

COLLEGE OF THE HOLY CROSS

Twentieth Annual Undergraduate
Summer Research Symposium



September 6, 2013

Hogan Ballroom

Dear Members of the Holy Cross Community,

Welcome to the 2013 Undergraduate Summer Research Symposium. Now in its 20th year, the symposium is a college-wide event that brings together faculty and students from all disciplines at Holy Cross and provides an opportunity to celebrate their accomplishments over the summer of 2013. It also provides an opportunity for students to witness the breadth of research possibilities both on and off campus and to open a dialogue with a faculty member about conducting research during the upcoming year and summer. We hope you enjoy the impressive collection of research on display today.

2013 Symposium Organizing Committee

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Julia Paxson, Department of Biology

Daniel Bitran, Science Coordinator

In recognition of those whose financial contributions have made this research possible:

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The summer research program was organized by Pr. Daniel Bitran, the College Science Coordinator, by Pr. Daniel Klinghard, the Director of the Summer Research Program in Humanities, Social Sciences and Arts, and by Pr. Bryan Engelhardt, the Director of the Summer Research Program in Economics.

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Poster 1

A New Approach to an Ancient Epic: Creating a Digital Diplomatic Edition of *Iliad* 9

D. Sokolowski, N. Churik, B. Clark, M. Ebbott, and N. Smith
Department of Classics, College of the Holy Cross

Every modern reader encounters the *Iliad* in a highly edited, printed form. Our research has taken a radically different approach to representing this familiar epic by studying the oldest extant complete manuscript of the *Iliad*, the Venetus A, a 10th Century Byzantine codex that includes copious *scholia*, or scholarly notes, as well as the poetry. The scholia provide both multiform readings of the poetry and insights into ancient scholarship on the epic tradition. Since they are written alongside the text of the poem, the scholia must be read together with the text rather than treated as a separate document. This unified reading is vital to better understanding the poem because it puts all multiforms on a level field, rather than subordinating all other readings to one primary reading. This goal can be achieved only in a digital environment. Our research, part of the larger collaborative Homer Multitext project, works to represent this concept in a digital environment by generating a digital diplomatic edition of Homeric primary sources. The scholia in book 9 reveal insights into ancient Homeric tradition including alternate readings of the poetry, evidence for multiple sources in the compilation of the Venetus A manuscript, and insight into Byzantine scribal practices. These scholia provide complementary information necessary to understand the background that a traditional audience may have had. Our digital edition links directly to digital images of the manuscript, so that the viewer can see the foundation for our editorial decisions.

For supporting our research, we thank the generous contributions made by Timothy W. and Deborah Coleman Diggins; Paul E. and Kathleen M. Roughan; and Stephen P. and Nancy Savage Skinner to the Alumni/Parent Summer Research Scholarship Fund; the Andrew W. Mellon Foundation; and the Center for Hellenic Studies.

Poster 2

Editing the Athenian Tribute Quota Lists: The Most Important Records of Athenian Imperialism

C. Bannan and N. Smith
Department of Classics, College of the Holy Cross

In 478/7 B.C.E. a defensive alliance, the Delian league, was formed against the Persians under the leadership of Athens. Member states paid tribute to support the navy and in 454/3 B.C.E., the treasury of the league was moved from Delos to Athens. Beginning in that year, one-sixtieth of each state's payment was given annually as offerings, *aparchai*, to Athena. The Athenian Tribute Lists are enormous stone inscriptions recording these offerings, and therefore reflect the amounts of tribute collected each year as the Delian League morphed into the Athenian Empire. We have begun to create a three-part edition of these inscriptions, working directly from original photography taken while studying abroad in Athens in 2012. This includes a diplomatic edition (the text exactly as it appears on the stone), a normalized edition (a conversion of the text to literary Greek), and an original English translation for each recorded year. Due to the fragmentary nature of this material, it is particularly important for an edition to explicitly convey what remains on the stone. My edition clearly differentiates text that is extant on the stones and text that is either my restoration or that of the original editors. My photography is directly incorporated into the digital edition, so that anyone working with the text can see the primary source material alongside the edited text. The normalized edition allows for people who can read Ancient Greek but who may not be familiar with epigraphy, to read the inscriptions comfortably, and the English translation similarly allows anyone interested in this period to read the source material. A digital edition has the capacity for automated analysis, which will allow patterns in the data, such as geographic and chronological patterns, to be more easily recognized.

I am grateful for the generous contributions made by Timothy W. and Deborah Coleman Diggins, Paul E. and Kathleen M. Roughan, and Stephen P. and Nancy Savage Skinner to the Alumni/Parent Summer Research Scholarship Fund.

Poster 3

Discovering Sources for an Unpublished Manuscript of Archimedes

R. Finnigan, A. Boudon, and N. Smith

Department of Classics, College of the Holy Cross

Our research focuses on an unpublished manuscript of the works of Archimedes, called Codex Bodmer 8. Although scholars have assumed that this manuscript is a copy of another extant document, these conclusions are based on the reconstructed date of the manuscript, rather than upon reading the text. Our work has brought to light information that contradicts this conclusion and suggests a different lineage for Codex Bodmer 8. We used XML software in order to create a 'diplomatic' edition of some of the works in Codex Bodmer 8. A diplomatic edition strives to reflect the text of the manuscript as faithfully as possible. While making this edition, we compiled information on the differences we observed between our manuscript and other manuscripts which may have been its source. This information clearly demonstrated that Codex Bodmer 8 was not copied from any extant manuscript, but in fact is likely a direct copy of a lost manuscript dating far earlier than any source existing today. Understanding the real source of Codex Bodmer 8 crucially changes its importance to the tradition of Archimedes manuscripts. As a direct copy of a lost manuscript, further analysis of Codex Bodmer 8 can offer us new conclusions and insights into the works of this ancient mathematician.

We thank the generous contributions made by Timothy W. and Deborah Coleman Diggins, Paul E. and Kathleen M. Roughan, and Stephen P. and Nancy Savage Skinner to the Alumni/Parent Summer Research Scholarship Fund; the Andrew W. Mellon Foundation.

Poster 4

Protein splicing of a temperature-dependent intein from an extreme thermophile

N. M. Siegart, K. M. Colelli, J. N. Reitter, and K. V. Mills

Department of Chemistry, College of the Holy Cross

Inteins are intervening polypeptides that self-catalyze their own excision from the flanking polypeptides, or exteins, in a process called protein splicing. We are studying an intein that interrupts genes from the archaeobacteria *Pyrococcus abyssi*. The *Pyrococcus abyssi* (Pab) PolIII intein only splices at elevated temperatures. The intein contains an N-terminal cysteine and is preceded by an asparagine in the N-extein at the -1 position. We have shown that the intein appears capable of cleavage at the N-terminus with an alanine in place of the cysteine and an aspartate in place of the asparagine. In addition, we created a split version of the intein to determine whether, when split into two fragments and recombined, the intein is capable of undergoing *trans* splicing.

This material is based upon work supported by the National Science Foundation under grant MCB-1244089, the Camille and Henry Dreyfus Foundation, and BD corporation.

Poster 5

Staff Attitudes Regarding the Impact of a Dog Therapy Program on Substance Abuse Inpatients

S. Brisson and A. Dekker

Fort Belvoir Community Hospital, Fort Belvoir, VA

Animal assisted therapy (AAT) is designed to promote improvement in human physical, social, emotional, and/or cognitive functioning. The first report of AAT occurred in 1792 when the Quakers documented the use of animals therapeutically in a mental health institution. Since that time the popularity of AAT in behavioral health has markedly increased. The purpose of this study is to ascertain the attitudes of behavioral health staff to a dog therapy program introduced regarding a substance abuse ward one year prior. In June of 2012 a highly trained service dog was introduced onto an in-patient substance abuse ward at a community hospital. The dog participated in both individual and group counseling sessions. During that time approximately 350 behavioral health staff members observed the interaction of the therapy dog with the patients. An anonymous survey will be conducted to ascertain the attitudes of the behavioral health staff regarding the impact of the dog therapy program on substance abuse patients. Preliminary interviews suggest a positive impact on patients but final survey results are not available at this time. Data derived from this study will be utilized in planning future dog therapy programs in the behavioral health department. Additional studies to ascertain the attitudes of substance abuse patients regarding a dog therapy program are needed.

Poster 6

The World in Worcester: Fieldwork Experiences Collaborating with Refugee Artisans of Worcester (RAW)

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Refugee Artisans of Worcester (RAW) is a non-profit organization that “aim[s] to identify refugee artisans and assist them to self sufficiency through the sale of their artwork while archiving their indigenous, cultural crafts.” In summer 2013, I worked to help RAW create their first website. In fieldwork, alongside the RAW co-founders, in home visits I interviewed refugee artisans from such nations as Rwanda, Bhutan, and Central African Republic, to record life histories and discuss their artwork. This fieldwork presented complex communication challenges, as I often had to talk to the artists with the aid of their children as translators. Also socially and linguistically complex was the endeavor to put artisans’ experiences onto a website, which some crafts people were encountering for the first time. I ask: How do their art and personal narratives reflect their refugee status in Worcester?

We gratefully acknowledge funding from Holy Cross’s Office of Government and Community Relations, Cantor Art Gallery, Asian Studies, and Garrity Professorship. Special thanks for website assistance to Roger Hankins, Paula Rosenblum, Mary Morrisard-Larkin, and Christian Santillo.

Poster 7

The Will to Charity: The Movement of the Will in *Piers Plowman* and the Works of George Grant

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William Langland's *Piers Plowman* and the philosophy of George Grant present a unique opportunity to examine analogous responses to the problem of the will in distinct historical epochs. *Piers Plowman* is a fourteenth-century Middle English alliterative poem that deals with the mental and physical journey of a dreamer named Will as he imaginatively grapples with the tensions of contemporary life. George Grant was a twentieth-century Canadian moral philosopher who diagnosed and confronted the difficulties of modern existence. The issues Langland finds fascinating are rooted in medieval Scholastic and Nominalist issues of the will, which find their apogee in the modern thought that Grant addresses. By viewing what Grant confronts as the apotheosis of a medieval spirit, I bring these two temporally disparate authors together, exploring one of the most fundamental questions human beings face: "What is the role of human willing in a dynamic world?"

We thank the Mellon Summer Research Program for generously providing the funding that made this work possible.

