CUR

Council on Undergraduate Research

12th Annual

2008 POSTERS ON THE HILL

April 30, 2008

Rayburn House Office Building

Washington, DC

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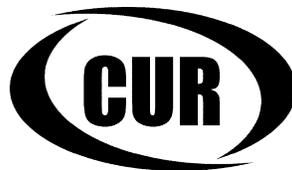
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Congress of the United States of America
House of Representatives

Vernon J. Ehlers

Michigan

March 13, 2008

Dear Posters on the Hill Participants,

I am pleased to congratulate you on your selection to participate in the 2008 Posters on the Hill. Your research project was chosen from a very competitive field of students, representing the finest colleges and universities across the country. You should be very proud of this accomplishment!

As a nuclear physicist and former professor, I am acutely aware of just how important leadership in scientific research is to our nation's future. After reviewing the many fields of study represented by your projects, I am encouraged that, through the efforts of students like you, the United States will remain in the forefront of scientific research and discovery.

Again, my heartiest congratulations to you for this special recognition. I wish you great success as you continue with your research and your studies.

Sincerely,

Vernon J. Ehlers
Member of Congress

VJE: cg

April 3, 2008

Dear Posters on the Hill Participants:

Congratulations on your selection to participate in the 2008 Posters on the Hill event, sponsored by the Council on Undergraduate Research (CUR). You represent the widest range of scientific disciplines in CUR's history, and the subjects of your research span the full spectrum of issues faced by scientists and science policymakers today.

The Office of Science and Technology Policy is responsible for advising the President on science and technology in domestic and international affairs and for coordinating research and development activities across the Federal government. To do this, we work with representatives from all levels of government, higher education, industry, and other nations. A key issue for all is the need for a high-quality and highly-trained scientific workforce. You represent the future leaders and innovators of America, and the scientific and technical foundation you build in your undergraduate years will serve you and the nation well.

I congratulate you on your work, wish you the very best for your future, and look forward to hearing about your discoveries in the years to come.

Sincerely,

John H. Marburger, III
Director

Program

Tuesday, April 29, 2008

Orientation Session
5:30 pm   American Chemical Society
                   1155 Sixteenth Street, NW
                   Washington, DC 20036

        Speaker -   James Brown
        Senior Legislative Associate, American Chemical Society
        How to Talk to Your Representative

        Presentation of Certificates

*Light Dinner will be available following the Orientation Session

Wednesday, April 30, 2008

Morning Session - Rayburn House Office Building, Room 2168
7:00 am   Continental Breakfast
8:00 am   Welcome –   Kerry Karukstis
                            President - Council on Undergraduate Research (CUR)

                 Introduction of Speakers- Nancy Hensel
                                    Executive Officer – CUR

                 Address - Congressman Vernon J. Ehlers
                        3rd District of Michigan

                 Address - Dr. John H. Marburger III
                     Science Advisor to the President and
                     Director of the Office of Science and Technology Policy

10:00 am–3:00 pm   Appointments with Representatives

3:30 – 5:00 pm   Poster set-up

5:30 – 7:30 pm   Poster session, reception and ACS Awards Ceremony
                    *Students, we ask that you step away from your
                    posters once the ACS Awards Ceremony begins. At the
                    conclusion of the ceremony, you may return to your posters.

7:30 pm   Break down posters

Student Poster Abstracts

Arizona

Student: Kevin Keys
Institution: The University of Arizona
Faculty Advisor: Michael Hammer
Poster title: Languages and Genes: The Population Dynamics of Eastern Indonesia
Display Area: 1A
Funding: National Science Foundation
Abstract: Analyses in macroscopic population dynamics have suggested a good correlation between languages and genes on a global scale. Recent developments have allowed researchers of population genetics to use genetic mutations in microsatellites to clock the genetic history of a group of populations. Likewise, historical linguists can chart the proximity of those populations' languages to each other, thus mapping their linguistic history. It is now possible to do similar studies at very small scales. We begin such a project in eastern Indonesia, where a historical human migration of Austronesian peoples, originally from Taiwan, moved through there 4500 years ago. We hypothesized that a linguistic and genetic analysis of individual islands, a scope never seriously attempted in previous studies, could reveal clues as to how Austronesians populated and eventually dominated the area. We determined the degree of retained proto-Austronesian (PAn) words left in native languages on one island in eastern Indonesia, Sumba, in order to reconstruct a language tree that established each language's proximity to PAn. We compared this language tree to a phylogenetic tree of genetic data from the same peoples to see if retained PAn vocabulary aligned with retained Austronesian genes from haplogroup O. Results from a complete analysis of the island demonstrated that Austronesian genes are indeed expressed to a higher degree in admixtures of peoples speaking languages with more PAn vocabulary. This analysis also resulted in new ways of studying population dynamics at an unprecedented tiny scale; these methods are useful for further research into human population history.

California

Student: Alexander Trevelyan, Brandon Sorbom
Institution: Loyola Marymount University
Faculty Advisor: Jeff Sanny, David Berube
Poster title: Fingerprinting Space Storms using Dynamic Wave Power Spectra
Display Area: 1B
Funding: National Science Foundation
Abstract: As we increasingly depend on satellite technology in our everyday lives, understanding space weather is of critical importance to our national interests. Magnetic storms in the Earth's space environment often occur following periods of intense solar activity. Some, but not all, of these storms are accompanied by a rapid enhancement in the population of very energetic electrons that travel at near-relativistic speeds. These so-called "killer electrons" are of particular interest to the space science community because of their potential threat to spacecraft instrumentation. Recent work has indicated that the mechanism for the production of these relativistic electrons is likely to be associated with pulsations in the Earth's magnetic field at ultra low frequencies (ULF). In this study, the dynamic power spectra of ULF waves over a frequency range that encompasses three classes (Pc3, Pc4, and Pc5) of these waves are examined for two major magnetic storms:

one with, and the other without, relativistic electron enhancement. The ULF fingerprint of the storm that is accompanied by the energetic electrons exhibits a significant and prolonged increase in wave power during the storm's recovery phase over a frequency range that encompasses all three wave classes. Alternately, the fingerprint of the storm without the energetic electrons shows an increase in wave power only for the lowest frequency waves in the Pc5 band. This difference indicates that a prolonged, broadband enhancement in wave power may be necessary for the production of killer electrons.

Student: Viviana Vallin
Institution: Loyola Marymount University
Faculty Advisor: John Wolfe
Poster title: Exploring Protein Manipulation for Improved Detection of Protein Expression for Gene Therapy Treatment in the CNS
Display Area: 1C
Abstract: Lysosomal storage diseases result from the deficiency of enzymes required to catabolize macromolecules. The brain is affected in most of the diseases leading to neurological symptoms. Several approaches have been used for treatment including enzyme therapy, stem cell transplant, and gene therapy. Injections of gene transfer vectors into multiple sites in the brain have shown promising results in several disease models. Only small amounts of enzyme are required to reverse storage lesions in the cell leading to increased global correction in the brain. However, better methods for understanding protein delivery in the brain are necessary in the evaluation of successful gene therapy treatment in the CNS. Protein tags can serve as a valuable alternative for detection of gene expression. When manipulating protein fusions it is possible to disrupt the structure and function of the therapeutic protein or the tag itself. In this project we analyzed the fusion of three tags (c-Myc, HA, and Venus) to glucuronidase (GUSB). HA and c-Myc are epitope tags that have been well characterized. Venus is a YFP mutant with improved properties to enable its use in fluorescent labeling. Using biochemical and immunohistochemical detection we evaluated the efficiency of the fusion protein's ability to express both the tags and the GUSB protein in vivo. The c-Myc and Venus fusions showed potential positive detection, while the HA tag was not detectable by the antibody. Significant problems with backround staining and signal to noise ratio need to be reduced in order to determine the success of the fusions.

Student: Kether Hayden
Institution: Occidental College
Faculty Advisor: Elizabeth J. Chin
Poster title: Female political mobilization through women's associations in rural and urban Malian communities
Display Area: 1D
Funding: Undergraduate Research Center
Abstract: In Mali, there is a shift currently taking place toward inclusive, democratic governance and equitable, participatory development. This shift makes study of gender in public participation particularly relevant. Over the course of 8 weeks in Mali during the summers of 2007, I conducted participant observation research and extensive interviews in Bamako and the region of Sikasso to uncover the functions of Women's Associations in female leadership development and public participation. I concentrated on women's associations, regional and national networks, and non-governmental organizations that specifically work in the gender and governance sector. Additionally, I looked at government programs encouraging more gender equitable participation. In the mostly agricultural and rural region of Sikasso, I considered the role of women in development initiatives and local decision-making. To do this, I examined how women maneuver within a national policy of

decentralization and village, neighborhood, religious and gendered authoritative norms. This discussion necessitates the consideration of gender in personal/family economies and public/private negotiations. My research illuminates societal and cultural structures that provide insight for gender understanding, community organizing, community and economic development, and local governance both for practical use in Mali and for theoretical application in other geographic locations in the developing world.

Student: Manuel Alingog, Hector-Eduardo Mendoza-Solano, Chona May dela Cruz
Institution: Southwestern College
Faculty Advisor: David Brown
Poster title: Mid-Infrared Spectral Characterization of Volume Holographic Gratings and Nanofabrication of Optical Structures
Display Area: 1E
Funding: National Science Foundation
Abstract: Funded by the NSF SBIR IICC Program, this project represents a collaborative venture between a community college research team and a small business enterprise, with the research being undertaken on the community college campus. Volume Holographic Gratings (VHGs) serve various functions in the design, construction, and performance enhancement of lasers and devices that employ lasers. Ondax, Inc. manufactures glass VHGs with a proprietary process that modifies the local index of refraction of the glass by producing nano-clusters with different indices of refraction from the bulk glass. The purpose of this research was two-fold. One component was aimed to characterize Ondax VHGs in the mid-Infrared (IR) spectral region via Attenuated Total Reflectance (ATR) measurements that employed ATR crystals made from ZnSe and Germanium. The different crystal materials provided two distinct depths to which the IR radiation penetrated the samples, with depths of approximately 2.00 microns and 0.70 microns at 1000 wavenumbers for ZnSe and Germanium respectively. Preliminary results demonstrated slight but quantifiable differences in the IR spectra acquired with ATR from materials with various concentrations of nano-clusters. The second aspect of the project involved nanofabrication of optical structures in the VHGs through chemical etching, generating unique surface relief profiles due to differences in etching rates between the nano-clusters and the bulk glass. This presentation will underscore correlations between differing sample composition and variation in the IR spectra, along with proposing structural elements to account for spectral differences. Additionally, results from chemical etching studies to nanofabricate optical structures will also be presented.

Connecticut

Student: Erika Harrington
Institution: Eastern Connecticut State University
Faculty Advisor: Madeleine Fugere
Poster title: Perceived Racism as a Predictor of Depression, Anxiety, and Cultural Mistrust
Display Area: 1F
Funding: ECSU School of Arts and Sciences
Abstract: Previous literature shows that racism greatly impacts the psychological well-being of its victims. The negative psychological consequences of racism have been examined primarily in African Americans, and the impact of perceived racism on other racial and ethnic groups has not been adequately investigated. Therefore, the current research is among the first to examine the role of perceived racism in the development of cultural mistrust, depression, and anxiety in African Americans, Latinos, and Caucasians. Sixty six participants completed measures of perceived racism, depression, anxiety, and cultural

mistrust. As hypothesized, African Americans experienced the highest levels of perceived racism, followed by Latinos, and lastly by Caucasians. Also consistent with our hypotheses, perceived racism was significantly predictive of cultural mistrust in all ethnic groups, with higher levels of perceived racism related to increased mistrust. Furthermore, ethnicity significantly affected the three psychological constructs; with African American participants reporting the highest levels of depression, anxiety, and cultural mistrust, followed by Latino participants, and finally by Caucasian participants. In addition to these findings, we found a significant two way interaction of perceived racism and ethnicity on cultural mistrust. For both Caucasians and African Americans, higher levels of perceived racism were associated with higher levels of cultural mistrust. However, for Latinos cultural mistrust did not change based on the level of perceived racism. These results have implications for improving the treatment of depression, anxiety, and cultural mistrust, and for further understanding the etiology of these conditions and the role of racism in their development.

