of these larvae are determined genetically, I predict that *S. longipennis* and var. *vittigera* will show different patterns of host use: one may infest narrow stems and the other may infest wider stems.

Megan Michalski, '09 Rome, NY
Major: Biochemistry and Molecular Biology, Biology
Craig Teague, Ph.D.
Cornell College Sponsor: Craig Teague

Lacunary Polyoxometalate Syntheses and Phosphotungstic Acid Interaction with Neodymium

Polyoxometalates (POMs) are unique metal-oxide clusters that are of particular interest due to their wide array of applications including medicine, oxidation catalysis, magnetic materials, and nanotechnology. Phosphotungstic acid (PTA) is a Keggin polyoxometalate with the chemical formula $H_3[\alpha\text{-}PW_{12}O_{40}]$. When one of the tungsten atoms (along with its terminal oxygen) is removed, the monovacant lacunary POM is formed. Lacunary POMs are of importance because the vacant site is reactive and coordination with other atoms or groups of atoms is possible. The coordination of lacunary POMs with uranium is of current interest due to the possible compaction and storage of nuclear waste. In this work, three lacunary POM syntheses were attempted and analyzed through spectroscopic methods including infrared spectroscopy, Raman spectroscopy, and x-ray photoelectron spectroscopy. Neodymium is chemically similar to uranium, and neodymium was used in the present research. Phosphotungstic acid was attached to colloidal metal oxide particles, and its interaction with neodymium was analyzed through spectroscopic methods. Future research plans include examining lacunary POMs on colloidal particles and studying this material's interaction with neodymium.

Paul Miller, '08 Minnetonka, MN
Major: Philosophy Sponsor: Genevieve Migely

C.D. Broad and Berkeley's Unique Ontology

In a paper on George Berkeley's unique immaterialism, Professor C.D. Broad asserts that Berkeley ought to have held the position that the having of a sensation is, "an occurrence in the mental history of some one and only one person at some one and only one date." So that he might validate this translation of Berkeley, Broad first asserts that in regards to the relation between what Broad calls a *cognitive act* and a *cognised object*, "the latter always is in principle existentially independent of the former." Within this interpretation, Broad is presuming incorrectly that Berkeley's position concerning sensible objects is much like Berkeley's

predecessors. I will explain what exactly it means to have a sensation for Berkeley and how this must translate to an object's existence being dependent on a perceiver, or a cognitive act.

Amy Moenning, '08 Evergreen, CO
Majors: History, Medieval and Early Modern Studies Sponsor: Howard Miller

The Medieval Warm Period: How Climate Change Shaped European History

When discussing the issues surrounding current global warming, is not uncommon to hear people bring up the so-called "Medieval Warm Period." Such conversations are littered with debates about what the Medieval Warm Period actually was, how it impacted the world of the Middle Ages, and what an accurate comprehension of it could mean for our future. With new data gathered only in recent years, climatologists are able to more accurately reconstruct past climates. For historians, this relatively new climate data may provide vital contributions to our explanations and understanding of the past.

The Medieval Warm Period had many effects on European history. To name a few examples, climate change played a significant role in the exploration and settlement of the Norse in Greenland, Iceland, and Canada; caused significant changes in medieval farming and husbandry; and allowed the English to compete with the French in producing high quality wine. Climate change also shaped the general health of the medieval population by creating crop surpluses and famines, determining diet and nutrition, and contributing to the spread of many diseases including the infamous bubonic plague.

Michael Mulholland, '08 Cypress, TX
Majors: Psychology, Philosophy Sponsor: Carolyn Zerbe Enns

Interpersonal Interaction in the Workplace: A Comparison Between Face-to-Face and Computer-Mediated Communication

Computer-mediated communication is defined as communication that occurs over the internet and involves the use of a computer. Despite outward appearances, computer-mediated communication and face-to-face communication may be similar in some respects. Research on computer-mediated communication has encompassed a variety of topics such as interaction style, interpersonal factors, and their relationships to leadership. The most common finding of researchers is that the elimination of social cues from a conversation can reduce potential bias and allows for unrestricted flow of opinions.