Poster 8

Three Contrastive Visions of Organic Farms in Bali: A Fieldwork Study

M. Walters and S. Rodgers

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Globally, organic farming has become more widespread in response to a growing demand for more wholesome food grown without excessive use of chemicals. In Bali, an organic scene that has arisen since the 1990s has grown quite complex, wrapped now into an economy relying heavily on international tourism. This project focuses on three case studies of organic farming in Bali: a government program endorsing organic coffee agriculture for export in North Bali (tied to agrotourism); an expatriate project meant as an example, or "contoh," for local Balinese farmers (acting as well as a tourist hotspot); and an alternative, international school plus farm founded by a Canadian jewelry designer that seeks to produce "creative, innovative, and green leaders." The Green School does this through a nontraditional curriculum and full immersion into the "natural" environment. However, the Green School clearly has been created primarily to serve the interests of a privileged few. This exploratory research, based on joint summer 2013 ethnographic fieldwork, seeks to interrogate these instances of organic farming and to place them within Indonesia's broader history of colonialism, tourism, and development. Drawing on work from anthropologists J. Stephen Lansing and Clifford Geertz, I seek to understand the importance of local, or indigenous, knowledge, especially pertaining to agriculture, as such knowledge relates to internationalized organic farming. I explore how local knowledge may be being overlooked in these globalized endeavors.

We thank the Andrew W. Mellon Foundation and the W. Arthur Garrity, Sr. family, which endowed the Garrity Professorship at Holy Cross.

Poster 9

Rhenium Compounds with Diazabutadiene Ligands

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Recently, rhenium has been closely researched in organometallic chemistry. ^{188}Re has attracted interest due to its similarities to $^{99\text{m}}\text{Tc}$, the most widely used nuclide in nuclear medicine. ^{188}Re emits β^- particles that are useful for tumor therapy while $^{99\text{m}}\text{Tc}$ emits γ -photons that are useful for in vivo diagnosis. Since Tc and Re have similar chemical properties, this means that a pair of Tc and Re compounds could be used first for diagnosis and then therapy on a specific tumor. This summer's research focused on attaching N,N' diimine ligands to a rhenium center. These compounds were prepared by heating rhenium pentacarbonyl chloride, glyoxal and ester protected amino acids. Ester protected amino acids are of interest because they have been used to target tumor receptors. ^1H and ^{13}C NMR, IR, and X-ray crystallography were used to characterize these compounds. Future work in this area will be to improve upon the preparation of these diazabutadiene compounds and to uncover the details of their geometries by solving their molecular structures.

This research was made possible by a generous contribution by Anne E. and John Kirby Bray to the Alumni/Parents 2013 Summer Research Scholarship Fund. We also acknowledge Christopher J. Ziegler and the University of Akron for their collaborative work.

Poster 10

Investigating the anti-viral capabilities of APOBEC3G

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The Human Immunodeficiency Virus 1 (HIV-1) attacks the body's immune system rendering it vulnerable to opportunistic infections. The endogenous human protein, APOBEC3G (A3G), has been shown to have antiviral capabilities in combating HIV. A3G functions as a cytidine deaminase, which induces cytidine to uridine point mutations in the negative strand of viral DNA. It was long thought that this catalytic function was also A3G's sole antiviral mechanism as it hypermutates the HIV genome and halts repeated viral replication. Recent studies suggest an uncoupling of A3G's cytidine deaminase and antiviral activity hinting at an alternate mode of viral restriction. The Sheehy lab previously generated a library of 135 A3G mutants by alanine-scanning mutagenesis and found that 92 retained antiviral activity. Here we identified several mutants in this antiviral subset that displayed a loss of catalytic activity. This supports the notion that A3G utilizes an alternate unidentified mechanism that is independent of catalysis to counter viral infection. These regions of the protein that display an uncoupling of its catalytic and antiviral activity are of significant interest in that they depict areas for possible chemotherapeutic intervention to enhance our innate defenses.

We thank Becton Dickinson Corporation and the Holy Cross Summer Research program for financial support. Additional thanks to Eileen Geoghehan, Kate Broderick, Michelle Arata, Melissa Farrow, and Meiling May for their previous contributions to the lab.

Poster 11

The Middlemore Emigration Scheme and English Children's New Lives in Canada in the Early 1900s

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During the child emigration movement between 1869 and the early 1930s, over 100,000 children were sent to Canada from Great Britain by philanthropic "child rescuer" organizations. The purpose of this research is to examine the treatment of "orphan" children who emigrated from Great Britain to Canada through John T. Middlemore's Children's Emigration Homes in Birmingham in the first decade of the twentieth century. The intention of migration was to save children from the mean streets of the inner city by transplanting them in new homes with responsible families who would ensure that children received education, religious and moral instruction, and vocational training. The degree to which children received good care in all of these areas has been contested. During the past twenty years, as stories of these immigration schemes have come to light in Canada, there have been multiple claims that foster families abused their charges. My purpose is to consider whether these recent claims of abuse can adequately stand for English migrant children's experiences in Edwardian Britain and Canada. Middlemore's organization was clearly interested in the welfare of the children and continued to make sure they were placed in good homes. Put into context of schooling and life in England for street children, many of Middlemore's children in the early 1900s received a better life in Canada.

We thank the Mellon Summer Research Program for financial support.

Poster 12

Synthesis of New "2 + 1" Rhenium Complexes

C. Bogdanowicz and R. S. Herrick

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Rhenium compounds have attracted much interest from researchers in recent years. It acts as a cold analog of technetium-99m, a gamma photon emitter, which has no stable isotopes. With the recent advance where rhenium-188, a β^- -emitter can be obtained carrier free, there is even more interest in the research, as it may now be possible to create analogous compounds for diagnosis and therapy at a specific tumor site. We have previously prepared novel compounds as possible target-specific radiopharmaceuticals. This summer's research focused on attaching ligands in a "2 + 1" style of complex to the $\text{Re}(\text{CO})_3^+$ center. The bidentate ligand consisting of the AcNac, dithiolate or diiminoisoindolene ligands and various monodentate ligands were attached to the rhenium center. Several new compounds were created and their identity was confirmed by single crystal X-ray analysis or NMR analysis. Future work in these areas will include variations of reactions and testing properties of compounds.

This research was funded by a grant from the Petroleum Research Fund of the American Chemical Society; crystallography was made possible by Professor Ziegler at the University of Akron.

Poster 13

Studying the Aggregation of α -Synuclein Based Peptides Using Infrared Spectroscopy

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Parkinson's disease, among other neurodegenerative disorders, is characterized by deposits of protein aggregates throughout the neurons of the central nervous system. The primary component of these fibrillar deposits, or Lewy bodies, is α -synuclein (α -syn), a protein involved in many important neurological functions. Although natively unfolded, α -syn can undergo a structural change that causes the protein to adopt a β -sheet secondary structure. The misfolding process is thought to be nucleated by the central hydrophobic residues 61-100. After β -sheet formation, intramolecular forces enable α -syn, and other proteins, to aggregate into the amyloid fibrils found in Lewy bodies. The fibrils, or some intermediate species, possess the cytotoxic properties that result in dopaminergic neuron death. In this study, we analyzed residues 67-71, GGAVV, to identify which short peptides lead to the formation of stable β -sheets and may potentially be the nucleating site of α -syn misfolding. Peptides were synthesized in a way that mimics their presence within the entire α -syn protein. The propensity for each of these peptides to form β -sheets was monitored at pH7 over multiple temperatures via infrared spectroscopy. We found that the tripeptide AVV and any peptides containing this sequence have the ability to form stable β -sheets. Future work will synthesize additional α -syn based peptides that are known to be critical to β -sheet formation. We hope to acquire a better understanding of the nucleating site of α -syn misfolding and to provide researchers with a target for therapeutic intervention.

We thank the O'Brien Family Summer Research Fellowships for funding this project.

Poster 14

Effect of dodecylamine on the electrocatalytic activity of platinum nanoparticles

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Platinum is a highly utilized metal in various scientific and commercial applications due to its high catalytic activity, resistance to corrosion, and electrical stability. The high cost of the metal prevents the viability of alternative fuel cells, such as the direct methanol fuel cell, that rely on a Pt catalyst in each of the half reactions. As such, it is necessary to increase efficiency, which can be accomplished by using nanoparticles of Pt, thereby increasing the surface area-to-volume ratio, and changing the shape of nanoparticles, which exposes active facets. Ligands play an important role in this process because they can be used to direct growth and slow the effects of catalyst poisoning. In order to simulate an industrial application, we explored the effect of ligand-capped PtNPs on the methanol oxidation reaction (MOR) using cyclic voltammetry. We have developed reliable methods to synthesize unprotected platinum nanoparticles, characterize their surfaces electrochemically, and functionalize them with amine ligands. We found that the presence of these amine ligands lowers electrocatalytic activity. Going forward it will be important to quantify this decrease and explore the effects of ligand structure.

We thank the Renee and Anthony Marlon M.D. Summer Research Scholarship.

Poster 15

“Tackling the MonSter:” Coping Mechanisms and Quality of Life for Patients with Multiple Sclerosis

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Multiple Sclerosis (MS) is a chronic illness impacting millions of people worldwide at a time of life that many would consider their prime years. The autoimmune disease attacks the myelin sheath in the central nervous system, leading to future problems with mobility. Yet, compared to many chronic illnesses, MS continues to be overlooked by leading health organizations like the WHO and CDC, which results in limited funding, research, media attention and, thus, public awareness. Semi-structured, in-person interviews with 17 individuals diagnosed with MS were conducted. These individuals included those who were diagnosed with Relapsing-Remitting MS, Primary-Progressive MS and Secondary-Progressive MS. Grounded theory techniques were utilized to collect, code, and analyze textual data. Among these unique illness narratives, a number of common themes were discovered. Core findings included the importance of early diagnosis, how MSers became proactive in the fight against MS, and then coping mechanisms used to overcome the symptoms and stigma associated with MS. Core sociological variables such as age and gender also shaped illness narratives in meaningful ways. Through this study, an improved understanding of the subjective experience of living with MS emerges. This information can be used to improve both the medical treatment of patients with MS and the social policies aimed to support them and people with other disabling chronic conditions. Equally importantly, however, these narratives put a face on a largely neglected health problem, helping us all understand MS from the perspective of these lay experts.

We thank the Greisch Family Summer Research Fellowship Fund for funding our work.