Delaware

Student: Kevin Shuman
Institution: Wesley College
Faculty Advisor: Malcolm D'Souza
Poster title: Method to evaluate mechanism of reaction of a former war gas that has found applications in medicine
Display Area: 2A
Funding: NIH

Abstract: In 1915, Phosgene was first employed as a war gas because it readily dissolved in Acetone to form the chemical Isopropenyl Chloroformate which then underwent rapid hydrolysis to produce a corrosive gas, hydrogen chloride. Therefore since World War I there has been significant interest in Isopropenyl Chloroformate due to its ability to cause sharp pain in the eyes upon exposure of the evaporating gas.

Today Isopropenyl Chloroformate is used in experimental medicine, mainly in the esterification of pMOBA (peptidyl p-methoxybenzoic acid). This knowledge has been directed in the development of selective inactivators for serine proteases e.g. protein turnover, coagulation, fibriolysis, etc., which in most cases lead to the offset of diseases such as emphysema, cystic fibrosis, cancer, and myocardial infarction.

However the solvolytic mechanism of reaction for Isopropenyl Chloroformate is widely misunderstood. This sophomore Directed Research project has expanded previous kinetic studies of Isopropenyl Chloroformate in predominantly aqueous alcohol solvents with varying solvent nucleophilicity and solvent ionizing power. This analysis included solvents that exhibit strong hydrogen bonding and that can dissolve a large number of biological molecules with receptive sites such as oxygen, double bonds or amine groups. Our results indicate that a two-step mechanism is operative as opposed to the previously proposed one-step mechanism. These results may lead to better ways to measure and understand effects of the solvent (medium) in which these reactions take place.
[This project was supported by NIH NCRR INBRE grant number; 2 P20 RR016472-07]

Florida

Student: Cynthia Romero
Institution: University Of Central Florida
Faculty Advisor: Andrew Daire
Poster title: Pairs for Peers: Relationship Education for High School Students
Display Area: 2B
Funding: University of Central Florida

Abstract: In 2006, the U.S. Department of Health & Human Services provided $100M in competitive grant awards for Healthy Marriage Demonstration grants nationwide. Dr. Andrew Daire, Associate Professor in the UCF Counselor Education program and Executive Director of the UCF Marriage & Family Research Institute, is the lead evaluator for the PAIRS Foundation's 'PAIRS Relationship Skills for Strong South Florida Families' Level 2 grant. An activity in this grant is the 'PAIRS for PEERS' program that provides relationship education (communication styles, emotional intelligence, and conflict resolution) to high school students.

With the help of the Research and Mentoring Program (RAMP), which provides first generation college students with the opportunity to conduct research at the undergraduate level in order to better prepare students for graduate studies, UCF undergraduate student Cynthia Romero was assigned Dr. Daire as her mentor. As Dr. Daire's RAMP mentee, Ms. Romero is part of the research team evaluating the PAIRS for PEERS project. This poster will present research findings on this program's outcomes and effectiveness with high school students. Pre, post and six-month follow-up of the adolescents' level of emotional, social, and academic functioning, as measured by the Child Behavior Checklist – Youth Self Report, will be presented along with recommendations for school, public policy, and mental health professionals. The findings derived from this research will have far reaching cross-disciplinary implications on the impact of adolescents for abstinence and life skills curricula, and adolescent value of marriage and healthy relationship skills.

Hawaii

Student: Natasha Flores
Institution: Chaminade University of Hawaii
Faculty Advisor: Patricia Lee-Robinson
Poster title: Altered Behavior in the Novelty-Induced Hypophagia Test in FoxG1+/- Mice
Display Area: 2C

Abstract: For this study we used mice with a heterozygous deletion of the FoxG1 gene to examine the relationship between adult neurogenesis and symptoms of depression as modeled by the Novelty-Induced Hypophagia test. The mice were given a 0.2 mg/ml dosage of fluoxetine through drinking water for 3 weeks. Testing occurred in both the home cage and novel cage. We did not find an effect of antidepressant treatment on behavior in either the FoxG1+/- mice or wild type mice. Compared to wild type controls the FoxG1+/- mice displayed transgenic mice had decreased consumption of milk in the home cage as well as increased latency to feed. These are similar to two features of depression in humans, increased anxiety and decreased response to rewarding stimuli. Thus our results are consistent with the hypothesis that decreased neurogenesis is responsible for some symptoms of depression found in humans.

Iowa

Student: Sam Berndt
Institution: Luther College
Faculty Advisor: Steven Holland
Poster title: Farmer Behavior in Karst Geology
Display Area: 2D
Funding: Luther College

Abstract: The Karst geology of northeast Iowa makes the groundwater more susceptible to contamination. However, despite this geological susceptibility, closer examination reveals that the differences between Karst and non-Karst regions are insignificant and both water supplies are safe for human consumption by EPA standards. Given that Iowa environmental policy fails to address the unique geological situation, the question remains: What accounts for groundwater quality in the Karst region of Iowa?

To answer this question, I conducted a series of interviews to look for ideological and behavioral differences between farmers in Karst and non-Karst regions of Iowa. These interviews showed four distinct areas of difference between farmers in each region. First, farmers in Northeast Iowa felt that the Iowa DNR failed to implement policy that dealt with the unique problems of Karst topography and more local control was needed. Second, Karst farmers had environmental concerns focusing more on water quality and groundwater contamination. Third, the two groups differed significantly in their support and conception of organic farming. And lastly, farmers in Northeast Iowa tended to have a wider conception of their community.

This research suggests that farmers in Northeast Iowa have adopted different beliefs and behaviors to compensate for the special geological features of the region. Farmers in Northeast Iowa recognize the inadequacies of Iowa environmental regulation and have adopted extralegal means to protect their groundwater. These results indicate that localized environmental control could be an effective way to deal with Karst geology and groundwater.

Student: Tiffany Choi
Institution: Luther College
Faculty Advisor: Anne-Marine Feat
Poster title: The Representation of Republican Presidential Candidates in the French Press
Display Area: 2E
Abstract: Ever since France's instrumental role in the United State's Revolutionary War, the two countries have been inescapably bound in a political relationship marked by both friendship and animosity. Four years ago, Franco-American relations suffered due to the United States invasion of Iraq and to Jacques Chirac's overt opposition to the war. Although the two countries have begun to resolve previous conflicts, the period of antagonism has left a mark on the French public's opinion of the United States. How do the French currently perceive the United States?   I wanted to discover what the French people might be saying about our own presidential elections. To begin to answer this question, I turned to a source that is very influential to the French public and accessible to Americans: France's daily newspapers. The three major French dailies, Le Figaro, La Liberation, and Le Monde publish Internet versions of their newspapers every day. I gathered news articles from these websites, focusing on the portrayal of Republican presidential candidates. French journalism, in contrast to American journalism, takes a subjective approach, often mixing

facts with an intentional standpoint. Considering the newspapers' overall political views, I analyzed the content of the articles found in these three newspapers. I discovered that although French newspapers are written with varying degrees of subjectivity, they all demonstrate French disapproval of the American political system, the American public's dissatisfaction with their own political system, a perceived incompetence among the Republican candidates, and a rejection of Republican religious values.

Idaho

Student: Taylor Dixon
Institution: Boise State University
Faculty Advisor: Owen McDougal
Poster title: Application of Diffusion-Ordered NMR Spectroscopy and Slice-Selection Imaging in the Study of the Interfacial Region of a Mixed Phase Solution
Display Area: 2F
Funding: Boise Technology, Inc.
Abstract: In this study, p-nitrophenol (pNP) was characterized at the interface of a mixed phase solution of deuterium oxide (D2O, aqueous phase) and deuterated chloroform (CDCl3, oil phase) using nuclear magnetic resonance (NMR) spectroscopy. The translational mobility of pNP differs notably between solvents, making this a good system to study using diffusion-ordered spectroscopy (DOSY). The DOSY experiment provided the additional NMR dimension (i.e. diffusion coefficient axis) that allowed pNP to be differentiated based on its local solvent environment. The pNP mixed phase system was prepared with the aqueous/oil interface at the center of the NMR probe detection coil, and analyzed with a one dimensional (1D) proton DOSY method. The diffusion coefficient (D) of aqueous pNP was determined to be 1.0×10^{-9} m2 s-1, whereas in the less viscous CDCl3 layer, D was determined to be 7.9×10^{-9} m2 s-1. Further, to track the concentration gradient of pNP across the interfacial region, slice-selection 1D proton NMR was utilized to provide spatially-selective information about the mixed phase system. At 1.8 mm slice thickness and applied field strength of 600 MHz, pNP partitioning was qualitatively tracked through the interfacial region using the changing ratio of solvent-resolved pNP proton peaks. The results support using the novel application of DOSY and slice-selection NMR methods to distinguish the partitioning behavior of a target molecule in a mixed phase oil/aqueous solution.

Student: Jamie Montgomery, Kate McHail, Alina Schimpf, Emma McInturff
Institution: Boise State University
Faculty Advisor: Don Warner
Poster title: Investigations into the Anti-Cancer Properties of Highly Potent Synthetic Aziridinomitosenes
Display Area: 3A
Funding: National Institutes of Health
Abstract: Synthetic aziridinomitosenes share structural characteristics with mitomycin C, a naturally occurring antibacterial and antitumoral compound used to treat cancer through a mechanism involving DNA crosslink formation. We recently reported that a mitosene analog forms rare sequence specific interstrand DNA crosslinks without the enzymatic reduction required by mitomycin C. To account for this previously unobserved cytotoxic event, we proposed a model that considers four possible electrophilic sites—designated C1, C6, C7 and C10. By varying the substituents at each of these sites using organic synthesis, we identified structural components necessary for DNA interstrand crosslink formation. Computational experiments created a molecular model of the proposed crosslink that results in minimal distortion of the DNA backbone and allows for interaction between C6/C7 sites

and intracellular nucleophiles. Additionally, we obtained evidence suggesting an alternate route of inhibition of cell division—the formation of DNA-protein linkages. Also, in vitro exposure of human promyelocytic leukemia cells to methyl-substituted aziridinomitosenes showed them to be more potent in arresting cell division than both mitomycin C and doxorubicin, a drug the American Cancer Society calls "one of the most successful and frequently used chemotherapy medicines." The aziridinomitosenes were characterized with regards to reduction potential, aziridine pKa, solvolytic stability, and DNA alkylating ability using techniques including electrochemistry, gel electrophoresis, liquid chromatography, mass spectrometry and nuclear magnetic resonance spectroscopy. Ultimately, our research plays an important scientific role in illuminating the chemical reactivity of molecules known collectively as aziridinomitosenes, and also contributes to the development of more effective cancer therapies.