Research also reveals other similarities and differences between virtual and face-to-face communication. For example, Guéguen (2002) tested whether the robust and well-supported social psychological concept known as the "foot-in-the-door" technique would be relevant to virtual communication. The "foot-in-the-door" theory states that those who are willing to complete a smaller task are more likely to accept a second, more time consuming, request.

Guégon's findings revealed that those communicating in a virtual environment were also susceptible to "foot-in-the-door" influences. Another interesting finding came from Potter and Balthazard's (2002) study, which examined whether the interaction styles of virtual teams would predict performance. Findings suggested that the reduction of visually-based social cues may result in less hesitation on the part of participants to communicate their ideas. In addition, participation levels were equalized, and interaction differences associated with status levels were limited. Future research should utilize longitudinal studies to examine whether effects such as there are long-lasting.

Matthew Mundell, '08 Muscatine, IA
Major: Sociology Sponsor: Mary Olson

The Chippewa Struggle for Environmental Protection and the End of the Crandon Mine Project

For the better part of thirty years, a mining project near Crandon, Wisconsin, was pursued by multi-national corporations. A struggle to permanently block mining there intensified during the last decade of the 20th century. In 2002, the project was finally closed when the site was purchased by a coalition of Native American Tribes. Important changes in tribal environmental powers and the ability of tribes to exercise those powers contributed to the mines' final closure. This presentation will focus on these environmental policy changes. It will explore the ways in which tribal authorities, working with the Environmental Protection Agency, worked to implement stringent environmental standards both for the benefit of their people and for the benefit of their reservation environments. It will also demonstrate how, in doing so, they made it impossible for the Crandon Mine Project to proceed.

Steven Murray '08 Marshalltown, IA
Major: Chemistry – ACS Certified Sponsor: Charles Liberko

Biodiesel: Vegetable Oil Transesterification by Means of an Acid Catalyst

The amount of usable fossil fuels is steadily decreasing as the world population increases. This has driven scientists to find alternative resources for fossil fuels. One alternative is converting vegetable oil to biodiesel by means of transesterification. This reaction most commonly is catalyzed by a base; however, with used vegetable oil, the product has a lower yield due to soap production. Acid catalysis, while slower, shows the promise of a much higher yield of biodiesel from used vegetable oil. Initial experiments showed that sulfuric acid, as a catalyst, produced biodiesel in good yield, in a reasonable time. Further experiments showed that both the kinetics and equilibrium position of the reaction are dependent on the chain length of alcohol used for transesterification.

Maggie Obermann, '08 Greeley, CO
Majors: English, Secondary Education Sponsor: Michelle Mouton

Managing the Individual: The Modern Moral Subject in Charlotte Brontë's *Villette*

> "These struggles with the natural character, the strong native bent of the heart, may seem futile and fruitless, but in the end they do good…they enable [life] to be better regulated, more equable, quieter on the surface; and it is on the surface only the common gaze will fall. As to what lies below, leave that with God."
> (*Villette*, 1853)

In her work *How Novels Think: The Limits of Individualism from 1719-1900*, contemporary literary theorist Nancy Armstrong examines the relationship, in the 18th and the 19th centuries, between societal changes and writers' portrayals of characters in novels. Specifically, she recognizes the importance of the modern individual, who emerged from the novel's production of a self-governing subject and who embodied the value of moral duty so important to the Victorian Age. The modern subject—one who is able to manage personal desire with submission to the social authority—is also essential to Charlotte Brontë's novel *Villette*, as seen by the portrayal of her protagonist, Lucy Snowe. This presentation will analyze the emergence of the self-governing subject by focusing on Lucy's struggles with her own "natural character," ultimately arguing that through the governing of her individuality, Lucy Snowe indeed emerges as an example of Armstrong's "modern moral subject."