Poster 16

Investigation of Thiol and Amine Self-Assembled Monolayers on Nanoporous Gold

D. A. Patel and E. C. Landis

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Nanoporous gold (NPG) is a promising material in the field of surface chemistry because it has a large surface area and high conductivity. However, NPG electrodes lack innate functionality; many applications such as catalysis and biosensors require a deeper understanding of self-assembled monolayers (SAMs) on the surface of NPG electrodes. Our research focuses on studying the binding and stability of thiol and amine SAMs on NPG through spectroscopic and electrochemical techniques. Infrared Spectroscopy (IR) was used to detect vibrations of bonds on the surface of samples as well as how ordered the monolayers were. Electrochemical techniques were utilized to observe closely-packed monolayers by monitoring their ability to block electrochemical activity on the surface. Electrochemical blocking was achieved after four days for samples functionalized with 1-octadecanethiol, a straight-chain alkanethiol, and one week for samples functionalized with 4-nitrothiophenol. After achieving electrochemical blocking, the functionalized samples were subjected to stability tests. Electrochemical techniques proved monolayers to be stable in ethanol over a course of days and unstable in water; monolayers degraded in a matter of minutes when subjected to a 1M salt solution. Binding of amines to NPG proved to be more challenging than that of thiols. Preliminary IR data suggests binding can be achieved; however, highly ordered monolayers were not achieved after a course of three days.

We thank the Renee and Anthony Marlon M.D. Summer Research Scholarship Fund for financial support.

Poster 17

The Topological Microstructure of Murine Tumors

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Using methods of computational topology, we have developed a method of analyzing CT-SPECT images of experimentally induced solid tissue tumors in mice. With a focus on Morse theory, we extract and analyze critical points on each image, and represent their structure with contour trees. In attempt to discriminate between treated tumors and control-group tumors, we utilize a phylogenetic metric on trees and clustering. Invicro, co-founded by Jack Hoppin '98, provided us with images of murine tumors, and we used VivoQuant, Matlab, JavaPlex, and PHYLIP to analyze and compare the images.

We thank Marion and Samuel Krug, PhD for their generous support of the Alumni / Parents Summer 2013 Research Scholarship Fund.

Poster 18

Re(CO)₃ Diimine Aminoester Derivatives

J. Bass and R. S. Herrick

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Rhenium is a promising element in bioorganometallic chemistry, as ¹⁸⁶Re and ¹⁸⁸Re are both β⁻ emitters and can be prepared in a nuclear reactor. d⁶ diimine carbonyl systems often exhibit air-stability, allowing them to be studied more effectively. Finding molecules able to withstand harsh biological conditions will have great benefit to bioorganometallic chemistry. In collaboration with Dr. Christopher Ziegler of the University of Akron, we have been studying the reactions of pentacarbonylchlororhenium(I) with 2-imidazolecarboxaldehyde and various amino esters. Several derivatives have been characterized by NMR analysis and by single crystal X-ray analysis. Future work will include varying the reactions performed by replacing the amino esters with other molecules containing a primary amine that can form a diimine carbonyl system.

This research was made possible by the American Chemical Society and the Petroleum Research Fund. The authors thank Dr. Christopher Ziegler at the University of Akron for performing the crystallography.

Poster 19

“Home-made, Home-made, Aren’t We All?”

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Ever since Ulysses struggled to get back to Ithaca, writers and thinkers have explored the concept of “home.” Though the dictionary definition of a home as a physical place, “where one lives or was brought up;” “a person’s own country or native land” might seem adequate, it did not fit my experience. I grew up, like many others, as a “Third Culture Kid” (TCK), a term coined by Dr. Ruth Hill Unseem to describe “an individual who has spent a significant part of their developmental years in a culture other than that of their parents, and developed a sense of relationship to both.” My project has sought to understand my experience growing up abroad: in Tunisia, Egypt, France, the Philippines, and Hungary – none of which I could ever truly call a home. As a result, my continuous uprooting gave me no actual home to return to. This sense of rootlessness has tried me to express this experience in poetry. My model had been Elizabeth Bishop, a poet who came to see her own restless experience of travel, in terms of a question: home-made, home-made, aren’t we all? That is, Bishop came to see that “home” is just as much a region of the mind as it is an actual place. My poems, as might be expected, have looked at both sides of my experience. On the one hand, my constant re-location has provided me with a myriad of experiences unlike any other travel experience could; on the other, it has left me feeling restless and displaced. Thus, my work has sought to broaden the idea of home, and to look especially at the physical, emotional and psychological aspects of making the world one’s home rather than a particular place.

We thank the Mellon Research Program for financial support.

Poster 20

Characterization of Lung Mesenchymal Stem Cell Phenotype and Function in *Ovis aries*

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Chronic lung disease in older patients is a major source of mortality and high medical costs worldwide; effective treatments have yet to be developed. Lung mesenchymal stem cells (LMSCs) may be a viable treatment option because of their regenerative and immunomodulatory potential. Understanding the differences in therapeutic potency of these cells between patients is currently a critical concern for the reliability of this treatment. Sheep are a useful model organism because their lungs are comparable to human lungs in terms of their molecular response to lung disease. However, sheep LMSCs have yet to be fully characterized. Therefore, the goal of our research was to develop a molecular toolbox that can characterize these cells. First, LMSCs were isolated from sheep lung explants and grown in culture. We were able to characterize the regenerative and immunomodulatory capacities of cultured LMSCs by analyzing the relevant mRNA and protein profiles through the development of quantitative polymerase chain reaction (qPCR) primers, immunohistochemistry (IHC), immunocytochemistry (ICC), and flow cytometry. Furthermore, we developed assays to test the functionality of these LMSCs through colony forming units and mixed lymphocyte reactions (MLR). As a result of our tests on these LMSCs, we were able to produce a set of antibodies, qPCR primers, and functional assays that could be used to determine the potency of LMSCs in a clinical setting.

We thank the Renee and Anthony Marlon M.D. Summer Research Scholarship Fund; and James and Jeanne Moyer of the Alumni / Parents Summer 2013 Research Scholarship Fund for their financial support.

Poster 21

Massive ventral hernia repair through separation of components technique: a plastic and general surgery combined approach

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This retrospective clinical data outcomes study was done to look at some of the trends and outcomes of component separation, a relatively new and unique form of hernia repair involving rectus muscle dissection to reapproximate the midline for massive, recurrent, ventral hernias. Using hospital databases, we retrieved records on 47 patients who underwent this procedure at our institution from 2006 to 2013 and inputted data measuring 41 indices on pre, post, and intra operative data. Although the small sample size somewhat limited the power of our statistics, we saw interesting results. It was found that many of the patients were overweight, and all had previous abdominal surgery, putting pressure on and weakening the abdominal wall. Twelve patients suffered serious complications, which we classified as those requiring readmission or further surgery. Five others saw their hernia recur in an average of 11 months and required surgery. We saw that patients undergoing concomitant abdominoplasty or panniculectomy did have an increased, although not statistically significant, rate of serious complication. This could impact the way surgeons approach these procedures going forward. Although not definitive, this study helps contribute to the overall new and expanding knowledge base surrounding component separation repair of massive ventral hernias. Future research could expand the patient base to get more powerful data, as well as look into causes of complications and recurrence, such as concomitant surgeries.

Poster 22

Linearly Stable Relative Equilibria Utilizing a Dominant Mass

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We consider the linear stability of relative equilibria (rigid rotations) in the $(1+n)$ -body problem where one mass is ‘dominant’ in relation to the others. For various n values, and for stable solutions, we numerically search for the smallest possible ratio between the dominant mass and the sum of the remaining masses. Based on a conjecture of Moeckel’s, we apply the technique of gradient flow to locate minima of the Newtonian potential function constrained to a level surface of the moment of inertia. These minima are possible candidates for linearly stable configurations. Then, by computing the Jacobian of the equations of motion at the relative equilibrium, linear stability was determined by finding whether or not all the eigenvalues were purely imaginary. Using Matlab, various programs were written to follow different families of central configurations and calculate the dominant mass ratio. This program provided several revealing pictures and captivating animations.

We thank the National Science Foundation for financial support.

Poster 23

Development of an efficient method for the synthesis of the C-terminal fragment of peptide isosteres

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Our research is focused on developing an efficient way to synthesize peptide isosteres. Peptide isosteres are compounds that mimic the structure and size of peptides (or their larger counterparts, proteins), but have replaced the amide backbone with a different functional group. The amide backbone is responsible for the structure and binding of peptides and proteins and is readily hydrolyzed under physiological conditions. Peptide isosteres can thus be used to study the structure and binding of peptides or provide alternatives to peptide drugs that are not currently pharmacologically viable. The use of peptide isosteres is often limited by lengthy syntheses that are specific for a particular amino acid combination. We employ the Nobel Prize winning reaction olefin cross metathesis to synthesize peptide isosteres, combining a carboxyl (C) and amino (N) terminus. The focus of our study is to create an efficient way to cross different C and N termini to allow for the creation of a variety of peptide isosteres. Previous chemistry used in our laboratory to synthesize the C terminus was difficult to conduct and inefficient. Our current method employs pseudoephedrine as a chiral auxiliary, which enables us to add various electrophiles to our substrate with high levels of selectivity. Our goal is to expand the number of electrophiles used successfully in this reaction and thus the array of available C termini to be used in the cross metathesis.

We thank Wendy R. and Kenneth J. Edwards for their generous support of the Alumni/Parent Summer Research Fellowship Fund.

Poster 24

Combining motion and depth cues in the detection of moving objects by moving observers

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When an observer moves in a straight line through a stationary scene, the image motions of the objects in the scene create a radial pattern. Observers can identify objects as moving if their image speed deviates from this pattern. However, objects closer to the observer have faster image velocities than those further away. Objects in the radial pattern with faster image velocities could be moving, or simply stationary and located closer to the observer. Therefore, speed is an ambiguous source of information. We tested whether adding depth information via binocular stereo would improve the abilities of observers to detect moving objects. In our experiments participants watched computer stereo movies in which disks simulated the motion of an observer towards a stationary scene. We altered the speed of one disk, the target disk, to emulate a moving object. In experiment 1 we changed the starting disparity of all the disks. In half the trials we multiplied the speed of the target disk by factors of .3-.9 or 1.1-2.0. One condition contained no binocular stereo information. Observers recorded whether they saw an object moving relative to the other disks. In experiment 2, we altered the depth of the target disk and kept the depths of the other disks the same. We asked observers whether they saw a disk moving away from or towards the center relative to the other disks. In experiment 3 the depths of the background disks were randomized. Experiment 1 showed that, on average, the addition of binocular stereo does not improve the detection of moving objects. Experiment 2 showed that observers relied mostly on motion rather than stereo to determine if the target disk was moving. In experiment 3 observers used stereo more than in the other experiments. This may be because randomizing disparities made motion a more ambiguous cue.

Supported by NSF grant IOS-0818286.