Illinois

Student: Jamie Rogers
Institution: Illinois Wesleyan University
Faculty Advisor: Ram Mohan
Poster title: Environmentally Friendly Organic Synthesis Using Bismuth Compounds. Bismuth(III) Bromide Catalyzed Synthesis of Substituted Tetrahydroquinoline Derivatives
Display Area: 3B
Funding: National Science Foundation
Abstract:
Synthetic organic chemistry provides access to literally thousands of useful molecules including life saving drugs, differing widely in their structural complexity. Work continues to be done to develop new reagents, catalysts and reactions, which are then used in the assembly of complex target molecules. However, most of these efforts have focused on achieving the synthetic processes in an efficient manner and not enough consideration has been given to the effects that the reagents used in chemical syntheses have on human health and the environment. In 1990, Congress passed the Pollution Prevention Act, which introduced the concept of pollution prevention through proper waste disposal, waste treatment, source reduction and source prevention. In this regard, bismuth compounds are especially attractive as catalysts because of their remarkably low toxicity, low cost and ease of handling. For example, most bismuth compounds are even less toxic than sodium chloride. Substituted tetrahydroquinolines are of considerable interest due to the range of their biological activities and presence in a variety of natural products. We have developed a bismuth bromide (5.0-20.0 mol%) catalyzed synthesis of 2, 3, 4-trisubstituted tetrahydroquinloines via a coupling reaction between substituted anilines and dihydrofuran or dihydropyran.   The results of this study will be presented.

Indiana

Student: Andrea Schilling
Institution: Indiana University Purdue University Indianapolis
Faculty Advisor: Kathy Licht
Poster title: XRD analysis of glacial till from Nimrod and Byrd Glaciers, Antarctica
Display Area: 3C
Funding: IUPUI Undergraduate Research Opportunity Program

Abstract: X-ray diffraction (XRD) data were collected on 21 samples of glacial till from Byrd and Nimrod Glaciers, Antarctica to characterize sediment composition. Determining sediment composition signature from these outlet glaciers, which drain the East Antarctica ice sheet, are essential for reconstructing past ice flow paths in the Ross Embayment during the last glacial maximum (~18,000 yrs ago). Understanding this region's past response to global climate change will help modelers make more accurate predictions of Antarctica's response to current global warming trends.

X-ray data were collected on the <2mm sample fraction which was crushed to <20 microns using a McCrone Mill and compared to previous point count data (500-2000 microns). My hypothesis is that the XRD method is a more efficient and accurate method to characterize samples than the point count method.

Preliminary results show that XRD data provide information on sample compositions that are missed by the traditional point count method. For instance, the Crazy Jim site was shown to contain five forms of feldspar, where only two were identified through point counts. Additionally, a variety of clay minerals were also identified. The Bates site was found to contain mainly mafic igneous material with little feldspar and pyroxene identified. X-ray diffraction data showed that a variety of Na and Ca rich feldspars, pyroxene, as well as, clay minerals were identified. This higher level of detail, achieved with the XRD method, will help to better determine the distinct signature of these sediments.

Kentucky

Student: Jeremiah Alexander
Institution: Eastern Kentucky University
Faculty Advisor: Stephen Richter
Poster title: Effects of urbanization and habitat fragmentation on spotted salamander (Ambystoma maculatum) populations.
Display Area: 3D

Abstract: With the U.S. population now over 300 million and growing at a record rate, the natural landscape is being reduced and fragmented. Reductions in habitable land threaten the genetic health of native wildlife. Such a loss in genetic diversity can negatively affect a population's ability to keep pace with long-term environmental changes, as well as short-term changes induced by humans. Microsatellites are short sequences of highly variable DNA that can serve as molecular indicators of health, connectivity, and reproductive potential within and among populations. In this study, we chose five microsatellite loci to determine the effects of habitat fragmentation on a network of spotted salamander (Ambystoma maculatum) populations in the greater Charlotte, North Carolina area. We addressed two primary hypotheses: (1) degree of connectedness among populations across the fragmented landscape is inversely related to distances between populations and intensity of urbanization and (2) genetic variation within populations is inversely related to level of degradation of surrounding habitat. To address these hypotheses, we studied five populations of salamanders that varied in distance from nearest neighboring population and

in quality of surrounding habitat. We used GIS to quantify habitat and distance variables. Results revealed low genetic variability across all populations with no significant differences in heterozygosity. No relationship between distance between populations and quality of surrounding habitat were found in terms of reduced genetic differentiation and variability. This study suggests that current wide-spread urbanization has negative effects on large communities of populations, and thus the overall viability of a local species.

Maryland

Student: Suman Khatiwada
Institution: Morgan State University
Faculty Advisor: Dereje Seifu
Poster title: Understanding the Physics of Exotic Rare-Earth Compounds
Display Area: 3E
Funding: Army Research Laboratory
Abstract: Permanent magnets are vital components in all electronic devices and probes. Materials scientists are constantly searching for simpler, stronger and less expensive permanent magnets for technological advancement. Compounds and alloys of rare-earth metals have shown great potential to be used as permanent magnets and also exhibit interesting Physics. In our nanomagnetics lab, we study several compounds and alloys of europium, a rare-earth metal. In this project, we synthesized nanometer sized grains of $EuFeO_3$ (Europium Iron Oxide) by a metallurgical process known as mechanical alloying and studied its magnetic properties using a method of Nuclear Chemistry known as Mössbauer Spectroscopy. This work is the first instance where both the rare-earth site (europium) and the transition metal site (iron) of the same compound have been probed using Mössbauer Spectroscopy. For further analysis of magnetic properties of $EuFeO_3$, we conducted experiments from room temperature (i.e. 300 Kelvin or 79 °F) to 20 Kelvin (i.e. -424 °F). Results show that $EuFeO_3$ is ferromagnetic (or pure magnetic) at 20 Kelvin, however, its ferromagnetic behavior decreases with increasing temperature. This has prompted us in launching other projects such as filling the nanoparticles of $EuFeO_3$ in carbon nanotubes to control superparamagnetic fluctuations, and study exotic properties of compounds and alloys such as EuS and EuFe. With our research on Europium compounds, especially $EuFeO_3$, we are trying to understand the Physics behind the magnetic characteristics of rare-earth compounds and utilize the knowledge to synthesize novel materials for technological applications.

Massachusetts

Student: Julianne Kulevich, Christopher Smith
Institution: College of the Holy Cross
Faculty Advisor: Gareth Roberts
Poster title: Using Algebraic Geometry in the Circular, Restricted Four-Body Problem
Display Area: 3F
Funding: National Science Foundation
Abstract: We investigate the circular, restricted four-body problem (CR4BP) in which three large masses travel along individual Kepler orbits as a fourth body of infinitesimal mass moves under the gravitational force of the other three. Our study uses the software package Maple, algebraic geometry concepts including resultants and Groebner bases, and analytic proofs that bodies can be arranged in equilateral triangle central configurations (c.c.'s). Examples of these c.c.'s exist in our solar system between Jupiter, the Sun and two asteroid belts, the Trojans and the Greeks.

Our goal is to prove that the only solutions to the CR4BP are equilibria (or critical points) of the amended potential. Critical points can be considered to be points where a spaceship could be "parked" between planets. From these critical points, a spaceship could use the gravitational pulls of the surrounding planets to propel the ship to other areas of the solar system and minimize the amount of fuel needed for the journey. For the equal mass case of the CR4BP, we show that there exist ten critical points, each forming a symmetric configuration. Current work focuses on locating the critical points for cases in which the masses of the three bodies differ and proving the finiteness of these points.

Student: Alison Santos
Institution: Salem State College
Faculty Advisor: Peter Sablock
Poster title: Unknown Soldiers: Locating Lost Graves of 18th and 19th Century Veterans
Display Area: 4A
Abstract: The Porter/High Street Cemetery, created in the mid 18th century, is a significant site in the town of Danvers, Massachusetts. It is the burial ground for many veterans who fought in wars ranging from the French and Indian War through the Spanish-American War. Due to time, vandalism, construction and other alterations around the site, many of the head and footstones have been moved, broken, or otherwise disturbed, leaving potentially unmarked graves. Ground penetrating radar with a 400mHz antenna and electromagnetic induction at frequencies of 13kHz, 11kHz, and 6kHz was used to locate any unmarked graves. The data was correlated to more clearly define the position of anomalies which may represent these unmarked burial sites. The radar typically placed the anomalies/suspected burial sites in the western portion of the cemetery around 1.5m-2m deep, while in the southeast-northeast region the graves were found to be at a more shallow depth. The average width of the anomalies was found to be approximately 1.6m, with a few wider anomalies present that possibly represent multiple interments. A possible relation between signal amplitude and burial age was also detected, perhaps due to the further resettling of the ground in the graveshaft. The electromagnetic data confirmed the radar results, and a definite pattern emerged indicating the presence of burial sites especially when using the 11kHz quadrature EM data. As a result of this research as many as 15 unmarked and unknown veterans' graves have been identified.

Michigan

Student: Marlie Johnson
Institution: Hope College
Faculty Advisor: Gregory Fraley
Poster title: Mammalian RFRP-3 is a possible mediator between the brain and the onset of puberty.
Display Area: 4B
Abstract: Sexual precocity, or an abnormally early onset of puberty, is an increasingly common pathology around the world. Recent studies estimate that 4-5% of females demonstrate signs of precocious puberty as early as the age of 3 and the average age of menstruation is now under twelve years of age. A significant number of boys are also showing the same trends.

The brain regulates an animal's reproductive status, especially the hypothalamic-pituitary-gonadal (HPG) axis. Activation of the HPG axis results in the release of gonadotropins and

the production of gametes and sex steroids. The main control of gonadotropin secretion is dependent on the hypothalamic production of gonadotropin-releasing hormone (GnRH). The synthesis of GnRH begins at birth; however, until puberty GnRH is not released and thus never activates the HPG. Even as adults, the release of GnRH from the hypothalamus is known to be under the control of a negative feedback mechanism; however naming an inhibitory hormone to GnRH has remained elusive. A promising candidate to fill this role is the recently named RFamide family.

In mammals, RFRP-3 appears to have inhibitory actions on both behavioral and hormonal reproduction. I have found promising neuroanatomical, endocrine, and behavioral support that all suggest RFRP-3 is possibly acting as an endogenous inhibitor of GnRH and thus, reproduction. Our studies also suggest that RFRP-3 may by a mediator between the neuroendocrine "environment" and the onset of puberty.

Continuing to examine the effects of environmental stimuli — such as nutritional changes — on RFRP-3 gene expression could help us understand the underlying mechanisms responsible for the increasing trend of precocious puberty.

Student: Jean Kim
Institution: University of Michigan – Ann Arbor
Faculty Advisor: Anthony King, Ph.D.
Poster title: A Pilot Study of Mindfulness-based Group Therapy for Combat PTSD
Display Area: 4C
Abstract: The purpose of this study was to test the feasibility and efficacy of mindfulness-based therapy for combat-related posttraumatic stress disorder (PTSD) compared to usual clinical care. The experimental group participated in eight weekly, ninety-minute therapy sessions. The therapy consisted of psychoeducation on relaxation and mindfulness techniques. Participants practiced attending to bodily sensations, thoughts, and emotions and participated in group discussion and feedback. Subjects practiced these techniques at home, keeping a daily log of practice, mood, and stress ratings. The therapy was adapted for patients with PTSD from researched and accepted treatment for stress and anxiety (mindfulness-based stress reduction), which has been used in patients with conditions such as cancer, and for people with severe, chronic depression (Mindfulness-based Cognitive Therapy). This group was compared to usual clinical care at the Ann Arbor PTSD Clinic. The control group received eight weekly sessions of group psychoeducation on topics including PTSD symptoms, stress, coping, psychological treatment, medications, impact on family, and connecting with additional services. They also kept a daily log of mood and stress ratings. The two groups were compared using physiological (heart rate, skin conductance, and muscle tension) and stress hormone responses to personal trauma recall using personalized scripts. Psychological measures were also used, including structured interview (CAPS) and standardized questionnaires for PTSD symptoms (IES-R), cognitions associated with PTSD (PTCI), dissociation (DES), and depression, anxiety, and stress symptoms (DASS-21). This study examined the effectiveness of both treatments and can be used to better reduce emotional and physiological reactivity to trauma recall in patients with PTSD.