Nate Olafsen, '08 Monona, IA
Major: Biochemistry and Molecular Biology Sponsor: Barbara Christie-Pope

The Role of Toll-Like Receptor 2 on Adipose Tissue Inflammation in Obesity

This research focused on the role of Toll-like Receptor 2 (TLR 2) in the development of adipose inflammation in obesity. Both Toll-like Receptor 4 and Toll-like Receptor 2 have been shown to be critical components of the innate immune response to bacterial pathogens. Moreover, TLR 4 has been shown to bind saturated fats directly and develop an inflammatory response. Knowing the similarities in function between TLR 2 and 4, TLR 2 was hypothesized to be required for the production of inflammation in adipose tissue in response to a diet high in saturated fat. In a similar fashion, RNA of several inflammatory cytokines was measured quantitatively using realtime-PCR once cDNA templates were synthesized. Tissue was harvested from wild type and TLR-2 -/- mice, which were fed either a control or a high fat diet. Although inflammation was not completely absent in the TLR-2 -/- mice, results showed the receptor has a role in regulating tumor necrosis factor and Interleukin 10 in acute obesity in response to a diet high in saturated fat.

Michalene Otis,'08 Dubuque, IA
Major: Biochemistry and Molecular Biology Sponsor: Barbara Christie-Pope

Neuroprotection via Learning in the Hippocampus

Environmental enrichment is a natural means by which the brain can make itself more resilient against disease; however, its mechanisms remain incompletely defined. Environmental enrichment consists of increased social, physical and intellectual activity (i.e., learning), which can reduce brain injury by more than 50%. This is greater than any treatments now available for all degenerative disorders of brain. Thus, the mechanisms by which the environment makes the brain stronger have immense clinical and basic scientific importance. The goal of this study was to determine how signaling within and among neural cells from environmental enrichment results in neuroprotection. The important aspects of environmental enrichment (i.e., increased physical, social and intellectual activity) lead to synaptogenesis, neurite branching, gliosis and improved learning and memory. We have shown that environmental enrichment is neuroprotective against kainic acid injury, a model of temporal lobe epilepsy. In order to model learning in vitro, we used chemical long-term potentiation (cLTP), which induces long-term changes in synaptic strength and transmission thought to be the cellular basis of learning and memory. We have shown that there is a decrease in injury from 45% in controls to 10% from cLTP. This would implicate that learning is neuroprotective *in vitro* as well as *in vivo*. We also examined the effects of TNF-α preconditioning on injury. Tumor necrosis factor-α (TNF-α) is a cytokine that is injurious at high doses, yet nutritive at low levels (Wilde et al. 2000). These results show that learning—both *in vitro* and *in vivo*—can be neuroprotective.

Michalene Otis,'08 Dubuque, IA
Major: Biochemistry and Molecular Biology Sponsor: Carol Lacy-Salazar

A Look at Cultural Differences Between Medical Practices in the United States and Latin America

An in-depth look at the cultural differences between medical practices in the United States and Bolivia after an internship in a Bolivian hospital. This presentation will compare and contrast the differences in how practices are run, sanitary practices, and differences in care between a developed and a developing country.

Kristina Pontarelli, '09 Iowa City, IA
Major: Biochemistry and Molecular Biology, Spanish
Craig Teague, Ph.D.
Cornell College Sponsor: Craig Teague

Studies of Polyoxometalates on Single Crystal Silica and Alumina

Polyoxometalates are metal oxide clusters with many useful chemical properties. The Keggin heteropolyanion has the general formula general formula $[XM_{12}O_{40}]^{n-}$ where M=Mo or W and X

can be from all over the periodic table. The Keggin anion readily turns into the lacunary form $[XM_{11}O_{39}]^{n-}$ with adjustments of the alkalinity of solution; this lacunary form is reactive with heavy metals and may perhaps be utilized in a system to store nuclear waste. This system would include adhesion of the anion to a metal oxide colloid to remove waste from solution. In this work, the Keggin heteropolyanion was studied on metal oxides, single crystal silica and alumina, using Atomic Force Microscopy and X-Ray Photoelectron Spectroscopy techniques. Flat single crystals were used as opposed to colloids to employ as many techniques as possible (such as AFM imaging).