Poster 25

Synthesis of Aminophenol Ligands by the Mannich Condensation and Reductive Amination Reactions

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Aminophenols are a class of compounds that contain both nitrogen and oxygen heteroatoms, which are used to bind to a variety of transition metals. By varying the number of binding sites, geometry, and electronic properties of the molecule we are looking to model the active sites of metallo-enzymes and proteins seen in nature. The most common ways to synthesize these complexes are through two different reactions: the Mannich condensation and a reductive amination reaction. The Mannich condensation is a multi-component reaction (MCR) where a phenol, formaldehyde, and an amine combine to form a new carbon-carbon and carbon nitrogen bond, resulting in an aminophenol. In the reductive amination reaction, an imine is formed from an aldehyde and a primary amine, which is then reduced by a reducing agent. Over the course of the summer, both of these syntheses were applied to prepare a variety of different aminophenol ligands, to determine the best route for a variety of chemical architectures, such as two and four armed aminophenols, hydrohexapyrimidine rings, and benzoxazine rings.

We thank the Summer Science Research Program at Holy Cross as the source of funding for this fellowship.

Poster 26

Protein Splicing of an Intein from the Extreme Halophile *Halobacterium salinarum*

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Protein splicing is the self-catalyzed excision of an intervening polypeptide (intein) from flanking polypeptides (exteins), concomitant with the ligation of the extein. An intein in the archaebacterium *Halobacterium salinarum* (Hsa) interrupts the DNA Polymerase II. We have observed that the Hsa intein splices poorly in *Escherichia coli* *Pyrococcus abyssi* and *Methanoculleus marisnigri*, which are not halophilic. Our DNA sequencing results differ from that of the published sequence, so we plan to make site directed mutants to test if these mutations affect activity. To test if splicing activity depends on salinity, we also altered the expression conditions by varying the salinity of the growth media and of *in vitro* activity assays. Future experiments will involve *in vivo* techniques by over-expressing the intein and the flanking exteins into *Halobacterium salinarum*, and by using antibodies to detect possible splicing of the native protein.

This work was supported in part by the National Science Foundation and the Dreyfus Foundation.

Poster 27

Kinetics and Thermodynamics of Beta Sheet Formation and Disaggregation

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Proteins are essential biological molecules that perform a variety of vital functions in the human body. In order to work correctly, they must have a specific three-dimensional structure. Interactions within the protein cause the structure to fold and, in some cases, misfold into non-native structures. Misfolded proteins can adopt a structure rich in β -sheets that are linked with diseases such as Alzheimer's Disease, Parkinson's Disease, and Huntington's Disease. The model peptide, Poly-L-lysine, PLL, folds into one of three different conformations, α -helices, β -sheets, or random coil depending on the pH. We have observed the kinetics of secondary structural changes (predominantly β -sheet formation and disaggregation) in PLL using Infrared spectroscopy. Additionally, we have begun experiments using Congo Red, (which is known to bind to amyloid aggregates), to study changes in the tertiary structure of PLL. It was observed that at chain lengths of 295 and 404, PLL misfolds from α -helices to β -sheets at temperatures greater than 45°C. Disaggregation of this polypeptide occurs after PLL is incubated at temperatures lower than 45°C. After cooling PLL from 65°C, disaggregation is seen at temperatures lower than 10°C. Incubation reveals that PLL rich in beta-sheets does not fully refold back into its native state.

We thank the O'Brien Family Summer Research Fellowships for financial support.

Poster 28

Separation and Chemometric Analysis of FAMES in Biodiesel Blends

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With a growing interest in alternative energy, biodiesel is gaining popularity as a new fuel source. In order to fully understand the functionality of this fuel, knowledge of its chemical components is necessary. Our lab has worked to build on past research in determining optimal analytical conditions for instrumental analysis of fatty acid methyl esters (FAMES), of which biodiesels are composed. Biodiesels can be synthesized from a variety of feedstocks, such as soy, canola, tallow, and waste grease, among other plant and animal sources. We have determined that these different feedstocks produce a distinct chromatographic fingerprint when analyzed by gas chromatography-mass spectrometry (GC-MS). Our current research is focused on analyzing biodiesel blended with conventional diesel, as it is traditionally sold. These blends range from very low concentrations of biodiesel, such as B2, to blends that are composed of biodiesel by 20%, B20. We have successfully used chemometric methods such as principal component analysis (PCA) and hierarchical cluster analysis (HCA), to classify the blended fuels by both feedstock type as well as biodiesel concentration.

We thank the Alumni/Parent Summer Science Research Scholarship Fund for financial support.

Poster 29

Classification of Feedstock Source in Biodiesel-diesel Blends

M. P. Connolly, M. E. Flood, and A M. Hupp

Department of Chemistry, College of the Holy Cross

In the past ten years, biodiesel fuels have had a beneficial impact on the environment and the economy. Biodiesel is created when fatty acids in the feedstock source (i.e. soybean oil, canola oil, waste grease, animal tallow) are transesterified to produce their corresponding fatty acid methyl esters (FAMES). Biodiesel has the ability to power traditional diesel engines without any need to modify the engine itself, yet is typically blended with diesel (2 – 20% biodiesel) to adjust the fuel efficiency. In this research, various biodiesel-diesel blends (B2 to B20) were examined using Gas Chromatography and Mass Spectrometry in an effort to identify the FAMES in each feedstock. Principal Component Analysis (PCA) was then utilized to allow clustering of blends with similar chemical compositions. Interestingly, the FAMES present in each biodiesel contribute more to the clustering that is observed than the numerous components present in the diesel fuels. Clustering based on feedstock type is observed regardless of the concentration of biodiesel in the blend.

We thank Gerard P. and Clare S. Richer for their generous contribution to the Alumni/Parents Summer 2013 Research Scholarship Fund.

Poster 30

Structural Analysis of Human Carbonic Anhydrase II and a Thermophilic Intein

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Department of Chemistry, College of the Holy Cross

We are interested in various structural aspects of human Carbonic Anhydrase II (hCAII) and the *Pyrococcus horikoshii* PolII intein (Pho PolII). A combination of analyses including x-ray crystallography and biochemical assays will be used to study each of the two proteins. We will compare the activity and structure of hCAII to hCAII where the active-site zinc ions have been replaced with rhenium. Additionally, we will assay both zinc and rhenium hCAII for enzymatic functionality using a p-NPA hydrolysis assay. Thus far, we have optimized expression in *E. coli* and purification of hCAII and have assayed for functionality. The PolII intein, which comes from a sea-dwelling, thermophilic archaea, was mutated so that a stop codon precedes the poly-His tag at the C-terminal end of the intein before expression and purification were optimized. In order to isolate the intein from its remaining extein, we first used DTT to facilitate N-terminal cleavage and will use size exclusion chromatography to separate the products. Once crystallization of the intein is achieved, we will compare its structure to that of the precursor.

This material is based upon work supported by the National Science Foundation under grant MCB-0950345 and by the Camille and Henry Dreyfus Foundation.

Poster 31

Peptide Bond Cleavage through the Cyclization of Asparagine

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Protein splicing is the post translational modification by which an internal peptide, or intein, separates itself from the surrounding residues, known as exteins. In the third step of the mechanism, it is proposed that asparagine cyclization, coupled to peptide bond cleavage, splices the intein from the neighboring exteins. We studied the cyclization in two ways. The first was by a model peptide assay by which the cyclization of Asn is coupled to fluorescence. We observed that an increase of temperature correlates to a faster cyclization reaction, while a decrease in the dielectric of the solvent slows the cleavage of the peptide. The second way we studied cyclization was through the proteins *Trichodesmium erythraeum* and *Syncechococcus sp. PCC 6803*. In nature, the intein from *T. erythraeum* ends in a Gln as opposed to the highly conserved Asn. By making mutations to the last residues, Asn or Gln, we revealed that *T. erythraeum* intein can complete C-terminal cleavage with either amino acid whereas *Syncechococcus sp. PCC 6803* requires the asparagine in order to cleave. This supports the concept that a naturally occurring cyclization with Gln could also be completed if the residue was mutated to the more kinetically favorable Asn. However, it is unlikely that a natural Asn cyclization would be able to react in the same way if mutated to Gln.

We acknowledge the National Science Foundation and Dreyfus Foundation for their financial support.

Poster 32

The Structure and Aggregation of Glutamine Based Peptides

J. Lam and S. Petty

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Polyglutamine diseases are neurodegenerative disorders caused by an expanded chain of glutamines (more than 35) at the N-terminus of the protein. The extra glutamines cause the protein to misfold into β -sheets which aggregate into amyloid fibrils. To better understand polyglutamine aggregation, we studied the relationship between glutamine based peptides and β -sheet formation using infrared (IR) spectroscopy. However, the glutamine side-chain vibrations overlap with the peptide backbone vibrations in the amide I region of the infrared spectra, making it difficult to distinguish between them. One of our goals is to separate these infrared signals so we can interpret the spectra of glutamine based peptides and determine peptide structure. We have synthesized glutamine based peptides of 4-5 residues and analyzed them using IR spectroscopy. Fitting the spectra allows us to differentiate the side-chain and backbone vibrations in the amide I region and draw conclusions about peptide structure. The data shows that regardless of the order, peptides containing two glutamines and three alanines are primarily disordered, as shown by Gaussian peaks at 1650 cm^{-1} . Peptides with lysine and glutamic acid surrounding the glutamine residues were expected to form β -sheets, and thus show Lorentzian peaks at 1618 cm^{-1} . Fits to the data show that the backbone and side-chain vibrations can be deconvolved and that both vibrations are sensitive to secondary structure of the peptide. Future work will consist of fitting the data for all peptides to determine whether the proximity of glutamines to one another affects the vibrational frequency of the side-chain. We will also synthesize different glutamine based peptides to determine the infrared signal of glutamine side chains in other secondary structural conformations.

The authors thank the BD Corporation for funding this project.

Poster 33

The Constitutional Politics of Districting

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Should states be subdivided into districts for electoral purposes? The Constitution makes no specific mention of districts as an essential component of elections. Yet, with regard to congressional representation, all states with more than one representative divide voters into districts. In electing presidents, on the other hand, almost all states have rejected districting for the Electoral College and employed a unit or winner-take-all system. We explored why states embraced districts for congressional elections while rejecting them for presidential elections. We found that the answer appears to be rooted in the Constitution, which gives Congress some power to regulate how states elect their representatives but awards states complete discretion over selecting presidential electors. Congress had the authority to enact the Apportionment Act of 1842, which mandated single-member districts for states. This allowed states to overcome the collective action dilemma that disadvantaged states that districted for congressional elections compared to states that maintained a unit rule, as the law created a uniform standard for all. On the other hand, because Congress could not, without a constitutional amendment, mandate states to use districts when awarding presidential electors, states confronting the same dilemma that shaped the politics of congressional districting had severely limited options in overcoming this dilemma of collective action.