Minnesota

Student: Brian Krohn
Institution: Augsburg College
Faculty Advisor: Arlin Gyberg
Poster title: Fuel of the Future: Biodiesel. A novel method and catalyst for the production of biodiesel.
Display Area: 4D
Funding: Augsburg URGO program
Abstract: Biodiesel is a renewable fuel that has great potential to address many of the environmental problems caused by petroleum fuels. The traditional method of producing biodiesel, however, requires expensive feedstocks rendering it too expensive to be economically competitive against petroleum fuels. Researchers in this study developed a novel method and catalyst, dubbed the Mcgyan Process, for the production of biodiesel that utilizes inexpensive waste feedstocks. Some of the key feedstocks used were virgin soybean oil, waste oil from restaurants, swine tallow (a major waste product in the food industry), stearic acid (a free fatty acid that is considered a contaminant in the traditional method), and remarkably acidulated soap stock (a waste product of the traditional process). The Mcgyan Process uses zirconia or titania microspheres as the catalyst and a high temperature and pressure continuous flow reactor to convert virtually any waste oil or fat into biodiesel in seconds. The reactants were converted into biodiesel in as little as 5.6 seconds, compared to several hours for the traditional method, with greater than 90% yield. Also, the reactor is small enough and simple enough that individual farmers could use it to safely create their own biodiesel on their own farms. The Mcgyan Process can utilize a variety of feedstocks, has fast reaction rates, is small in physical size, and produces little waste. All of which will makes the Mcgyan Process superior to the traditional process. As a result, the Mcgyan Process provides a solution to making biodiesel economically competitive with petroleum fuel.

Student: Nate Black, Abby Lane, David Swanson
Institution: St. Olaf College
Faculty Advisor: Rebecca Judge
Poster title: The Impact of Rising Ethanol Demand on Corn Price for Developing Nations
Display Area: 4E
Funding: National Science Foundation
Abstract: Recent literature suggests that growing demand for biofuels in the United States increases food prices in the developing world. In this study, we focus specifically on ethanol and corn, the biomass used to produce ethanol in the United States. We investigate the relationship between domestic ethanol production and world corn price, controlling for foreign exchange rates and gasoline production. Data comes from 1990 to 2007. Contrary to the perception widely portrayed in the media, our preliminary findings do not suggest that an increase in ethanol demand increases corn price. This study has wide-ranging policy impacts, in the areas of energy and agriculture, as well as offering developments in the study of food security for developing nations.

Student: Lauren Kunz
Institution: St. Olaf College
Faculty Advisor: Paul Roback
Poster title: Statistical Methods for Operon Prediction in Mycobacterium tuberculosis
Display Area: 4F
Funding: National Science Foundation

Abstract: Mycobacterium tuberculosis is the causative agent of the disease tuberculosis. The World Health Organization estimates that one third of the world population is infected with the bacterium. With increasing susceptibility worldwide due to immune suppression from HIV and other diseases, gaining a better understanding of the cellular functions of the bacterium will be vital to developing new treatments. Identifying operons is one way of creating a deeper understanding of cellular function, because it identifies groups of genes that are regulated together within the cell. The goal of this research was to develop alternative statistical models to improve operon prediction in the bacterial species Mycobacterium tuberculosis. Our dataset consisted of almost 4,000 gene pairs with coexpression data from microarray experiments for over one hundred experimental conditions, as well as intergenic distance, promoter, and terminator data. We used models traditionally employed for operon prediction, as well as other data mining techniques, such as Random Forests and naïve Bayes, that were not previously used in the literature, using cross-validated sensitivity and specificity to guide us in model selection. This research presents a predicted operon map for the Mycobacterium tuberculosis genome, which will help other researchers study the cellular processes of the pathogen.

Student: Nathan Langholz, Matthew Nelson, Katrina Tummers, Ellen Wann
Institution: Saint Olaf College
Faculty Advisor: James Scott
Poster title: A National Intervention to Engage Students in Science
Display Area: 5A
Funding: National Science Foundation

Abstract: Currently, 46 percent of all college students in the United States attend community colleges. As a result, community colleges have a large potential to influence science education nationwide. To test the hypothesis that students learn science by doing science, we conducted a national intervention in community colleges to promote engagement and critical thinking in the sciences among both students and faculty. A randomized Solomon four-group design was applied to a nationally representative sample of approximately 1000 students and 42 faculty at 40 community colleges. Faculty members in the experimental group attended a three-day workshop designed to help them integrate investigative psychophysiology laboratory activities into their introductory psychology classes. In particular, each faculty member received curriculum materials and an apparatus capable of recording electrocardiograms, electromyograms, electroencephalograms, and electrooculograms. Faculty members in the control group did not attend the workshop or receive any new materials or the apparatus. The effects of the intervention upon participating students and faculty were measured using a pretest and a posttest questionnaire, which gauged responses to cognitive, affective, and behavioral factors in regard to the learning and teaching of psychology. Analyses were conducted using ANOVA and principal component methods. Additionally, multivariable regression was used to assess the effect of the intervention while controlling for pretesting. This analysis is part of a larger NSF funded study that seeks to increase the number of community college students excited about science, enrolling in advanced science courses, articulating to four year institutions, and entering science careers.

Student: Daniel Day
Institution: University of Minnesota
Faculty Advisor: Daniel Swets
Poster title: Finding gene patterns in cancer patients and linking biological databases together.
Display Area: 5B
Funding: National Science Foundation, NIH
Abstract: Modern medical treatment relies more on targeting treatment towards a patient's genome in order to improve the effectiveness of treatment. Treatment of cancer is one area of particular interest for development of personalized medicine to help cure the disease. The primary focus of this study was to random forests, a machine learning technique, to analyze the single nucleotide polymorphisms (SNPs) of cancer patients to find patterns which could help in developing future personalized medicine tests. This technique worked well in analyzing the data, but a larger set of data is needed to improve the accuracy of the patterns found. In addition to finding patterns in the genome, a localized method was developed to create a link between the GenBank's SNP and the Gene Ontology databases, two databases currently without any direct connection, allowing researchers greater ease from finding gene ontology identifiers related with particular SNPs.

Missouri

Student: Jeff Pobst
Institution: University of Missouri Columbia
Faculty Advisor: Peter Pfeifer
Poster title: High Capacity Storage of Alternative Fuels through Adsorption on Nanoporous Carbon for use in Vehicles.
Display Area: 5C
Funding: The Department of Energy
Abstract: The USA's current demand for petroleum leads to many problems (many being global concerns as well): a dependence on foreign nations for our energy, an increase in pollution/global warming, and high gas prices. Each of those is the source of many more problems that will become worse if not addressed:
Foreign dependence results in oil effected politics and economic foreign dependence.

Pollution and global warming result in an increase in the destruction of natural habitats due to changing climates, skin damage/cancer due to sun exposure, and natural disasters such as hurricanes and tornadoes that depend on higher temperatures.

Along with gas prices increasing, so will the prices of goods and services as the cost of energy to produce them increases.

My research with the Alliance for Collaborative Research in Alternative Fuel Technology addresses these issues by overcoming many of the hurdles that make current alternative fuels impractical. We have produced porous activated carbons that store high capacities of methane (natural gas) through physisorption for use in vehicle tanks. In optimizing storage capacity, we have studied production methods that vary the pore size distributions, surface areas, and densities of our carbons. We have found that the optimal pore size for methane is 1.1 nanometers and that it is best to maximize surface area and density. Our current best performers store 115-119 grams of methane per liter of carbon at ambient temperature and 34 bar, compared to the DOE target of 118 g/L. Our research is now expanding to include hydrogen.

Montana

Student: Thomas Bassett
Institution: University of Montana
Faculty Advisor: Ragan Callaway
Poster title: Comparative Responses of North American and European Generalist Herbivores to Spotted Knapweed
Display Area: 5D
Funding: Howard Hughes Medical Institute

Abstract: Invasive plants alter native ecosystems and negatively impact economies around the world. The primary hypothesis for how plants invade is the "natural enemies" hypothesis. This is the idea that invaders leave behind natural enemies such as their specialist herbivores. Specialist herbivores are highly coevolved with their prey plant species, and usually to specific plant defense chemicals. Conversely, most ecologists assume that generalists cannot explain invasion because generalists exist in both the native and invaded ranges. However, my results suggest that generalists may play an overlooked role in plant invasions. In collaboration with Swiss scientists and others at The University of Montana, I grew eight species of North American generalist leaf eating insects on Centaurea maculosa (spotted knapweed), one of the most destructive invasive weeds in the northern Rocky Mountains, and found that all eight grew poorly relative to their performance on control plants. In contrast, of eight species of European generalist leaf eating insects tested in a laboratory in Switzerland seven grew as fast on spotted knapweed as on control plants. I hypothesize that the poor growth of American generalists may be due the absence of adaptation to novel knapweed defense chemicals, supporting the "novel weapons" hypothesis. Spotted knapweed leaves contain the defense chemical cnicin, which has only been found in the genus Centaurea. The evolutionary naiveté of North American generalist herbivores to novel chemicals such as cnicin, and their potential avoidance of the weed, could provide knapweed with a strong advantage over native plants in the invaded range.

North Carolina

Student: Martina Mustroph
Institution: Davidson College
Faculty Advisor: Julio Ramirez
Poster title: Histological and Behavioral Analysis of rAAV9-induced Rodent Model of Taupathy in Alzheimer's Disease
Display Area: 5E
Funding: National Institute of Mental Health, Grant #: MH60608

Abstract: One of two hallmark features of Alzheimer's Disease is tau neurofibrillary tangles. My project seeks to develop an accurate rodent model of AD taupathy, which can be used in the future to develop drugs that prevent tau pathologies in the brains of human Alzheimer's patients. . The hippocampus is implicated in memory formation and one of the first brain areas affected in Alzheimer's Disease. Therefore, brain surgery targeting the hippocampus was performed on 20 male Sprague-Dawley rats. Ten rodents received 4 hippocampal injections (3 μl per injection) of replication-deficient adeno-associated viral vector serotype 9 (rAAV9) containing the gene for human tau with mutation P301L, which predisposes tau protein to hyperphosphorylation, increasing its tendency to aggregate into tangles. Ten control rodents received 4 hippocampal injections (3 μl per injection) of rAAV9 containing the gene for green fluorescent protein (GFP), a protein from the jellyfish Aequorea Victoria that naturally fluoresces under blue light and that reports expression. rAAV9s were obtained from the lab of Dr. Ronald Klein, Louisiana State University. Multiple subjects were tested daily on a Y-maze alternation task for six months. Preliminary findings indicate that

spatial memory deficits occur in the group with the mutated tau gene. Throughout data collection, the researchers were blind to the conditions. Histology testing to confirm GFP and tau presence is ongoing in collaboration with Dr. Michael King, University of Florida.