Mike Quinn, '08 Hanover Park, IL
Major: Geology Sponsor: Emily Walsh

Scanning Electron Microscope Study of Zircon Grains in Gneisses and Pegmatites from the Western Gneiss Region

Metamorphic rocks, gneisses and pegmatites, from the Western Gneiss Region in southwestern Norway were analyzed to determine when the area was metamorphosed at ultrahigh pressures during the Caleonidonian orogeny. Cathodoluminescence images (CL) of zircon grains separated from the samples show older oscillatory-zoned igneous cores and younger metamorphic rims. The zircon samples were analyzed using a Laser Ablation Multiple Collector Inductively Coupled Plasma Mass Spectrometry (LA-MC-ICP-MS) to determine the age of metamorphism.

Multiple minerals are included within the zircon grains used for CL and LA-MC-ICP-MS. We analyzed the shape, size and elemental composition of the inclusions using a scanning electron microscope (SEM). The shapes and sizes of the inclusions varied, however the color of the inclusions are all dark except for monazite which is white. The location of the inclusions from these data specific minerals was identified. The location of each mineral inclusion was also compared to the chemical zonation of its host zircon grain to determine what role the mineral inclusion played in the growth of the zircon. Results show that quartz and apatite inclusions are commonly found in the oscillatory core of the zircon, suggesting that the minerals were included during the growth of the zircon from a magma. For the monazite inclusions, they were commonly found in the younger metamorphic rims suggesting that the minerals were included during the final growth of the zircon.

Megan Regel, '08 Aurora, IL
Major: Geology
Emily Walsh, Ph.D.
Cornell College Sponsor: Emily Walsh

Sector Zoning and Age in Zircon Grains from the Western Gneiss Region, Norway

Zircon is a strong mineral capable of withstanding extreme geologic pressures and temperatures. It is able to retain geochemical signatures. which allow the timing of geologic events to be

determined. The Western Gneiss Region of Norway is one of the largest exposed complexes of ultrahigh-pressure metamorphic rocks in the world. By determining the ages of the grains, we can understand when in time the rocks containing the zircons were at temperatures and pressures high enough to cause partial melting and resetting of the U-Pb ratio. Several of our zircon samples show an original core dated at ~1600 million years old with rims dated to ~400- 420 million years.

As a mineral grows, it uses elements in the vicinity; these elements then become depleted in the surrounding area and cause chemical zoning in the mineral. Oscillatory zones are extremely common in minerals, especially those with an igneous history. Sector zoning is less common, as such, it is not well understood. The presence of sector and oscillatory zoning in zircon grains is often used to interpret the geologic history. The study of sector zoning in other minerals is used to understand sector zoning in zircon in this paper. The zircon grains were imaged by cathodoluminescence (CL) to compare the pattern of zonation of each grain with the spot age location within the grain.

Zircon grains were picked from nine different rock samples. Sector zoning and oscillatory zoning often occur together; when they are together they are often in the grain core. The samples that contained the most sector-zoned grains were the migmatitic gneiss and the granitic gneiss. In the migmatitic gneiss, 13 grains contained sector zones. Of those grains, nine had oscillatory zoning as well. The granitic gneiss contained 25 zoned grains. The basement rocks (basalts) contain few zircons and with the exception of a few outliers contain no sector zoning. Although there is a relationship between sector and oscillatory zoning, the two types generally occur in different parts of the grain. The core is usually oscillatory zoned while the rim is sector zoned. Sector zones are not found to be correlative with age, except where the sector zones are located within the cores of the grains.