We thank the Mellon Summer Research Program for financial support.

Poster 34

Shackled Spirits: Journey to the Bali Arts Festival

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Our research project explores the journey and process of touring the multi-media dance drama *Shackled Spirits* to Bali, Indonesia. *Shackled Spirits*, a non-linear devised drama, addresses the topic of mental illness and its implications in the lives of various characters. The scenes are derived from the fantasies, memories, and dreams of a writer who spent time in a mental health facility. *Shackled Spirits* was first performed at Holy Cross in April 2012. An excellent review in *The Jakarta Post* resulted in an invitation to the 35th annual Balinese Arts Festival in June of 2013. In Bali, we rehearsed, watched other performances at the Bali Arts Festival, attended temple ceremonies, read primary source texts, and immersed ourselves in village life. We documented our trip with still photography, video, interviews, written journal entries, and individual research in our areas of expertise. We have created a video documentary as the culmination of our work.

We thank the following for supporting our work: The College of the Holy Cross; The Office of the President; The Mellon Summer Research Program; Research and Publication; Asian Studies; Center For Teaching; Dr. Mary Barbee; Makaradhwaja Performing Arts Group; Professor Dr. I Wayan Dibia, Geria Olah Kreativitas Seni (GEOKS); Widya Dharma Shanti Foundation; Wianta Foundation; STMIK STIKOM Bali; Marlowe Bandem, Board of Commissioner STMIK STIKOM Bali.

Poster 35

Implicit List-Learning in Pigeons

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The ability to master the arbitrary grammar associated with sequence learning is a key component to language acquisition — an ability that is usually assumed to be uniquely human. Extensive research has studied list-learning abilities in both human and non-human primates. It is questionable whether pigeons have the same sequence learning ability as primates. Some studies suggest that pigeons can only acquire end elements of lists, and cannot differentiate interior elements. For example, in an A->B->C->D->E list, the pigeon learns that A is first and E is last, but does not distinguish the locations of B, C, and D. Primates, however, could discern the order of all five list items. Our study investigated pigeons' abilities to learn lists implicitly, i.e. without reinforcement for correct responses. In humans, implicit learning is defined as learning without awareness of what is being learned, and it is relevant to language acquisition, food-foraging, and predator avoidance. We observed whether pigeons would implicitly learn both end elements (A and E) as well as interior elements (B, C, and D) of two different visual lists presented on a touch screen, while being randomly reinforced regardless of correctness. Three pigeons were taught two five-item lists. Baseline reaction times were compared to those when list elements were changed, to detect whether pigeons were disrupted by changes such as inserting elements from one list to another, altering the order of elements within a list, and completely randomizing the elements in both lists. This allows us to determine what has been implicitly learned.

We thank NIH grant R15RR031220 and the Summer Science Research Program for funding this research.

Poster 36

Catalytic Phosphorylation of Diols

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Our research is focused on the catalytic formation of phosphates from diols using a Lewis Acid catalyst. Phosphates are ubiquitous functional groups found in many organic systems. They are incorporated into molecules that are critical to life such as DNA, RNA, and numerous proteins. Because of this, the development of new and more efficient methods for forming phosphorylated compounds can improve our understanding of these important biological molecules and impact the study of diseases. The specific compounds we are interested in phosphorylating are alcohols known as diols, which contain two reactive sites. The phosphorylation of diols can place either one or two phosphates on the diol, yielding a mono or di-phosphorylated product. One molecule that is of particular interest to our group is the diol, FTY720. It is an immunosuppressive drug with many medical uses such as the treatment of multiple sclerosis and transplant rejection. It was discovered that FTY720 undergoes rapid mono-phosphorylation in the body to form the active drug, FTY720-phosphate. We hope to use our phosphorylation method to synthesize the active drug, FTY720-phosphate, directly. A main concern in the phosphorylation of diols lies in the selectivity of the reaction, as diols contain two reactive groups. Therefore, our research efforts are now directed towards the screening of various diols and reaction conditions to understand what factors are important for the selective mono-phosphorylation. We have currently phosphorylated ten diols, including model compounds for FTY720, with the highest selectivity providing 96% of the mono-phosphorylated product.

We thank Laurie D. and William C. Goggins, MD for their generous contribution to the Alumni/Parent Summer Research Fellowship Fund.

Poster 37

Elite Syncopations: A Study of Jazz, Class, and Exclusivity in Tunisia

A. J. Dalton and A. Karass

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The northernmost nation in Africa, Tunisia is situated at the crossroads of Arab, European, and African civilizations. Emanating from a history of colonization and political heterogeneity, the nation has developed a unique jazz performance culture, centered on the notions of social capital, status, and exclusivity. Through participant observation and formal interviews, I collected data on this subject during five weeks of fieldwork in Tunis. By performing with local musicians, attending performances, and collaborating with individuals from the *Jazz Club de Tunis*, I was able to immerse myself in the jazz community, gaining insight into the perceptions and practice of jazz in Tunisia. In synthesizing this information, I argue that a sense of exclusivity has developed as a result of the restrictive nature of domestic jazz festivals, the lack of a formal jazz education program, and most significantly, the polarization of wealth in a post-revolution Tunisia. Together, these elements have combined to establish jazz as a marginalized genre within Tunisian society. While limited in size, the community is very active, conveying a new sense of freedom that epitomizes the post-revolution societal ethos. It stands on the forefront of change, reflecting the sociocultural diversity and political reformation that is leading Tunisia into a new era.

This project was funded through a grant from the Andrew W. Mellon Foundation.

Poster 38

Sing the Change: Challenges of Dissemination for Tunisian Music

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The production and consumption of quality Tunisian music is restricted today as it faces challenges of dissemination. This research is based on interviews conducted during the summer of 2013 through the Holy Cross Mellon Summer Research Program with individuals involved in the Tunisian music scene. It explores the variety of difficulties faced by local musicians in producing and sharing their music. The study considers the challenges posed by rampant piracy, lack of enforcement of intellectual property rights, poor funding, impediments to collaboration, little infrastructure for music production, and cultural and historical tendencies. All of these factors can limit the dissemination of music. This study raises awareness around the problems faced by the local musical community today in order to begin a discussion of possible solutions to help the eager Tunisian music scene to reach its potential and bring all the riches that art can provide to its nation. At the center of this investigation lies the question, in what ways is a society responsible for its own art? Furthermore, should these responsibilities be addressed by governmental or civil action? It is by delving into the reasons behind problems that solutions can be created, giving us hope for a more robust Tunisian musical scene.

This project was funded through a grant from the Andrew W. Mellon Foundation.

Poster 39

Battling the Field of Honor and Shaping the New Nation: Republican Virtue in American Anti-Dueling Sermons

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The early 19th century in the United States was undoubtedly a chaotic and turbulent era. Emerging victorious, independent but bureaucratically weak from the American Revolution, citizens of the new nation were left with pressing questions of how to successfully operate their democracy. In this context, swollen with both optimism and apprehension, the Evangelical surge swept the United States, providing grounding as well as their own vision on what it meant to be an American. As Evangelicals crafted their vision, they encountered the practice of dueling, a sometimes-bloody affair prompted by an insult on one's honor. For Evangelicals, the ritualized violence of the duel was viewed as a pressing threat to national order and morality. The purpose of this research is to investigate the "duel" between duelist and anti-dueling advocates in the 19th century United States. More specifically, I hope to show how the anti-dueling campaign led to the development and definition of "republican virtue", a key lynchpin that both politicians and religious leaders believed to be indispensable in crafting the new nation. In order to conduct this research, I've gathered sermons from Evangelical reformers, newspaper articles and letters dealing with the practice and the anti-dueling campaign. While Evangelical reformers first wanted to stop the practice for its sinful and sometimes violent nature, they also believed the practice as threatening to the entire nation's future and prosperity. Given this notion, the anti-dueling campaign deserves historical attention, and can be used as a window into understanding the state of culture, politics and society in the early 19th century United States.

We thank the Mellon Summer Research Program in the Social Sciences, Arts and Humanities for financial support.

Poster 40

Deaf Education in the United States and Morocco

K. Domaney, J. Sipiara, and J. Pirone

Deaf Studies Program, College of the Holy Cross

Throughout the world, various educational laws exist to protect the rights of individuals who have disabilities. In the United States, these laws require access to support services for this population, which legally includes the Deaf and hard of hearing community. This study aims to understand whether the states of Maryland and Massachusetts interpret and apply these laws differently for Deaf and hard of hearing elementary students (grades kindergarten through fifth grade) due to their proximity to Deaf schools. While states must comply with these federal educational laws that require access to services for Deaf and hard of hearing students, not all countries have similar mandates. The question is then raised as to whether equivalent rights and services exist in an Arabic country, Morocco, which is arguably less developed than the United States. Findings from this study will help determine whether the more developed country provides more educational rights and services compared to its counterpart. Data were collected through an analysis of literature, news articles, and legislature. Phone calls were also made to educators at elementary schools in each state in addition to interviews conducted with members of the Deaf community. Findings show that the services, which Deaf and hard of hearing students receive vary in Maryland and Massachusetts. However, in Morocco, educational laws do not require that these students have access to support services. Regardless of these variations, all three locations are working to achieve the same goal of improving the quality of education for Deaf and hard of hearing students.

We thank the Mellon Summer Research Program for financial support.

Poster 41

Modeling Homeostatic Expansion of T Cell Populations

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Our project uses a ten compartment non-autonomous system of ordinary differential equations to model the various T cell interactions within the human adaptive immune system. By coupling the compartments for CD4+ and CD8+ T cells, we incorporate the concept of density dependent homeostatic expansion and density dependent death. We include time dependent decay of thymic output in our model to account for the aging of a healthy immune system. In order for the model to match a set of target populations for each compartment, three optimization methods are explored: a simplex method, simulated annealing, and Latin hypercube sampling. While it appears the model is a good fit to existing biological data, it is based on estimates from the literature. Therefore, local and global sensitivity analyses were performed to examine the sensitivity of the model to any one or group of parameters. This is part of long-term project to model and investigate the interaction of HIV with the immune system.

I thank the Alumni/Parents Summer 2013 Research Scholarship Fund for their generosity in funding this project.