Student: Jennifer Gray
Institution: University of North Carolina at Asheville
Faculty Advisor: Gordon Wilson
Poster title: A Gradual Improvement of the Second Exemplar of Henry of Ghent's Quodlibet IV
Display Area: 5F
Funding: National Endowment for the Humanities
Abstract: One of the first tasks in establishing a critical edition is to do a "test" collation of all the manuscripts for representative sections of the entire work. There are about 37 complete or nearly complete manuscripts of this particular text. This test collation has already been done by Professors Wilson and Etzkorn. During the spring semester I worked with Prof. Wilson to create a table of the common variant readings from these selected passages of the text. We discovered that there is a group of six manuscripts which consistently had common variant readings. This probably happened because these six manuscripts were copied from the same source, a second model or exemplar which was in the bookstore of Paris. This source is now lost. One would naturally expect as one medieval manuscript was copied from another that there would be a gradual corruption of the text – new faulty readings, omissions, etc. would make their way into the text. But what we have found is that later manuscripts copied from this model had fewer common accidents than earlier ones. How is this possible? In addition to the expected deterioration of the text was there also a gradual improvement of the text? My hypothesis is that the, now lost, model itself of these six manuscripts – the bookstore's second exemplar – was corrected over time. This would explain the preliminary data we have on our list of common accidents. Would my preliminary hypothesis be verified by an examination of the entire text?

This summer I expanded upon this preliminary work by examining and analyzing the omissions by homeoteleuta found within the entirety of the Quodlibet IV text. This project included going through the text established by Prof. Wilson and Etzkorn of roughly 500 pages of Latin text. (The list of manuscripts, as well as the 20 pages of collected data will be shown on my poster.) This expanded research did continue to show the same evidence as the collated test group had shown, which validates my (at one point only provisional) proposal that the common source did in fact undergo a gradual improvement.

Nebraska

Student: Carolyn Posey, Timothy Smith, Robert Thomen, Danny Hames
Institution: Creighton University
Faculty Advisor: Michael Nichols
Poster title: Determination of Cell Elasticity through Hybrid Ray Optics and Continuum Mechanics Modeling of Cell Deformation in the Optical Stretcher
Display Area: 6A
Funding: NIH

Abstract: The optical stretcher is a dual-beam trap capable of stretching individual cells. At this time there is no direct method for measuring the optical stress distribution that is responsible for the action of the optical stretcher. Previous studies used either ray- or wave-optical models to compute the optical pressure on the surface of a spherical shell (1-2). We extended the ray-optics (RO) model to account for focusing by the spherical interface and the effects of multiple internal reflections. Using the exact ray-optics solution for the stress distribution, cellular deformation in the stretcher is determined by a numerical solution of the Euler-Lagrange equations appropriate for thin spherical shells. Our simulation results for red-blood cells (RBCs) show that internal reflections can lead to significant perturbation of the deformation. Even in the absence of internal reflections, the RO model produces stress distributions that can deviate from the cosine-squared approximation, potentially leading to a systematic error in the determination of cellular elasticity. Calibration studies with polystyrene spheres show excellent agreement between model predictions and experimental escape force measurements, and RBC elasticity measurements are consistent with literature values. We have also used the stretcher to measure the elasticity of murine 2T3 osteoblast-like cells, and find these cells are approximately 20 times stiffer than red blood cells.

1. J Guck et al. (2001) Biophys J. 81:767-784.
2. R Ananthakrishnan et al. (2005) Current Sci. 88: 1434-1440.

New Hampshire

Student: Lina Faller
Institution: University of New Hampshire
Faculty Advisor: Philip Hatcher
Poster title: An Investigation of Repeating Sequences in the Pseudomonas fluorescens SBW25 Genome
Display Area: 6B
Funding: Hamel Center for Undergraduate Research

Abstract: Repetitive elements are common in the genomes of most bacteria species. While many studies of prokaryotic genome sequences have noted these features, our knowledge of the origin and function of these elements is still incomplete. In this study, we are investigating the evolution of certain palindromic patterns found in the genome of Pseudomonas fluorescens SBW25. Using a collection of computer scripts written in Perl, as well as the Blast software suite, we isolated patterns and investigated their evolutionary behavior throughout the genome. We succeeded in identifying a group of closely related patterns that replicates extensively throughout the genome. Based on statistical tests and

the rigorous preservation of the sequences throughout the genome, we conclude that this group of patterns provides a significant function for the organism.

New Jersey

Student: Zunair Ashfaq, Tracy Gentzel
Institution: Richard Stockton College of NJ
Faculty Advisor: Ron Hutchison, Tara Harmer-Luke
Poster title: A Unique Soil Community from the Transantarctic Mountain Range
Display Area: 6C
Abstract: Cyanobacteria, bacteria, algae, and fungi often form a living crust, called a macrobiotic crust, on soils in desert environments. A reddish, brown crust was collected from Antarctica along the shore of a small, frozen lake at the eastern side of the Beardmore Glacier, making this one of the southern-most collections of a microbiotic crust. The purpose of our research was the isolation and purification of DNA from the crust samples, and the identification of the organisms present by sequencing the 16S and 18S ribosomal DNA, as well as the gene for the carbon fixation enzyme RubisCO. Isolation of crust DNA was achieved using a standard DNA isolation kit, which yielded DNA of sufficient purity and quantity to amplify using the polymerase chain reaction (PCR). The products of PCR were analyzed both with gel electrophoresis and with denaturing gradient gel electrophoresis (DGGE) gels. The most abundant cyanobacterium strain present was Fr121 (identified using the 16S ribosomal sequence), an organism previously identified from an algal mat from Lake Fryxell, Antarctica. A unique soil tardigrade sequence was also identified using 18S ribosomal analysis. The sequences of the RubisCO genes will be used to construct a phylogenetic tree of the photosynthetic organisms. We are currently in the process of identifying other organisms present in the crust, and are beginning to culture these organisms at Stockton College. Identifying the organisms now present in this consortium is important given the potential for temperature changes in this ecosystem.

New York

Student: Tyler Callnan
Institution: Hartwick College
Faculty Advisor: John Dudek
Poster title: Analyzing for potential surface water Pb contamination around a WWI firing range adjacent to the Greater Plains Elementary School, Oneonta, New York
Display Area: 6D
Abstract: This project measures the amount of lead contamination within the watershed area of a WWI firing range in the city of Oneonta, NY. Samples from both surface water and ground water upstream and downstream from the site will be analyzed for lead content. Using local lead averages not within the WWI firing range watershed, we will determine the degree of hazard, if any, that maybe be coming from this area. Also, if there is lead contamination, the project will determine the movement of the lead contamination within the watershed. The amount of lead will be measured using atomic absorption spectroscopy and colorimetric tests.

Student: Sarah Yoon-Miller
Institution: Hobart and William Smith Colleges
Faculty Advisor: Erin Pelkey
Poster title: Developing new synthetic methodology for the synthesis of biologically active heterocycles
Display Area: 6E

Abstract: Small molecule nitrogen heterocycles are important molecules that are found in nature and have shown a variety of biological activity that includes antimicrobial, anti-tumor, and anti-inflammatory capabilities. We have developed a three-step approach to biologically active 3,4-diaryl-3-pyrrolin-2-ones and 4-aryl-3-pyrrolin-2-ones from readily available tetramic acids. Introduction of different aryl groups to the 4-position of the ring systems was accomplished utilizing Suzuki-Miyaura cross-coupling reactions of the corresponding tetramic acid sulfonate esters. The effect of lactam protection, sulfonate esters, and sterics on the cross-coupling reaction has been compared between 4-aryl-3-pyrrolin-2-ones and 3,4-diaryl-3-pyrrolin-2-ones. Our results showed that triflates are better than tosylates; increasing sterics decreases reactivity and yield; and although the presence of a protecting group increases the yield, it is not necessary for the reaction to succeed. We utilized our methodology to prepare the lactam analogue of the anti-inflammatory drug rofecoxib (Dorward et al., Synthesis 2007, 2317-2322) and a cyclic analogue of the GABA agonist baclofen (Yoon-Miller et al., Tetrahedron Lett. 2007, 48, 827-830).

Student: Andrea Rosenberg, Katie Baldwin, Yolanda Nelson
Institution: Nazareth College
Faculty Advisor: Timothy Kneeland, Marie Watkins, Timothy Weider, David Anderson
Poster title: North Star Project
Display Area: 6F

Abstract: The North Star project is a portable display that reconstructs Rochester's place on the Underground Railroad produced by undergraduate students as part of Nazareth College's contribution to the Frederick Douglass International Underground Railroad Conference.   To create the historical display students researched primary and secondary sources, documents, images, and material culture found in libraries, archives, newspapers, and cemeteries. This material was synthesized to produce a narrative of individuals who escaped the horrific institution of slavery and those who assisted them on their path to freedom that led through Rochester, New York. These stories were further reduced to a set of snapshots of the Underground Railroad in Rochester, New York that served as the basis of the public history display. The display consists of 10 panels, each 3 feet by 8 feet, that tell the story of Rochester's pivotal role as a gateway to freedom. Panels begin with a "Wanted" poster containing the name and story of a freedom seeker, and then follow that person's journey to the North. The project blended the theory and practice of service-learning, civic engagement and student centered research to provide an innovative model for community oriented undergraduate research.

Ohio

Student: Preethi Mani
Institution: Case Western Reserve University
Faculty Advisor: Radhika Atit
Poster title: Characterizing Wnt Signaling during Craniofacial Dermal Development
Display Area: 7A
Funding: Case Western Reserve University Start-Up Funds
Abstract: The dermis houses hair follicles, glands, and blood vessels and is critical for functional skin. In this study, we focus on the development of craniofacial dermis. In the chick embryo, craniofacial dermis is derived from cranial neural crest cells (CNC), which also give rise to craniofacial cartilage, bone, and nerves. The signals that instruct a CNC to become a dermal cell remain unknown. The Wnt signaling pathway specifies dermal fate in the mouse dorsum. Although dorsal dermis is derived from the somites, we hypothesize that there is a conserved mechanism of Wnt signaling in the development of craniofacial dermis from CNC. To test this hypothesis, we first characterized when and where Wnt signaling occurs in the head using a transgenic Wnt signaling reporter mouse. We found that Wnt signaling reporter expression is strong earlier in CNC and later in dermal progenitors and the subectodermal cells of the branchial arches, ear, and brain. We also defined the identity of Wnt signaling cells as CNC and dermal progenitors. Beta-catenin is a central transducer of Wnt signaling. The absence of beta-catenin in CNC leads to a loss of Wnt signaling reporter expression, demonstrating that beta-catenin is functioning in the Wnt signaling pathway. Our data suggests an important role for Wnt signaling in craniofacial dermal development. Future experiments will focus on the role of Wnt signaling in craniofacial dermal development. By defining the signals of dermal induction throughout the embryo, we can create functional skin equivalents to treat congenital skin defects, burns, and wounds.

Student: Annamaria Crescimanno
Institution: The Ohio State University
Faculty Advisor: Sam Stout
Poster title: A Comparison of Osteon Circularity between Human Long Bones versus Non Human Long Bones.
Display Area: 7B
Abstract: Distinguishing between human and non human bone is often important in forensic anthropology, especially when the skeletal remains are fragmentary. One promising approach is based upon differences in bone microstructure between human and non human bones. This study compares the shape (circularity) of microscopic structures, called osteons, which are present in the bone of all large vertebrates. Circularity is hypothesized to more closely approximate a perfect circle in non-human long bones than human long bones based on biomechanical differences between bipedal human and quadrupedal animals. Samples of midshaft diaphyses of several long bones, e.g., rib, femur…. from humans and several animal species that are most likely to be encountered in forensic recoveries were sectioned in a transverse plane and sectioned for microscopic analysis. Osteons were viewed at 20X magnification in three microscopic fields selected from each human and non human specimen with the criteria that 3 osteons exhibiting circular canals were observable in each field. Circularity was measured as Circularity = $4pi(area/perimeter^2)$ using image analysis software. Statistical comparison of circularity values among species revealed that there is a significant difference (0.0067) between the circularity of osteons present in human versus non human long bones. Therefore, it is concluded that a significant difference occurs for these microscopic structures and they can

be used to distinguish between human and non human long bone fragments in forensic investigations.