Andrew Reindel, '09 Independence, MN
Major: Physics Sponsor: Derin Sherman

Fractal Characteristics of Electrochemically Deposited Copper

The goal of this research was to study what factors affect the dimension of a copper fractal. A fractal is any shape that is self similar, meaning repetitive patterns can be found on large and small scales, for example: a snowflake, the branches of a tree, or in this case crystallized copper. Their other defining characteristic is their non-integer dimension, the copper fractals lie in between 1-D and 2-D. The factors tested in this experiment were the concentration, voltage and shape of cell. Once the copper fractal had been formed its image was scanned into a computer where a program then analyzed the fractals dimension.

Kristopher Rhodes, ’08 Mount Vernon, IA
Major: Geology
Bill DiMichele
National Museum of Natural History, Smithsonian Institution
Dan Chaney
National Museum of Natural History, Smithsonian Institution
Neil Tabor
Southern Methodist University Sponsor: Benjamin Greenstein

Paleobotanical Evident for "Pluvial" Intervals in the Western Pangean Tropics During the Early Permian

The transition from the Pennsylvanian to the Permian in the tropics of western Pangea was marked by a general trend toward increased temperature and decreased soil moisture, based on geophysical indicators, such as paleosol morphologies and oxygen isotopes. Vegetation tracked these changes and there is a 1:1 correspondence of species pools with climate proxies: floras dominated by spore-producing plants and primitive seed plants characterize wetter-cooler conditions, with floras dominated by more derived seed plants characterizing drier-warmer conditions. Taxa characteristic of wet habitats, particularly tree ferns and sphenopsids, continue to appear sporadically during periods that geophysical indicators suggest were dry-warm, possibly reflecting persistent wet sites on otherwise more xeric landscapes. However, during the middle Artinskian, parts of the Waggoner Ranch Formation of north-central Texas are characterized by the repeated recurrence of tree-fern dominated floras within an interval that includes xeric, seed-plant dominated floras and physical indicators of warm-dry climates. There are only minor, but noteworthy, overlaps between these two species pools. In several instances, the wet floras occur in channel-form deposits suggesting short, "pluvial" periods that did not leave significant paleosol records. Considering the close association of floral composition and climate, it can be inferred that there were fluctuations in soil moisture and possibly temperature that permitted the short-term spatial expansion of wetland vegetation during the Early Permian, probably from populations persisting locally in sites marginal to water bodies. These intervals of climate oscillation further suggest that glacial-interglacial cycles, similar to those of the Pennsylvanian SubPeriod, characterized Permian glaciations as well.

Kristopher Rhodes, ’08 Mount Vernon, IA
Major: Geology
Megan Regel, ’08 Aurora, IL
Major: Geology
Kristyn Rodzinyak, ’09 Colorado Springs, CO
Major: Geology, Chemistry
Abby Michaelson, ’08 Chicago, IL
Major: Geology, Biochemistry and Molecular Biology Sponsor: Benjamin Greenstein

Big Bend National Park, Texas: an Educational Spring Break

In 2008, Cornell College's Geology Club helped sponsor a trip for twelve students to Big Bend National Park in Texas. Big Bend hosts an array of impressive geologic features recording

disparate events from Cretaceous deep-sea deposition to volcanic flows less then 30 million years old. This presentation will present a short history of the park's geology as well as some of our favorite trip moments.