Poster 42

Synthesis and Characterization of Model Non-Heme Iron Nitrosyl Complexes

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Nitric oxide (NO) has been implicated in numerous signaling and immune defense pathways in mammalian systems. In particular, when invading pathogens are detected in the body, macrophages release toxic NO. Many pathogenic bacteria contain flavodiiron proteins (FNORs), which are able to reduce NO to N₂O. As a result, these pathogens are resistant to the body's immune system, and are thus able to proliferate, resulting in infection and disease. However, the mechanism of the reduction of NO to N₂O by these enzymes is not completely understood. To study the mechanism of the enzyme, the non-heme iron model complex [Fe₂(BMPA-PhO)₂(NO)₂](OTf)₂ (BMPA-PhOH = N-(2-hydroxybenzyl)-N,N-bis(2-pyridylmethyl)amine), which self-assembles into a dimer, was constructed. In addition, the synthesis of a complex with the nitro-substituted derivative BMPA-NO₂PhOH was attempted in order to determine how changes in the electronic structure of the NO complex impacts reactivity. Future work will include further characterization of the model complex using spectroscopic methods, as well as characterization of the reactivity (*i.e.* N₂O production) of the compound upon reduction. In addition, EPR studies will be performed to determine whether the newly synthesized model complex is a monomer or a dimer.

We thank the National Science Foundation, as well as the University of Michigan Chemistry REU program for their support of this research.

Poster 43

Trash Talk: A Study of Waste Management in Tunisia

C. Moynihan and A. Karass

Department of Music, College of the Holy Cross

In the early 1970s, advertising campaigns and government policies began reshaping environmental and pollution awareness in America. These campaigns and policies quickly transformed Americans' practices and attitudes towards trash. In only a short time, 43 years, the effort to create social change has taken deep roots in the American psyche. In contrast, in Tunisia there is little public practice of recycling and organized trash disposal, and there are no comprehensive national awareness and cleanup programs. Since the Jasmine Revolution of 2011, state officials has been concerned with establishing a functional interim government, drafting a new constitution, and reconciling opposing religious factions. Therefore, issues of municipal cleanup, recycling, and the environment are largely neglected. Through interviews conducted in Tunisia over five weeks in May and June, I found that most Tunisians believe that the source of the problem is rooted in a lack of awareness and public habits. Some interviewees suggested that raising awareness of recycling programs and trash issues through television and Facebook™ would be effective. The literature proposes that a solution for the dearth of clean up efforts might be found in the organization of trash pickers. Such an organization, whether private or public, could be profitable, socially equitable, and environmentally friendly.

My deepest gratitude is given to the Andrew W. Mellon Foundation and the College of the Holy Cross for supporting and funding my research.

Poster 44

Toric Surface Codes Over the Field \mathbf{F}_9

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Coding theory is the field of study concerned with the transmission of information across noisy channels using a variety of encoding and decoding techniques. A specific type of codes called Error-Correcting Codes are concerned with improving the reliability of information across these noisy channels. To do so, redundancies are incorporated so that errors occurring in transmission can be detected and corrected. Toric surface codes are a class of linear error-correcting codes that are constructed from a set S of integer lattice points in \mathbf{R}^2 and a finite field \mathbf{F}_q . The error-correcting capacity of a code is determined by a parameter called the minimum distance – the smallest Hamming distance between any two distinct codewords. The greater the minimum distance, the greater the error-correcting capacity is. The minimum distance of a toric code is determined by the geometry of subsets of lattice points in S in subtle ways. Our focus was on toric surface codes over the field \mathbf{F}_9 . From extensive calculations and results about the geometry of the sets of integer lattice points, we determined the best minimum distance for each dimension between 1 and 8 and compared these results to the best-known examples in the *codetables.de* online database. Our main result was a computer-assisted proof that toric surface codes of dimension 8 over \mathbf{F}_9 cannot have minimum distance greater than 45.

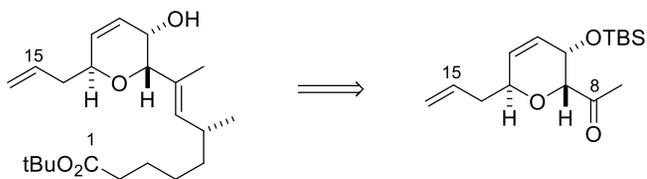
We thank the Richard B. Fisher '47 Summer Research Fellowship Program for their financial support

Poster 45

A Synthetic Approach Toward the C1-C15 Fragment of (+)-Sorangicin A

A. L. Fyles and K. J. Quinn

Department of Chemistry, College of the Holy Cross



(+)-Sorangicin A is a highly unsaturated macrolactone isolated from the gliding bacterium *Sorangium Cellulosum*. It is of biomedical interest based on its potent antibiotic activity against both Gram-positive and Gram-negative bacteria. We are examining a convergent approach toward its total synthesis in which three subunits of similar complexity are prepared independently and coupled together. Our attention has focused on a fully functionalized C1-C15 fragment, which we envision arising from formation of the C7-C8 alkene. We have completed a 10-step synthesis of the C8-C15 dihydropyran starting from (*S*)-ethyl lactate in which three stereocenters are controlled by the stereochemistry of the starting material. Key steps in the synthesis included an Achmatowicz ring expansion to form the six-membered oxycycle and a diastereoselective allylation to establish the C13 stereocenter. On this poster, we will present the optimization of this route and a proposed strategy for the formation of the complete C1-C15 fragment with functionalization appropriate for coupling with the remaining two segments.

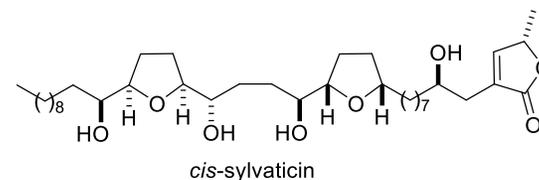
We gratefully acknowledge financial support of this research from the National Science Foundation and the generous donation of Mary Ellen Eagan to the Alumni/Parent Summer Research Scholarship Fund.

Poster 46

Synthetic Studies on (+)-*cis*-Sylvaticin

M. L. Maliszewski, J. H. Markowski, and K. J. Quinn

Department of Chemistry, College of the Holy Cross



cis-Sylvaticin is a cytotoxic natural product isolated from the leaves of the *Rollinia mucosa* plant belonging to the Annonaceae acetogenin family. We have examined two approaches to the synthesis of the bis(tetrahydrofuran) core that take advantage of its local C_2 symmetry by building from the center of the molecule in a two directional manner. On this poster, we will focus on our second generation route, which features a triple ring-closing metathesis reaction as the key step. Subsequent functionalization of the resulting bis(lactone) provides a suitable substrate for a planned double Sharpless asymmetric epoxidation and S_N2 ring opening, resulting in bis(THF) formation. Completion of the total synthesis will then require desymmetrization to append the alkyl and the butenolide side chains.

We gratefully acknowledge the National Science Foundation and the Alumni/Parent Summer Research Fund for financial support of this research.

Poster 47

The role of litter quality in stream biogeochemistry: Implications of species loss for Harvard Forest LTER

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The breakdown of vascular plants is imperative to the ecological processes that determine nutrient availability and carbon balance, and is therefore a major determinant of ecosystem productivity. Differences in the structure and chemistry of vegetation among species determine rates of degradation, so changes in litter composition have the potential to greatly alter ecosystem functioning. The purpose of this study was to investigate dissimilarities in the biogeochemical cycling of different vegetation in New England forest to assess the potential implications of changing litter type, as observed over the last decade in the decline of Eastern Hemlock (*Tsuga Canadensis*) associated with the rise of hemlock woolly adelgid (HWA), an invasive pest. Slurries of soil, litter, and fresh vegetation were prepared from both a coniferous and deciduous dominated site at Harvard Forest LTER in Petersham, MA. The supernatant water was analyzed for carbon concentration and composition, nutrient content, and microbial activity, to better understand how each litter type influences the biogeochemistry of streams. Results highlight coniferous components to be more biolabile with a more active microbial community. Deciduous components proved to be more recalcitrant, and seem to evoke a stronger pulsed microbial response, potentially due to the greater amount of energy required for degradation. These findings suggest that there are fundamental differences in the microbial communities of these two vegetation types, and that a deciduous dominance could result in a greater and more irregular ecosystem response.

We thank the Richard B. Fisher '47 Summer Research Fellowship Program and the Woods Hole Research Center for financial support.

Poster 48

Ubiquitin-conjugating Enzyme Complex, Ubc13/Uev1A Interacts with PSD-95 and Mediates Its Ubiquitination

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Protein ubiquitination involves the sequential actions of the E1 ubiquitin-activating enzyme, E2 ubiquitin-conjugating enzymes, and E3 ubiquitin-ligases. Ubc13/Uev1A is an established E2 enzyme complex that catalyzes the assembly of lysine 63 (K63)-linked polyubiquitination. PSD-95 is a conserved synaptic scaffolding protein that structurally and functionally interacts with glutamate receptors in the postsynaptic density (PSD), regulating synaptic function, maturation, and plasticity. Recent studies from our laboratory have shown that PSD-95 is ubiquitinated through the K63-linked mechanism; however, the molecular details have not been resolved. Here, we show that the Ubc13/Uev1A E2 complex directly interacts with PSD-95. We have also characterized the expression pattern of Ubc13 and Uev1A in neurons and various tissues. Confocal microscopic analyses show that Ubc13 localizes throughout the dendrites, whereas Uev1A and PSD-95 co-localize as clusters in dendritic spines. *In vitro* experiment demonstrates that the E2 complex, in conjunction with E3 ligase TRAF6, mediates PSD-95 ubiquitination. Our results clarify the molecular processes underlying K63 polyubiquitination of PSD-95, which may provide a novel regulatory mechanism for the regulation of PSD-95 function.

We thank Harvard Medical School, NIH, and the New England Primate Research Center Education and Training Base Grant for financial support.

Poster 49

Outcomes of Preimplantation Genetic Diagnosis in Patients with Neurofibromatosis Type 1

T. Murphy, V. Merker, B. Hughes, A. Muzikansky, M. Hughes, I. Souter, and S. Plotkin

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Neurofibromatosis type 1 (NF1) is an autosomal dominant neurogenetic condition that exhibits full penetrance. NF1 has a birth prevalence of 1 in 3000, making it the most common neurogenetic condition. Clinical manifestations include café-au-lait macules, neurofibromas, optic gliomas, intellectual disability, Lisch nodules, and bony abnormalities. Couples affected with NF1 now have the opportunity to undergo preimplantation genetic diagnosis (PGD), an emerging technique that uses genetic analysis of embryos generated by *in vitro* fertilization (IVF) to minimize the risk of transmitting inheritable diseases. However, there is little information available about outcomes of PGD in patients with NF1. For this reason, we retrospectively reviewed data from a large international provider of PGD. We found that at least 21/77 (27%) couples that underwent PGD gave birth to a healthy child. Over nine years, 85% of all PGD cycles for NF1 resulted in at least one embryo that was unaffected by the disorder. These results suggest that PGD is an effective technique for NF1 patients to minimize the risk of having a child affected with NF1.