Student: Greg Madonia
Institution: The University of Akron
Faculty Advisor: Francesco Renna
Poster title: Terrorism's Effect on FDI: Analysis of 96 Countries from 1999 to 2003
Display Area: 7C
Abstract: This study investigates the effects that terrorism has had on net foreign direct investment (FDI) inflows. Terrorism is expected to influence foreign direct investment because it increases the risk involved with an investment. Additionally, a terrorist incident has the potential to destroy infrastructure, buildings and human life. Loss in these factors has the ability to decrease the expected return form an investment and decrease economic growth. This paper distinguishes between total terrorist incidents, international terrorist incidents and domestic terrorist incidents of 96 countries between the years 1999 and 2003. Terrorist incident data comes from The Terror Knowledge Base, which was compiled by the RAND Corporation, from newspaper and police reports. The model used for estimation is a country fixed-effects regression. The dependent variable is the natural log of net FDI inflows and the control variables are terrorist incidents, GDP growth, natural log of imports and an index measurement of fiscal freedom. The findings of this study were that terrorist incidents, when lagged one year, had no statistically significant effect on foreign direct investment. However, when terrorist incidents were lagged three years, terrorism was found to have a statistically significant negative effect on FDI. An increase of 10 percent of total terror incidents decreased FDI by 1.14 percent. An increase of 10 percent of international terrorist incidents decreased FDI by 1.46 percent and an increase of 10 percent of domestic terrorist incidents decreased FDI by 1.22 percent.

Oklahoma

Student: Vagan Mushegyan
Institution: University of Central Oklahoma
Faculty Advisor: Gregory Wilson
Poster title: Population Genetic Structure of the Texas mouse, Peromyscus attwateri, in North America as inferred from mitochondrial DNA sequence data
Display Area: 7D
Abstract: The Texas mouse, Peromyscus attwateri, occurs in portions of Missouri, Kansas, Arkansas, Oklahoma, and Texas. As compared to other species of Peromyscus, the Texas mouse is thought to be more habitat specific and exhibits a more discontinuous and patchy distribution throughout its geographic range. Such habitat specificity makes P. attwateri a unique model species for investigating how the climatic fluctuations which occurred during and following the Pleistocene impacted both historic and contemporary population genetic structure. To elucidate how these factors impact patterns of population genetics of P. attwateri, we used DNA sequence data from the control region of the mitochondrial genome (mtDNA) from 311 individuals from 21 populations across the entire geographic distribution of P. attwateri. Analysis of molecular variance (AMOVA) revealed the majority of genetic variability was due to variation within populations (79.87%), whereas lower levels of variability were attributed to differences among populations (20.13%). Analyses also indicated significant population structure (Φ_{ST} = 0.2013; $P \geq$ 0.001), suggesting limited movement among populations. Populations from central Texas exhibited

the greatest amount of genetic variability, whereas populations from northeastern Oklahoma exhibited the least amount. Mismatch distribution suggested that an ancestral population might have been located on the Edwards plateau (central Texas) and the species subsequently expanded its geographic range northward during and following climatic oscillations of the Pleistocene. Understanding how organisms responded to historic climatic oscillations will allow us to predict how organisms might respond to future climatic change and help in conservation efforts for maintaining genetic diversity of species.

Oregon

Student: Justin Heser
Institution: University of Portland
Faculty Advisor: Steven Mayer
Poster title: Investigating the molecular interactions between solute and cosolvent molecules in supercritical carbon dioxide
Display Area: 7E
Funding: National Science Foundation
Abstract: We investigated the effect of adding acetonitrile to supercritical carbon dioxide ($scCO_2$) in the presence of rhodamine B. The spectra that we collected reveal several trends that are indicative of the mechanical constraint on the acetonitrile. An increase in temperature causes the stretching modes to blue shift, whereas; an increase in the acetonitrile concentration causes the same modes to red shift. An interesting effect that we did not anticipate is that the bending modes appear to be completely unaffected by either a change in temperature or concentration. Furthermore, the individual stretching modes of both acetonitrile and CO_2 are shifted by a different amount, which may lend some insight into spatial orientation of the molecules in the cybotactic region. At these concentrations of acetonitrile in $scCO_2$, we do not observe any difference in the spectra with the inclusion of rhodamine B. This is in direct contrast with the effect of rhodamine B on the cosolvent that we reported in the literature for low concentrations (~0.001%) of acetonitrile. Apparently, acetonitrile at a concentration of 0.5% in $scCO_2$ behaves more like it would in the bulk phase than it does at much lower concentrations.

Pennsylvania

Student: Allison Superneau, Ashley Mayer
Institution: Cabrini College
Faculty Advisor: David Dunbar
Poster title: The Identification of Downstream Signaling Partners to PTHrP in the Mammary Gland
Display Area: 7F
Abstract: Although mammary development is well-defined structurally, not much is known regarding the molecules involved in its regulation. Previous studies show that the parathyroid hormone-related protein (PTHrP) is necessary for normal mammary gland development and over-expression in mice leads to severe defects during puberty, a period of intense estrogen-induced growth. It is our hypothesis that PTHrP regulates pubertal growth of the mammary gland by modulating the expression/activation of growth factors in response to estrogen. Therefore, we examined the differential gene expression in adolescent wildtype and PTHrP-overexpressing mice by isolating RNA from each, reverse transcribing the RNA into cDNA, and then amplifying the cDNA using arbitrary primers. Several cDNAs have been identified that appear to be differentially expressed in mammary glands from wildtype and PTHrP-overexpressing mice.   Of particular interest is the transcription factor Rtf1 that we identified, whose expression is said to be in the mammary

gland during puberty leading us to believe it functions in mammary development. Experiments are ongoing to further explore PTHrP's effect on Rtf1 expression in mammary glands. These results should help to elucidate the role of PTHrP in regulating estrogen-induced growth in the mammary gland. Learning more about the specific molecules involved in mammary gland development may also give insight into which genes play a role in human breast cancer. Because breast cancer is essentially the result of abnormal mammary gland development and because mice and humans share about 99% of their genes, it's possible that this research may provide a foundation for new types of therapy.

Student: Nicholas Pashos
Institution: Drexel University
Faculty Advisor: Margaret Wheatley
Poster title: Mechanical Properties of Biocompatible and Biodegradable Hydrogel Scaffolds
Display Area: 8A
Abstract: Using tissue engineering and drug delivery techniques these hydrogel scaffolds have been modified to allow cell differentiation from neural progenitor cells and propagation of cell-to-cell connection from new nerves on the scaffold to the nerves in the surrounding environment.
The purpose of this project was to test the compression and elasticity of multiple hydrogels of various concentrations and surface modifications to establish which hydrogel is the most suitable scaffolding material. This was accomplished by determining whether the mechanical properties of the hydrogels are suitable for the spinal cord. The compression stiffness and elasticity of alginate, gellan gum and agarose were calculated. 1% alginate, was determined to be most promising with an average Young's modulus (tensile) of 41.402 N/mm2; however, the 1% gellan gum was proven to be the most brittle and the least desirable biomaterial with a Young's modulus (tensile) of 99.576 N/mm2.

Student: Dana Mears
Institution: The Pennsylvania State University
Faculty Advisor: Jeffrey Catchmark
Poster title: Acid Hydrolysis of Different Cellulose Fibers to Create Nanowhiskers for Clay Composite Reinforcement
Display Area: 8B
Abstract: Nanocomposite construction using biologically derived materials is an expanding research arena presenting the possibility for improved wood and agriculturally based materials which consume less fiber, chemicals and energy in production resulting in many environmental benefits. In addition to a reversion from dwindling resources, nanoscale composites have been shown to possess improved mechanical properties such as strength, stiffness, and thermal stability.

Cellulose, the most abundant organic material in nature, can be used for nanocomposite reinforcement of building materials. One of the most common methods of extracting cellulose from organic materials and reduction of its size to the nanolevel is acid hydrolysis. Six hydrolysis runs of two different sources of cellulose, microbial and plant, were performed using identical sulfuric acid concentrations, hydrolysis times, and temperatures. Comparison of the fiber dimensions were characterized using the field emission scanning electron microscope (FESEM) to determine the optimal cellulose source for nanowhisker development and to elucidate if a slight variation in sulfuric acid concentration affected whisker size. Further expansion of this research will involve dispersion of the hydrolyzed

nanowhiskers into clay-based nanocomposites for reinforcement and study of mechanical properties.

Student: Andrew Novick
Institution: University of the Sciences in Philadelphia
Faculty Advisor: Shanaz Tejani-Butt
Poster title: The Effects of Stress on Dopamine Type-1 Receptor Binding in an Animal Model of Depression
Display Area: 8C
Funding: NIAAA
Abstract: Genetic predispositions to the effects of stress likely underlie the development of psychiatric disorders. In order to study such predispositions, our lab has utilized the Wistar-Kyoto rat (WKY): a stress-sensitive strain that is prone to depressive-like behavior in various experimental paradigms. Due to the important role of central dopamine pathways in the response to stress, recent work has focused on exploring dopaminergic regulation in WKY rats compared to other strains. To further this work, the present study utilized autoradiographic analysis of 3H-SCH23390 binding to dopamine type-1 (D1) receptors in various brain regions. D1 receptor binding was measured in WKY and Wistar rats both in a naïve state and after being exposed to either acute or chronic stress. The results revealed a significant baseline strain difference, with naïve WKY rats having lower D1 receptor binding in the caudate putamen and nucleus accumbens and higher D1 receptor binding in the substantia nigra pars compacta and substantia nigra pars reticulata compared to Wistar rats. In response to acute stress, WKY rats showed a decrease in D1 receptor binding in the substantia nigra pars reticulata, while Wistar rats demonstrated an increase in D1 receptor binding in response to both types of stressors in both regions of the substantia nigra. Given the role of the D1 receptor in movement, motivation, and adaptive behavior, such differential regulation in the WKY could be partly responsible for the stress-susceptibility and depressive behavior noted in this strain.

South Carolina

Student: Brent McCarragher
Institution: The Citadel
Faculty Advisor: Alix Darden
Poster title: Developmental characterization of Xenopus laevis photoreceptor cells.
Display Area: 8D
Funding: National Science Foundation
Abstract: Purpose: Photoreceptor cells contain opsin which mediates vision. Inappropriate expression of the opsin leads to photoreceptor cell death, and ultimately can lead to retinal degeneration. Targeted gene expression using transgenic Xenopus laevis, African clawed frog, provides a model for dissecting normal retinal function and development. However, this model is limited by the fact that the development of all photoreceptor cells has not been characterized. Red rod and red cone photoreceptors develop within days of fertilization. The aim of our research is to developmentally characterize the green rod and violet cone photoreceptors completing the developmental characterization of the retina photoreceptors.

Methods: Tadpoles were staged according to developmental progression.   Retinal RNA isolated from these tadpole stages was reverse transcribed and amplified by polymerase chain reaction (RT-PCR) using primers specific for the violet cone and green rod opsin genes.   Immunohistochemistry was performed on crytostat thin sections of staged tadpole eyes, using photoreceptor specific antibodies.