Joni Rice, '08 Englewood, CO
Major: Music Performance – French Horn Sponsor: Jama Stilwell

Examining Musical Borrowing in an Era of Sophistication, Transition, and Turbulence: Johannes Ciconia's *Sus Une Fontayne*

Musical borrowing: the intentional integration of previously-composed material into a new composition. Such borrowing has been an integral facet of music composition throughout music history, and was particularly important during the Medieval and Renaissance eras. During the Medieval period, most instances of musical borrowing reflected the beliefs and ideals of the church, generating a sense of holy authority by incorporating the traditional sacred melodies (which were considered to be of holy origin) into new compositions. During the Renaissance, composers continued to borrow, but for different reasons, and from different sources. For instance, while they continued to draw upon the traditions and existing music of the church, Renaissance composers also incorporated aspects of other composers' works into their own compositions, and even drew upon melodies and texts of secular music, in order to establish authority by alluding to other important compositions, to pay homage to their predecessors, and to demonstrate their own worldly knowledge of music. Generally speaking, the fourteenth century served as a transitional period between the Medieval and Renaissance, allowing the borrowing techniques and rationales of the past to mingle with the new and experimental spirit of the Renaissance. Written at the height of this transition, Johannes Ciconia's *Sus Une Fontayne* provides an example of the highly sophisticated treatment of musical borrowing during this volatile period of musical and cultural change.

Kristyn Rodzinyak, '09 Colorado Springs, CO
Majors: Geology, Chemistry
Dan King
University of Minnesota
Mark Zimmerman
University of Minnesota
David Kohlstedt
University of Minnesota Sponsor: Emily Walsh

Stability of Melt-rich channels in Earth's Mantle: High Pressure and Temperature Experiments on Olivine, Chromite and MORB

Melt transport, the movement of molten rock through the Earth's relatively solid outer shell, is important in many geological processes. Volcanism at subduction zones and hot spots and the formation of oceanic crust at mid-ocean ridges all involve melt transport. To increase our

understanding of how melt moves from depth to Earth's surface, we conducted experiments at high temperature and pressure on fabricated rock samples of modeled mantle rock compositions. We deformed these rock samples, containing olivine and chromite and 4% mid-ocean ridge basalt, at a constant twist rate at experimental conditions of 1473 K and 300 MPa. These conditions are comparable to the temperature, pressure and stress conditions experienced by rocks within Earth's mantle and at which melt segregates or separates into layers. In our experiments, the samples were then exposed to a 4-hour static anneal at 1473 K and 150-200 MPa to cause the melt from the melt-rich layers to dissipate and redistribute homogeneously. Our observations demonstrate that surface tension is an important factor in melt redistribution when a stress is no longer present. These small scale experimental results, obtained on cylindrical samples a centimeter in diameter, can be scaled to the sizes appropriate for Earth processes, helping to expand our knowledge of how the Earth removes heat from within by transporting melt in channels from the mantle to the surface. NASA sponsors this research because a solid understanding of Earth processes helps us understand similar processes on other planetary bodies.

Nathan Sacks, '09 **Ames, IA**
Majors: English, Secondary Education Sponsor: Rebecca Entel

Telling a Man by the Songs He Sings: Claims and Counterclaims of Anti-Semitism in Philip Roth's *Goodbye, Columbus* and *Letting Go*

Despite being considered one of the preeminent Jewish-American novelists of the last 100 years, Philip Roth has always managed to make enemies with major Jewish-American advocates. Many of them have claimed that Roth is a "self-hating Jew," citing as evidence the fact that many of the characters in his books possess classic "self-hating" qualities: they are openly defiant of certain Jewish customs, especially regarding a complete lack of spiritual identity and a need to pursue romantic relationships with non-Jews. These critics argue that since Roth has readily admitted that much of his work is autobiographical, he must by extension be promoting an anti-Semitic agenda.