We thank the Fuller Fellowship and the American Cancer Society for funding TM.

Poster 50

Investigating synthetic methods for generating novel metal complexes: Binding mono and multidentate ligands to Rhenium pentacarbonyl via microwave and reflux techniques

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Rhenium has been studied at length and is particularly useful as a non-radioactive chemical analog to Technetium, a popular but highly toxic diagnostic imaging agent employed in nuclear medicine and biology. As such, using Rhenium and exploring its reactivity is useful in investigating the potential of Technetium complexes in an experimentally friendly, safe, and low hazard environment. Specifically, this study details a new twenty-minute synthesis of $[\text{Re}(\text{CO})_3(\text{H}_2\text{O})_3]^+\text{Br}^-$, a useful starting material for a number of imaging reagents that was previously prepared with a twenty-four hour reaction. We have demonstrated the utility of this starting material by preparing and characterizing six complexes where the three water moieties are replaced by a single tridentate ligand. A separate study investigating the effect of the electronic properties of ligands on the IR stretching frequencies of the CO ligands on $[\text{Re}(\text{CO})_3\text{L}_2\text{Cl}]$ complexes will be presented.

I thank the Summer Science Research Program at Holy Cross for financial support.

Poster 51

Characterizing Novel Antiviral Domains of APOBEC3G as Potential Targets for HIV-1 Therapeutics

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The retrovirus, Human Immunodeficiency Virus type 1 (HIV-1) is the cause of Acquired Immunodeficiency Syndrome (AIDS). HIV-1 destroys CD4+ T cells of the human immune system leaving infected people particularly susceptible to devastating opportunistic infections. The human immune system's T lymphocytes naturally express a protein called APOBEC3G (A3G). A3G is an antiviral protein that exerts potent antiviral activity mainly through cytidine deamination of the nascent viral DNA strand and also through a deaminase-independent mechanism. Characterizing A3G is of utmost importance in determining which domains are involved in its antiviral activity and which areas could be potential targets for chemotherapeutics. Through the examination of mutant A3G constructs, the lab has found two unique domains in the N terminus of A3G that appear to be important for its antiviral function but not its catalytic function. This project seeks to characterize these unique domains and to examine their role in A3G's antiviral activity. Further examination of these domains can help elucidate how the deaminase-independent mechanism is able to exert antiviral activity and could allow for potential harnessing of its endogenous antiviral activity.

We thank BD Corp for their financial support of our research.

Poster 52

Stability Analysis of Solitary Wave Solutions of the KdV Equation

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The KdV equation is a mathematical model for water waves in shallow surfaces. We consider the stability of solitary wave solutions of the generalized KdV equation, where our nonlinear term of interest is one of mixed powers. Through both numerical analysis and analytical approaches, we determine the range of speed c over which the solitary waves are stable for this equation. We apply the known theorem regarding stability, which depends on the function of wave speed $d(c)$ and its derivatives over a range of speed c . Further, we consider a variation of this nonlinear term for the compound KdV equation and later investigate the original mixed power term applied to the fifth-order KdV model.

We thank Dan Kennedy, PhD, for his generous donation to the Alumni/Parent Summer Science Research Scholarship fund.

Poster 53

Schaphinotus Petersi in Arizona Sky Islands

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The Arizona Sky Islands located in Southeastern Arizona are the home of the carabid beetle species *Scaphinotus petersi* and its six subspecies. Over the course of millennia as the climate warmed, populations of the beetle species became independently isolated amongst the mountain peaks. It is believed that the beetles, having been isolated independently, diverged evolutionarily. Differences in total length, head and pronotum characteristics, hind legs, and color variation have been observed in the subspecies; however no genetic study has ever been done to determine differences at the molecular level. The aims of the research were to infer the genealogical relationships of the *S. petersi* populations using molecular sequence data from nuclear gene 28S and, from this evolutionary hypothesis, investigate the phylogeographic patterns of the genetic tree. Then finally, infer the age of divergence and isolation of subspecies and populations of *S. petersi* from molecular clock estimates. Sequences of the 28S gene were acquired by DNA extraction of the *S. petersi* flight muscles followed by PCR amplification to amplify the desired gene. After the 63 samples were amplified the genes were sequenced and the genetic differences in the genomes were compared. Future work will reconstruct the molecular phylogeny of these beetles using DNA sequence data.

We thank Domenic J. and Catherine E. Dinardo for their generous contribution to the Alumni/Parents Summer Science Research Scholarship Fund.

Poster 54

The Limits of Physicalism: A Reflection on the Contemporary Phenomenal Consciousness Debate

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This project investigates the contemporary philosophical debate about phenomenal consciousness and its central presuppositions. Most importantly, I analyze the ontological framework of physicalism that constitutes the discursive framework of this debate. I explain why contemporary authors think that only phenomenal consciousness is a fundamental problem for physicalism because it leads to an explanatory and perhaps ontological gap. I also look at “the phenomenal concept strategy” that is often appealed to in trying to counter the above argument against physicalism within this framework, and show it to be unsuccessful. Finally, I raise some doubts about the framework of the debate as a whole. In particular, I argue that the exclusive focus on phenomenal consciousness is misleading. It forces us to accept too many of the presuppositions of the debate, and does not allow us to address more important questions in the philosophy of mind.

Special thanks to the Mellon Foundation for providing the financial support to make this paper possible.

Poster 55

Effect of Neutrophil Depletion on Skeletal Muscle Following Hind Limb Ischemia Reperfusion Injury

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Muscle necrosis following ischemia reperfusion (IR) injury incites tissue granulocyte infiltration. Inflammatory cells including neutrophils are known to release extracellular traps (NETs) that have thrombogenic and inflammatory properties. The experiments tested whether neutrophil depletion would ameliorate skeletal muscle fiber injury by decreasing NETs formation in a mouse model of hind limb IR injury. Two groups of C57BL6 mice received IP serum injections of a neutrophil antibody to achieve neutrophil depletion (ND; n=8), or normal rabbit serum as a control (CON; n=7) for two days. Mice were then subjected to 1.5 hours of unilateral hind limb ischemia followed by 24 hours of reperfusion. To verify neutrophil depletion plasma was collected for a complete blood count. Hind limb muscle tissue was harvested for quantitative analysis of skeletal muscle integrity including histologic evaluation of skeletal fiber injury and an ATP chemiluminescence assay. Tissue myeloperoxidase (MPO) levels were quantified with ELISA to confirm local depletion of granulocytes. NETs formation in the hind limb tissue was visualized with a fluorescent immunohistochemistry assay. The relative corrected total fluorescence (CTF) in randomized fields was calculated with ImageJ software. Circulating granulocytes and local MPO levels were significantly reduced in the ND mice compared to the CON group. This correlated with a marked reduction in the formation of NETs. In contrast, neutrophil depletion had no effect on hind limb perfusion, muscle fiber injury and the steady state level of ATP. These data suggest that neutrophils are an important source of tissue extracellular traps during skeletal muscle reperfusion. However, successful neutrophil depletion and decreased NETs formation neither altered hind limb perfusion nor did it protect against muscle necrosis following IR injury.

Poster 56

Perceiving Reformation: From Iconoclasm to Canvas

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December 4, 2013 marks the 450th anniversary of the twenty-fifth and final session of the Council of Trent. That session was earmarked as a session on reform and, in part, evaluated the usefulness of the cult of saints, relic veneration, and sacred images, which the Protestant Reformers had attacked in previous decades. Ultimately, the Council Fathers determined that the veneration and devotional use of sacred images was not just valid, but also profitable to the faithful.

Our goal was to analyze the gap in understanding between John Calvin, a Protestant Reformer noted for iconoclastic leanings, who the Council alluded to in the twenty-fifth session and Michelangelo Merisi da Caravaggio, who as a late sixteenth-century and early seventeenth-century artist created a new era of sacred images for the Roman Catholic Church. The project started in Rome where we were fortunate enough to examine six altarpieces of Caravaggio that remain *in situ* in their originally intended locations. Our research led us to believe that John Calvin and Caravaggio do not so readily fit into the conventional notions of “iconoclast” and “iconographer,” respectively. Each is somewhere in between. Calvin did not wholly support the physical act of iconoclasm and Caravaggio’s innovative style did not allow for the iconic attributes of his artistic tradition. Instead, we concluded that each of these men believed that sacred art had an important role in the Christian instruction of the laity.

We thank the Summer Mellon Research program for its financial support.

Poster 57

Laser Cooling and Temperature of a Cold Atom Cloud Measured by Thermal Expansion

*K. Candee, B. Dapaah, B. Geddes, and T. Roach
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We developed a system to measure the temperature and further cool a cloud of cold rubidium (Rb) atoms. The atoms are cooled and collected in a vacuum space in a magneto-optic trap (MOT), using forces from laser light in the presence of a magnetic field. We briefly turn the trap off which allows the cloud to expand where the atoms move outward due to their thermal kinetic energy. After some specified time, we capture an image of the expanded cloud with a high sensitivity digital camera. The 2D distribution of the pixel intensity is reduced to a 1D distribution which has approximately a Gaussian shape, as expected for a thermal velocity distribution. We fit this data to a Gaussian and extract the width parameter to determine the cloud size. From a plot of the thermal expansion data we can determine the average thermal velocity and from this calculate the temperature of a Rb cloud. We further cool the trapped atoms by briefly detuning the laser used for trapping, just before the trap is shut off. As the frequency moves further from resonance, the light-induced forces on the atoms are lessened, and the average energy of the atoms is reduced. This additional cooling lowers the temperature from 40 microKelvin to under 15 microKelvin.

We thank the Robert J. Stransky Foundation for financial support.

Poster 58

An Investigation of the Capabilities of a Compact Diffraction Grating Laser Spectrometer

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Spectrometers of high precision are available commercially but are of a correspondingly high price. For our studies in atomic and laser physics, we needed a spectrometer with picometer accuracy, and we needed an inexpensive solution. Robert E. Scholten and James D. White of the University of Melbourne published in 2012 a review of the design and applications of such an instrument, so we adapted their design to fit our specific needs and built our own spectrometer. We aligned and calibrated the spectrometer, and analyzed its resolution both experimentally and theoretically. We found that it could measure the wavelength of incoming light with a precision of better than 1 picometer over a range of 7.8 nanometers. The absolute accuracy is limited by day-to-day drifts of several picometers. As an application, we used the spectrometer to analyze light from a bare laser diode. We measured how light coming from the laser diode changed as the laser current and temperature were changed, and measured the spacing between modes as the laser “mode-hopped.” The spectrometer will next be used for studies of laser mode competition in our extended cavity diode laser (ECDL) system. The precision and range of the spectrometer, as well as its ability to capture an entire spectrum in one image, will make it very useful for deciphering the complex behavior of the ECDL.