Results and Conclusions: The expression of violet cone and green rod opsins was first detected at the onset of metamorphosis, one to two months after fertilization, as shown by both RT- PCR and immunohistochemistry. This opsin expression is delayed compared to red cone and red rod opsins. The research conducted has allowed for the complete developmental characterization of the Xenopus retinal photoreceptors, thus allowing for the continued studies of normal and diseased retina.

Tennessee

Student: Taylor Barnes
Institution: Middle Tennessee State University
Faculty Advisor: Preston MacDougall
Poster title: Coulombic Model of the Anomalous Conformations of the Chlorinated Acetates
Display Area: 8E
Abstract: Quantum chemical calculations and crystallography data indicate that the chlorinated acetates favor several counterintuitive conformations in which a chlorine atom is eclipsed with a carboxyl oxygen. In order to explain these results, the Quantum Theory of Atoms in Molecules is used to examine the conformational behavior of the chloroacetate anion at the atomic level. Trends in atomic energies, dipoles, and electron densities are presented. The anomalous conformational energies are modeled in terms of a novel perspective on intramolecular Coulombic interactions and the stability of the eclipsed conformation is attributed to a chlorine-induced dipole along the carbon-carbon bond which lowers the energy of both eclipsed atoms.

Student: Jeremy Curtis
Institution: Middle Tennessee State University
Faculty Advisor: Daniel Erenso
Poster title: Formation of Synthetic Structures with Micron Size Silica Beads Using Optical Tweezer
Display Area: 8F
Abstract: Colloidal particles, such as silica, are particles having size ranging between several nanometers and several millimeters and can be suspended in a liquid. Because of their tunability, in size, shape, as well as in chemical composition, and their ability to self-assemble they find applications in the development of advanced materials like photonic crystals. Typically, colloids self-assemble into face centered cubic or body centered cubic structures and this self orientation determines their optical and electrical properties. The control over the structures of one-component colloids using array of optical tweezers, without changing the liquid chemical composition, is limited. If we cut off the laser, then the colloids will eventually lose their new structure. However, by changing the chemical composition of the liquid in which the colloids are suspended in and using optical tweezers, it is possible to assemble the colloids in a new stable structure which possibly results in new optical and electrical properties. In this work, we have demonstrated that micron-size silica beads can in fact be arranged in desired synthetic structure using an optical tweezer in a saline buffered solution.When 3.1 micron silica beads are suspended in a colloidal aqueous solution and the right proportion of antistick glycol and NaCl are added a solution a solution is formed in which silica beads brought close to one another can bind by an adhesive electrostatic force without drifting away due to their thermal energy. Then by trapping and dragging one bead at a time using an optical tweezer, we have arranged the silica beads in two-dimensional structures. [Journal of Modern Optics, 54, P 1529-1536]

Texas

Student: Shauna Yow
Institution: Texas A&M University
Faculty Advisor: Edward Rister
Poster title: Water Market Distortions Created by Legislation
Display Area: 9A
Funding: USDA, CSREES, and Texas Cooperative Extension

Abstract: The population of Texas is expected to double by 2050. Such population growth substantially increases the demand for potable water, raising concerns regarding both the quantity and quality of future water supplies. The Lower Rio Grande Valley is one area in which alternative water sources and potable treatment methods are being sought to support a high population growth. An emerging promising approach to expanding potable water supplies is the desalination of brackish groundwater. Recent technology developments in desalination membranes combined with an increasing price of local water rights have resulted in the economics of desalination becoming more competitive with traditional treatment methods.

Attempting to facilitate meeting the increasing needs for municipal water, the 2007 Texas legislative session passed Senate Bill 3, establishing the price at which irrigation water converts to municipal water at 68 percent of the prevailing market price. Preliminary economic and financial investigations suggest this legislation could create a technology-oriented market distortion between desalination and traditional surface water treatment methods, raising the costs of desalination relative to traditional methods.
This project seeks to identify and analyze the economic and social implications of Texas Senate Bill 3 in the Rio Grande Valley water market and the resulting adoption of alternative technologies for producing potable water. The motivation behind this project is to identify the most efficient practice of providing water to regions where water is scarce and population is rapidly increasing and to identify the potential implications of legislative actions developed in the absence of thorough prior considerations.

Utah

Student: Lindsay Cole
Institution: Weber State University
Faculty Advisor: John Cavitt
Poster title: Nest-site selection of shorebirds at Great Salt Lake: implications for development of water quality standards
Display Area: 9B
Funding: Utah Division of Water Quality and U.S. Environmental Protection Agency

Abstract: The "Clean Water Act" requires that states develop water quality standards for the beneficial use of its water bodies. The Great Salt Lake (GSL) is a critical stopover and breeding site for shorebirds. Approximately 5 million birds utilize the GSL each year. Despite its importance, water quality standards do not exist. The state of Utah and the USEPA have initiated projects to develop water quality standards for GSL. In order for these standards to provide optimal breeding habitat for shorebirds, it is imperative that habitat conditions are identified which sustain healthy populations of coexisting species. Consequently, I monitored the nesting success of two shorebird species, American Avocets (AMAV) and Black-necked Stilts (BNST) at GSL, and characterized the vegetation surrounding each nest. I measured the following variables at nests and at random non-use sites: substrate, percent cover, cover height, distance to water, and vertical concealment of nests. My results identified key habitat features used in selecting nesting sites. For

example, BNST selected sites with significantly greater vertical concealment relative to AMAV and random sites. The results of this study also documented habitat features which increased nesting success. Successful AMAV nests had less bare ground relative to those nests later consumed by predators. In addition, successful nests of both species were significantly closer to water than depredated nests.   The results of this study provide clear information on breeding habitat preferences. These data will be utilized to ensure that water quality standards and management guidelines promote optimal breeding habitat for these species.

Virginia

Student: Kathryn Lamp
Institution: Christopher Newport University
Faculty Advisor: Andrew Velkey
Poster title: Photoperiod Shifts Choice Preference from Impulsivity to Self-Control in Siamese Fighting Fish (Betta Splendens)
Display Area: 9C
Abstract: Animals can often choose between smaller and immediately available rewards (i.e. impulsiveness) and larger but delayed rewards (i.e. self-control). While past research has examined the effects of various factors on impulsive choices in a number of species, little research has been conducted on the effects of photoperiod duration on these choice distributions. Furthermore, limited research is available on choice behavior in teleost species. To address these limitations, the current study examined instrumental choice behavior in 22 male Siamese fighting fish (Betta splendens) housed under different light cycles. In the current study, 14 subjects were housed under a 12:12 h light-dark cycle, and 8 subjects were housed under a 24 h light cycle. Over a 3-week series of instrumental trials, each subject had the choice of a smaller-sooner reward (1 food pellet delivered immediately) or a larger-later reward (3 food pellets delivered after an 18-s delay). Subjects tested in the 12:12 h light-dark condition made significantly more self-control choices than impulsive choices, whereas subjects tested in the 24 h light condition made significantly more impulsive choices than self-control choices. Substantial research has established a direct connection between photoperiodicity and serotonin levels; perhaps serotonin plays a role in the sensitivity of animals to delays in reinforcement. Future research should further examine the effect of photoperiod duration other species' sensitivity to changes in magnitude and delay to reinforcement to determine if similar effects of light cycle are found in the choice behavior of other species.

Student: John Bajacan
Institution: Virginia Commonwealth University
Faculty Advisor: Jacqueline Smith – Mason, Yan Zhang
Poster title: DESIGN AND SYNTHESIS OF ANIBAMINE-BASED, MACROPHAGE CCR5 ANTAGONISTS FOR HIV-1 FUSION INHIBITION
Display Area: 9D
Funding: Department of Health and Human Services
Abstract: HIV-1 is the most widespread causative agent of the continually expanding acquired immunodeficiency syndrome (AIDS) pandemic. Its rapid rate of mutation and high development of drug resistance prompt the need for more potent antiretroviral drugs with novel modes of action in targeting critical and more conserved HIV-1 activities. One novel finding has confirmed that the macrophage chemokine receptor CCR5 plays an essential role as the co-receptor in M-tropic phase HIV-1 fusogenesis. Anibamine, from the Aniba sp., was recently characterized with high-affinity antagonism to CCR5 (IC50=1.0 uM). This quaternary alkaloid possesses a novel structure compared with other known CCR5

antagonists. Completion of an eleven-step total synthesis of this natural product allows us to pursue the structure-activity relationship study. Two series of the derivatives of anibamine have been designed to optimize the inhibition activity and to identify the new lead compound. The chemical synthesis of these novel ligands are in progress. Characterization of final compounds will be accomplished by NMR, IR, MS, and elemental analysis. Structure-activity relationship will then be evaluated through biological testing, including [125I]-RANTES competitive binding assay. Promising final compounds (IC50<0.10 uM) will be evaluated on HIV-1 entry inhibition assays, including competition with HIV-1BaL on GHOST R5 cells. This work may usher in further improvements on the clinical potential of anibamine analogs for delaying early HIV-1 infection and thus the onset of AIDS.

Student: Daniel McCord
Institution: Virginia Military Institute
Faculty Advisor: Patricia Hardin
Poster title: The Teutonic Order: Conversion and Conquest
Display Area: 9E
Funding: VMI Undergraduate Research Initiative
Abstract: One of the most important results of the Third Crusade was the German crusading order that would come from some of its participants.
In 1199, the Order of St. Mary of the Teutons, the Teutonic Order, was founded in the Holy Land at the city of Acre. Most of the order's activities though were based on actions not in the Holy Land, but in the northern and eastern regions of Europe. In 1291 though, the order was pushed out of the Holy Land, and moved their headquarters to Venice, where they stayed until 1309. That year, the order moved to Malbork in modern day Poland which remained their headquarters until 1525.

My summer research focused primarily on two questions concerning the history of the Teutonic Order, namely its reasons for moving to Venice, Italy after the fall of the Order's headquarters in Acre and then what the Order did while it was in Venice and how exactly it came to move its headquarters to Malbork, Poland roughly twenty years after the shift to Venice.

I conducted research at various libraries and archives throughout Europe. At the Central Archive of the Teutonic Order, I had the opportunity to interview Pater (father) Bernhard Demel, the head of the archive as well as one of the chief scholars for the Teutonic Order and one of the few members of the Order itself.

Vermont

Student: Rebecca Garcia-Putnam
Institution: Middlebury College
Faculty Advisor: Marcia Collaer
Poster title: Sex Differences in a Spatial Virtual Navigation Task
Display Area: 9F
Funding: Vermont EPSCoR & Vermont Genetics Network
Abstract: Males and females of many species differ for aspects of navigation ability, and a variety of factors are suggested to contribute to these differences both within-sex and between sexes. Previous research in humans indicates that, after learning an environment using desktop virtual reality (VR) technology, subsequent pointing to nonvisible locations within that environment is easiest from the original (aligned) perspective and more difficult from misaligned perspectives that require "spatial position updating." Additionally, a subset of females is particularly impaired at this task. We sought to replicate this finding and

explore whether extending peripheral vision using a wider field of view (FOV) might provide richer input and thus improve spatial updating. We hypothesized that females would have greater difficulty pointing to targets from misaligned orientations than males, and wider FOVs would lead to better performance than narrower FOVs. Right-handed participants (34 male, 35 female) traversed simple three-segment VR pathways with different FOVs, were returned to various positions along the path, and pointed to previously encountered locations. There was a significant interaction of alignment and sex, with the sexes not differing in pointing accuracy for aligned positions, but with males more accurate for misaligned positions. FOV was a significant factor, with narrow fields impairing performance; however, wider views did not help performance versus medium views. Results are being explored with respect to video game experience and potential hormonal factors. Future research aims to identify the role of hormones as well as environmental factors that could optimize the performance of females.