This project aims to refute claims that Roth is anti-Semitic by developing a working definition of what anti-Semitism is (which is to be considered different than being opposed to Zionism or certain outdated cultural practices) and by looking specifically at Roth's first two works: his story collection *Goodbye, Columbus*, and his first novel, *Letting Go*, for evidence of open hostility towards Judaism. I argue that critics of these two works fail rhetorically at several levels: first of all, they argue that Roth is openly hostile towards specific Jewish customs or individuals, which automatically assumes that there is only one right way to be Jewish, a claim that many Jewish scholars would not agree with. As Roth shows in both of these works, there are multiple ways of being Jewish, none more intrinsically right than the other. Furthermore, they make the mistake of equating certain aspects of Jewish culture with religion, which Roth argues is a comparison fraught with problems. Finally, they argue that Jews have already had experienced more than their fair share of criticism, but Roth is similarly critical of other religions, particularly Catholicism in *Letting Go*. These arguments should clearly show that those who accuse Roth of

being anti-Semitic fail to take into account that he is dealing with Jewish characters who are fundamentally human, and therefore flawed, and furthermore he rightfully does not share his critics' view that literature should live up to certain ethical standards.

Page Marilene Strong, '08 Longmont, CO
Major: Archaeology Sponsors: Marty Condon and Alfrieta Monagan

The Diseases and Medicinal Practices of the Ancient Egyptians of the Western Desert Oases

The knowledge that life is precious and that our hold on life is tenuous has haunted humans for thousands of years. The ancient Egyptians had a strong belief surrounding life, death and the afterlife. For many, what defines the ancient Egyptians is not their lives, but their deaths and the funerary practices surrounding their death cults. As fascinating as the life after death aspect of the ancient Egyptian culture is, what often eludes common knowledge is how these people strove to preserve the lives of the living as much as they strove to preserve the lives of the souls of the dead. The following research will focus on the illnesses and cures of the ancient Egyptians, specifically the ancient Egyptians of the oases in the Western Desert. I will cover a number of illnesses that could have been common to the oases by looking both at the physical remains of the ancient oasis dwellers and the medical papyri left behind by ancient physicians. From these sources I will provide an overview of the preservation of life in ancient Egypt in the oases, one of the harshest environments the ancients could have encountered.

Brittany Szczepanik, '09 Appleton, WI
Majors: Chemistry, English
Craig Teague, Ph.D.
Cornell College Sponsor: Craig Teague

Colloidal Metal: The Synthesis of Gold and Silver Nanoparticles and the Attachment of Modified Gold Nanoparticles and Nanochains to Alumina Surfaces

Gold nanoparticles were produced by a citrate thermal reduction method and by a procedure involving the inclusion of reduced polyoxometalates (POMs), where phosphotungstic acid (PTA) served as the photocatalyst, reducing reagent and stabilizer for the reaction. In addition to synthesizing gold and silver nanoparticles, linear chainlike aggregates of gold nanoparticles (known as nanochains) were formed from colloidal gold in solution by adding varying amounts of cetyltrimethylammonium bromide (CTAB). The colloidal metal was successfully synthesized, as indicated by UV-Visible Spectrophotometry (UV-Vis) data, where strong gold peaks were revealed at approximately 520 nm and strong silver peaks at approximately 400 nm respectively. Single crystal alumina surfaces were soaked overnight in a solution of PTA-derived gold nanoparticles or in a solution of CTAB-derived gold nanochains to determine if the colloidal gold would attach to the single crystal alumina surface. X-ray Photoelectron Spectroscopy (XPS) and Atomic Force Microscopy (AFM) were performed on the dry single

crystal alumina surfaces after being submerged in their respective solutions. These data suggest that some colloidal gold remained on the alumina surface for both syntheses. However, the gold nanochains did not attach to the surface as linear chainlike aggregates, but agglomerated into clusters of colloidal gold either on the surface of the single crystal alumina, or prior to attaching to the surface of the single crystal alumina.

Rachel Tjaden, '08 Jordan, MN
Major: Elementary Education Sponsor: Kerry Bostwick

Breaking the Language Barrier: Teaching in an Immersion Classroom

In the fall of 2007, I student taught at Katoh Elementary School in Numazu, Japan. While there, I worked in an English immersion program with staff who shared my constructivist ideal. In a constructivist classroom, the teacher searches for student's understanding of concepts and then structures opportunities for students to refine their understanding through questioning and connecting to their prior experiences. Working with English language learners emphasized the importance of closely observing students and providing a variety of supports in the classroom. My experiences teaching second grade math in an environment with limited communication challenged me to create activities that integrated language skills through different learning modalities. In my journals, I identified what worked for my students and from those experiences was able to better define what student-centered learning means in an English immersion program – scaffolding to build independence through modeling and the use of visuals, and by creating a foundation for continued language development through the content.

Emily Wachutka, '08 Kaneohe, HI
Major: Biology
Erin Lappen, '08 Chanhassen, MN
Majors: Biology, Environmental Studies Sponsor: S. Andrew McCollum

Survival of Leatherback Hatchlings During Their First Night at Sea

Leatherback turtles (*Dermochelys coriacea*) are critically endangered, largely due to a variety of human activities. While many aspects of their life history are documented, there is virtually nothing known about survival of hatchlings during their first hours at sea. It is widely thought that most mortality occurs very early in the life of sea turtles. The pattern of this early survival influences whether offshore release could provide a conservation benefit. We tracked leatherback hatchlings leaving Playa Grande, Costa Rica and observed the mortality rate of the hatchlings at different distances from shore (0, 1, 2, 4, and 8km). Our sample size at any given distance is small, precluding significance testing for effects of distance from shore, but predation rates appear to be greatest near shore (0-2km), then to decline precipitously. Moonlight has a significant effect on survival, with predation far more likely when the moon is up. While the results suggest that offshore release may substantially enhance survival, we need more data before promoting offshore release as a conservation tool.

Katie Ward, '08 Greenwood Village, CO
Major: Biochemistry and Molecular Biology Sponsor: Craig Tepper

Serum Opacity Factor (SOF) Forms Cardioprotective Products from HDL via Rate-Limiting Apo A-1 Desorption

HDL is the major carrier in reverse cholesterol transport (RCT). Low plasma HDL and cardiovascular disease are strongly associated. Management of dysregulated HDL metabolism and low HDL is a public health priority for which current therapies are inadequate. Thus, it is important to develop new therapies that enhance RCT. SOF, a protein from *S pyogenes,* clouds serum, an effect that is specific to HDL and involves liberation of lipid-free apolipoprotein A-I, formation of a cholesterol poor neo HDL, and transfer of cholesterol esters of ~100,000 HDL to a new cholesteryl ester-rich microemulsion (CERM). The CERM contains a ligand for the hepatic receptor, which allows it to be removed from the blood. The dynamics of this non-enzymatic reaction, from size exclusion chromatography, are shown here. The free energy of activation for this reaction equals the free energy of activation for the guanidinium chloride/HDL reaction, indicating that the rate limiting step is the removal of apo A-1 from HDL.

Trisha Williams, '08 Dousman, WI
Majors: Sociology and Anthropology, Psychology
Nicole Wanty, '08 Rhinelander, WI
Majors: Sociology and Anthropology, Biology, German Sponsor: Marty Condon

Alternative Spring Break in New York City: A Look Into Homelessness

A group of 15 students and one staff member from Cornell College headed to New York City for a week long service project to help the homeless. Students volunteered in soup kitchens as well as in homeless shelters in Harlem. Their experiences were one of a kind as they met persons of varying backgrounds with riveting stories that will be presented through pictorial and video documentaries.

Saydra Wilson, '08 Florissant, MO
Major: Mathematics Sponsor: Melinda Green

Perceived Discrimination and its Effect on the Physical Health, Psychological Health, and Academic Performance of Ethnic Minority and Homosexual Students in College

In the field of health psychology it has been well documented that experiences with discrimination, whether blatant or furtive, can result in negative physical and psychological reactions such as increased blood pressure, heart rate, susceptibility to illness, low self-esteem, and depression. This talk will examine recent studies of the stress that perceived discrimination places on marginalized populations in a college setting and how it relates to the academic success of these groups. A college specific action plan will be presented to promote minority student retention.