Washington

Student: James Rosser
Institution: Seattle Pacific University
Faculty Advisor: Derek Wood
Poster title: Identification of Essential Genes in Azotobacter vinelandii DJ
Display Area: 10A
Funding: National Science Foundation
Abstract: Azotobacter vinelandii is a Gram-negative soil-borne bacterium that fixes nitrogen aerobically. This bacterium has a number of industrial applications including the production of pharmaceutical grade alginate and bioplastics. We recently completed sequencing the 5.36-Mb genome of A. vinelandii DJ. The availability of these sequence data allowed us to implement a novel high-throughput screen to investigate the function of proteins in this genome. Our specific goal in this project was to identify essential genes under nitrogen-limiting conditions. Several previous studies have reported that A. vinelandii maintains between 40 and 80 identical copies of its genome per cell depending on growth conditions. Genetic studies in this organism have shown that mutations in essential genes are maintained in a heterogenomic state while mutations in non-essential genes will become homogenomic after chromosomal segregation. These observations form the basis for our screen. To address our goal, an 8000 member Tn5 mutant library has been constructed in A. vinelandii DJ. Using a two-step high throughput screen, we identified 1082 mutants in essential genes under nitrogen limiting conditions. Fifty of these mutants have been confirmed and the locations of the Tn5 inserts have been identified. The success of this assay indicates that essential genes can be identified under a variety of conditions that affect this model organism's biology.

Student: Amy Jemelka
Institution: Washington State University
Faculty Advisor: Timothy Freson
Poster title: Cardiovascular Fitness, Anxiety, Depression, and Insulin Resistance in a Young Population
Display Area: 10B
Abstract: Insulin resistance (IR) is a significant risk factor for the initiation and progression coronary heart disease (CHD). Anxiety (AX), depression (DEP), and cardiovascular fitness (CF) play a role in IR in older populations. This study evaluates the relationship of CF, AX, and DEP to IR in a young healthy population. Participants were 159 healthy young adults with a mean age of 18.25 and SD = .88 (59.1% female, 40.9% male). Psychological factors of DEP and AX were measured using the Center for Epidemiological Studies-Depression

scale (CES-D), and the trait anxiety portion of the State-Trait Anxiety Inventory (STAI). Physiological predictor variables included blood pressure, lipids, adiposity, CF, and inflammatory markers. Significant correlates with CF, CES-D, and STAI were entered into hierarchical regressions, controlling for gender, smoking and medication. CF was a significant independent predictor of log transformed homeostatic model assessment-IR (HOMA-IR) (b = -.224, p = .007), log transformed insulin (b = -.231, p = .006), waist circumference (b = -.274, p = .001). CF (b = -.242, p = .000) and gender (b = -.748, p = .000) were significant predictors of percent body fat while CF (b = -.209, p = .011), gender (b = .192, p = .021) and smoking (b = -.179, p = .020) were significant predictors of diastolic blood pressure. The psychosocial factors trait AX and DEP were not significant predictors of insulin resistance risk factors in this younger healthy sample. Perhaps psychological factors play a larger role with increasing age and level of diseas

Washington, D.C.

Student: Emily Herzberg, Allison Boyd, Allison Porter, Nicole Lamparello, Kaileen Rohr, Miguel deLeon, Katie Dickinson, Staceyann Smith, Sunaina Yarlagadda
Institution: Georgetown University
Faculty Advisor: Charles H Evans, Jr., Michael Relf
Poster title: Antiretroviral drug resistance among treatment-naïve HIV-1-infected individuals in Washington, DC.
Display Area: 10C
Abstract: Recent literature has documented the emergence of HIV-1 genotypic mutations resulting in reduced susceptibility of the HIV-1 virus to antiretroviral therapy among treatment-naïve individuals, i.e., individuals who have never received antiretroviral drugs. Emergence of HIV-1 drug resistance mutations presents a serious challenge to addressing HIV/AIDS, as individuals with drug resistant virus must be identified and treated accordingly. The rates of HIV-1 genotypic drug resistance mutations among treatment-naïve HIV-1-infected individuals in Washington, DC, the city with the highest rate of HIV/AIDS in the US, have not been reported as of November 2007. We conducted a molecular epidemiological investigation to determine the rates of antiretroviral resistance in a retrospective sample of treatment-naïve individuals in Washington, DC newly enrolling in medical care during 2005. Analysis of the HIV-1 genotypes from 42 treatment-naïve individuals indicates the presence of resistant HIV-1 among treatment-naïve individuals in Washington, DC. 9.5% of the study population presents with clinically significant drug resistance, including 4.8% with resistance to nucleoside/nucleotide reverse transcriptase inhibitors, 4.8% with resistance to non-nucleoside reverse transcriptase inhibitors, and 0.0% with resistance to protease inhibitors. A similar pattern of drug resistance is present in approximately 130 treatment-naïve individuals enrolling in care during 2006. This distribution of drug resistance in some 170 treatment-naïve individuals in Washington, DC is similar to the pattern being observed both nationally and globally. The presence of transmitted antiretroviral drug resistance in Washington, DC has important public health implications and validates the need to further investigate the rates of resistance in other metropolitan areas.

West Virginia

Student: Joseph Boyd, Joshua Posey
Institution: Fairmont State University
Faculty Advisor: Rebecca Giorcelli
Poster title: A Research Study of New Computing Algorithms for a Public Grid Infrastructure using the Global Grid Exchange
Display Area: 10D

Abstract: Computer scientists are researching ways to increase the capability of computing, and the public grid is one solution. A public grid harnesses the unused processing power of many computers donated by its users. This allows researchers to use the computing power, but brings in many variables like computer speed and latency.
An examination of the feasibility of a public grid was conducted with two node variations, one using 10 nodes and the other using 250 nodes, and compared to the processing speed of one computer when calculating complex algorithms. A calculation that tests the bit error rate of data in transmission when noise is added was used as the standard for basing the results. The algorithm calculates signal to noise values, or EsNos. Analysis of these calculations shows that with small values of EsNo a single node is faster than a public grid, as the latency and overhead associated with a public grid slows calculation time. With increasing EsNo values, both grid platforms calculated results faster than the single computer since the complexity of the calculation and resources needed became more demanding. When compared to a single node at 30 EsNos, the 10 node grid was twice as fast, and the 250 node grid was three and half times faster than the single node. Conclusion shows that answers in increasingly complex algorithms can be obtained quicker using a public grid than a stand-alone workstation when sufficient bandwidth and resources are obtained, thus overcoming latency issues associated with a grid environment.

Wisconsin

Student: Matthew Blodgett
Institution: University of Wisconsin – River Falls
Faculty Advisor: James Madsen
Poster title: Calibrating South Pole IceTop Detectors using Tagged Cosmic Rays
Display Area: 10E
Funding: National Science Foundation

Abstract: IceTop is the surface component of the National Science Foundation supported IceCube Neutrino telescope under construction at the South Pole. IceTop detects high energy cosmic rays, which are charged particles from outer space that travel at nearly the speed of light. In addition to it's role investigating cosmic rays, IceTop is also contributes to the calibration and operation of the neutrino telescope.

Each IceTop station consists of two tanks of bubble-free ice containing two Digital Optical Modules. These detect light produced when radiation passes through the tank.
When finished in 2011, there will be 80 stations 125 meters apart on a triangular grid. IceCube is the largest research project in Antarctica, and an official International Polar Year Project.

Vertically traveling muons were identified with a portable secondary detector, originally developed for studying cosmic rays as part of the Quarknet high school education and outreach project. Cosmic rays were independently measured by the two detectors, and the simultaneous events were matched using a GPS time stamp.

The energy loss per meter of travel in ice is known for muons. The vertical events identified by the secondary detector serve as a known signal to calibrate the response of the IceTop tanks. Results for different IceTop tanks are shown, as well as the variation of responses depending on where the muon passes through the tank.

Student: Amanda Liesch
Institution: University of Wisconsin River Falls
Faculty Advisor: William Anderson
Poster title: VISUAL SOIL STRUCTURE, VANE SHEAR STRENGTH AND DRY AGGREGATE DISTRIBUTION IN THREE DIFFERENT ORGANIC MATTER TREATMENTS
Display Area: 10F
Abstract: The Visual Soil Structural Assessment (VSSA) is a rapid, comprehensive visual tool in gauging the overall health and productivity of the soil, especially for the non-scientist. The VSSA is done by removing a spadeful of soil from the ground, and observing its physical attributes, and matching these attributes to a designed grid, assigning a visual quality score from 1 being the best, to five being the worst. Visual analyses like this one are not usually correlated to other physical measurements of soil. This study correlates VSSA with vane shear strength and dry aggregate distribution, as these indicators of soil physical health and fertility closely match the characteristics measured by VSSA. These tests were administered in three different treatments of organic matter: municipal compost, slurry (urine and manure mix), and a control plot with no treatment. All three treatments of organic matter were tested in October 2006, and then again in March 2007 to determine whether a period without tillage and mechanical manipulation changed the visual quality of the soil. We found that VSSA and vane shear strength had a very strong correlation and accurately reflect the compaction level in the soil, while dry aggregate distribution did not have a strong relationship with visual score. We concluded that VSSA is a reliable detector of soil of poor soil health and compaction. Soil with the two organic matter treatments showed substantial improvements over the winter, while the control plot had a drastic deterioration in soil quality.

1	**2**	**3**	**4**	**5**			**6**	**7**	**8**	**9**	**10**
A/D	A/D	A/D	A/D	A/D			A/D	A/D	A/D	A/D	A/D
					Reception Area						
B/E	B/E	B/E	B/E	B/E			B/E	B/E	B/E	B/E	B/E
C/F	C/F	C/F	C/F	C/F			C/F	C/F	C/F	C/F	C/F
1	**2**	**3**	**4**	**5**			**6**	**7**	**8**	**9**	**10**

Entrance   **Entrance**

Participants

Arizona
University of Arizona

California
Loyola Marymount University
Occidental College
Southwestern College

Connecticut
Eastern Connecticut State University

Washington, D.C
Georgetown University

Delaware

Wesley College

Florida
University of Central Florida

Iowa
Luther College

Idaho
Boise State University

Illinois
Illinois Wesleyan University

Kentucky
Eastern Kentucky University

Massachusetts
College of the Holy Cross
Salem State College

Michigan
Hope College
University of Michigan – Ann Arbor

Minnesota
Augsburg College
Saint Olaf College
University of Minnesota

Missouri
University of Missouri – Columbia

Montana
University of Montana

North Carolina
Davidson College
University of North Carolina at Asheville

Nebraska
Creighton University

New Hampshire
University of New Hampshire

New Jersey
Richard Stockton College of NJ

New York
Hartwick College
Hobart and William Smith Colleges
Nazareth College

Ohio
Case Western Reserve University
The Ohio State University
The University of Akron

Oregon
University of Portland

Pennsylvania
Cabrini College
Drexel University
The Pennsylvania State University
University of Pennsylvania
University of the Sciences in Pennsylvania

South Carolina
The Citadel

Tennessee
Middle Tennessee State University

Texas
Texas A&M University

Utah
Weber State University

Virginia
Christopher Newport University
Virginia Commonwealth University
Virginia Military Institute

Vermont
Middlebury College

Washington
Seattle Pacific University
Washington State University

West Virginia
Fairmont State University

Wisconsin
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