We thank the Alumni / Parents Summer 2013 Research Scholarship Fund for financial support.

Poster 59

Dichroic Atomic Vapor Reference for Rb: Preliminary Steps

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Gases strongly absorb light at particular frequencies, referred to as absorption lines. Thus, they can be (and are often) used as a frequency reference for tuning laser light. We built a system to use the absorption of polarized light by Rb vapor as a frequency reference point. The use of a magnetic field causes the polarization of transmitted light to change, dependent on its color – hence the name (dichroic), due to the different responses of the vapor to different colors of light. For a tunable source of light, we built an extended-cavity diode laser (ECDL). In our ECDL system, we used a grating with piezoelectric transducers to control the frequency. Through the use of an optical fiber, we aimed the laser beam through an Rb vapor cell enclosed by eight magnets, and tuned the laser to the frequency of Rb absorption. The two circular polarization components of the transmitted light are separated by a quarter-wave retarding plate and a Wollaston prism, and the two beams are directed to separate photo-detectors. We observed Rb absorption by the two polarizations and the effects that a magnetic field had upon them. Eventually, an electronic feedback loop can be implemented in order to adjust the laser's output frequency in relation to the reference point produced from the dichroic absorption signals, to provide a known, stable frequency of laser light.

We thank Lindsay B. and Richard K. Watson, Jr., for their generous contribution to the Alumni / Parents Summer 2013 Research Scholarship Fund.

Poster 60

Collective Beliefs in Corporate Morality

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As Margaret Gilbert opens her article on *Modelling Collective Belief*, “It is natural to distinguish between the beliefs of groups, or collective beliefs, and the beliefs of individuals” (185). In her discussion, Gilbert raises significant questions such as *What is the nature of this distinction?* and *What is a collective belief?* In this article, I seek to examine and compare four theories which propose answers to these questions. Although each of these theories lies moderately between individualism and holism, each takes a distinct approach to defining collective belief. Creator of the Corporate Internal Decision Structure, Peter French suggests that all aspects of a corporation (as a particular type of collective) can be defined by the organization of its members, corporate policy, and sanctioned corporate acts. In her discussion of collective beliefs, Margaret Gilbert proposes her Joint Action Theory, which requires individuals to share or jointly accept beliefs. Michael Bratman presents his list of seven qualifications for a collective to achieve a group intention which has implications for a theory on collective belief. Lastly I discuss the theory of Kendy Hess, who avoids discussion of the individual by comparing the systems at work in forming collective beliefs to the systems at work in forming individual beliefs. In my comparisons, I group the first three theorists as individualist, and in my conclusion I identify the benefits of a more who list approach such as the approach taken by Hess.

We thank the Mellon Foundation for supporting this work.

Poster 61

Characterization of PI3K Recruitment and Function in the T Cell Immunological Synapse

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T lymphocytes play a significant role in adaptive immunity both in their ability to modulate other immune cell responses and by acting against infected cells directly. Formation of the immunological synapse (IS) between the T cell and target cell is required for T cell activation. The IS facilitates directional secretion of lytic granules towards the target cell and is characterized by an annular arrangement of filamentous actin (F-actin). Annular accumulation of phosphatidylinositol triphosphate (PIP₃) is necessary for growth and maintenance of the F-actin ring that forms at the synaptic membrane. Synaptic PIP₃ is generated by class IA phosphoinositide 3-kinase (PI3K)—a heterodimeric enzyme consisting of a catalytic p110 subunit and regulatory p85 subunit. Previously, we have shown that the isoforms p85 α and p85 β both colocalize with T-cell receptor (TCR) microclusters at the IS. In this study, we examine the mechanism of p85 β recruitment in TCR microclusters using both pharmacological and structural analysis. We employ various kinase inhibitors to examine TCR microcluster formation and PI3K colocalization. In addition, because p85 β has two Src homology-2 (SH2) domains that may be required for binding with TCR microclusters, we use fluorescently-labeled p85 β constructs and total internal reflection fluorescence (TIRF) microscopy to examine the role of each SH2 domain in PI3K localization at the IS. Ultimately, these strategies will provide insight to how PI3K is recruited to the IS and its function in driving F-actin reorganization.

We thank the Gerstner-Sloan Kettering Graduate School of Biomedical Sciences for financial support.

Poster 62

Environmental Privilege and Green Space: Social Disparities in the Distribution of Worcester's Urban Tree Canopy

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Most studies of urban environments focus on the inequitable distribution of environmental ills, but few consider the unequal allocation of environmental privileges. Perhaps the most integral of these environmental privileges is urban tree canopy cover. Increasingly, while studies of the urban canopy have revealed the social, psychological, and economic benefits of urban trees, the equitable spatial distribution of the canopy has remained taken-for-granted. Utilizing ITree Canopy, an online tool from the USDA Forest Service used to calculate land cover percentages, we analyzed 45,000 randomly sampled points across the 166 census designated block groups comprising the city of Worcester, MA. Statistical analysis revealed many significant correlations between tree cover and block group demographic data. Block groups with high population densities, high rates of poverty and unemployment, as well as high percentages of black residents, multi-family and rental housing, were more likely to have decreased amounts of canopy cover. Contrarily, high income areas with higher percentages of white, elderly, or female residents and single family housing were likely to have the highest amounts of tree cover. These findings have important implications for public investment strategies as Worcester seeks to restore its urban tree canopy, alleviate environmental inequity, and combat the dual ecological threats of urban development and the Asian longhorned beetle infestation.

We thank the Andrew W. Mellon Foundation and the College of the Holy Cross for their financial support.

Poster 63

Synthesis of Novel Ligands through Mannich Condensation and Reductive Amination

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Metallo-enzymes and proteins are capable of catalyzing a variety of chemical reactions that are otherwise very difficult to reproduce. As such, developing efficient syntheses for novel ligands that can modify the reactivity of transition metal complexes to mimic that of these metallo-protein active sites promises to yield substantial rewards. To that end, we have employed Mannich condensations and reductive aminations to synthesize novel aminophenols. In the Mannich condensations, we combined a diamine with paraformaldehyde and a substituted phenol, yielding an aminophenol in a one pot reaction through the formation of a new carbon to carbon and carbon to nitrogen single bond. In the reductive aminations, primary diamines were combined with a salicylaldehyde derivative and a reducing agent. The primary amine attacked the aldehyde, resulting in an imine, which in turn was reduced by the reducing agent to produce an aminophenol. Over the course of the summer we focused on applying these two synthetic pathways to determine the most effective way to synthesize a variety of novel organic ligands such as two and four armed aminophenols and imidizolidines. We hope that the variation in number of binding sites, geometry, and electronic properties offered by these different ligands will allow us to subtly modify the reactivity of transition metals that bind them.

We thank the Science Summer Research program for its financial support of our project.

Poster 64

Adolescent Mothers and Postpartum Contraceptive Choice: A Cohort Study

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Teen pregnancy is a major social, economic, and public health concern in the United States. Easily reversible contraception, such as the birth control pill and condoms, has proven to be less effective for teen use due to the necessary user involvement and potential user error. Long Acting Reversible Contraception (LARC) has proven to be more effective among adolescents, as it greatly reduces the possibility of user error with near 100% efficacy. Our study will assess how postpartum contraceptive choice influences birth control continuation and pregnancy rates in the first year postpartum. We are conducting a prospective cohort study at Baystate Medical Center - a single, academic, urban, medical center in Springfield, MA. We approached inpatient postpartum women, aged 19 and younger, following delivery. After obtaining consent, we administered a brief questionnaire regarding demographics, contraceptive history, and pregnancy history. Participants self-selected into one of two study arms - LARC inserted in hospital prior to discharge and all other contraception plans. We will contact participants at 3, 6, 9, and 12 months via phone call, text, or email to administer a brief follow-up questionnaire to determine pregnancy rates in the first 12 months postpartum. Secondary outcomes are use of any contraception and method satisfaction. The target cohort size of 172 participants was calculated to ensure an adequately powered study. As we are currently enrolling participants, we will be presenting preliminary data.

We thank the Baystate Summer Student Scholars Program for financial support.

Poster 65

Characterization of Acute and Chronic Regenerative Responses to Hind Limb Ischemia Reperfusion Injury in Diet Induced Obese Mice

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Diabetic patients are at risk for the sequelae of peripheral vascular disease including the development of limb ischemia reperfusion (IR) injury. The mouse model of diet induced obesity replicates several characteristics of early type II diabetes in humans. Studies were designed to compare hind limb IR injury in diet induced obese mice (DIO) vs. non-obese control mice (CON) during the acute and regenerative phases of reperfusion. C57BL/6 male mice were fed either a 60% high fat diet to induce obesity and insulin resistance (DIO n=14) or normal diet (CON n=15) for 26 weeks. Mice were subjected to 1.5 hours of unilateral hind limb ischemia followed by either 1 day or 28 days of reperfusion. After these reperfusion intervals, mice were sacrificed and the limb tissue was subjected to morphometric and quantitative analysis. Hind limb tissue perfusion ratios were assessed using laser doppler imaging. DIO mice demonstrated substantially more acute inflammation, evidence of pro-thrombosis, and metabolic compromise as compared to controls (CON) following IR. These findings are independent of limb perfusion and muscle fiber injury. During the regenerative phase of reperfusion, there is comparable fiber cross sectional area suggesting similar muscle fiber maturation. However, there is markedly more accumulation of fat in the DIO hind limb muscle as compared to CON. These results suggest that the regenerative phase of IR in DIO mice diverges to favor greater non-contractile fat accumulation in the injured tissue. This data implicates that modulating the acute responses to IR may be beneficiary for skeletal muscle healing after IR.

We thank the National Institutes of Health (NIH) for support.

Poster 66

Investigating the Mechanisms of the Male Fertility Defect Under Glucose Stress in *Caenorhabditis elegans*

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The regulation of glucose is critical for the maintenance of function and homeostasis. *Caenorhabditis elegans* is a prime model organism for glucose research due to its conserved, yet simplified, insulin signaling pathway. Studies have shown that in humans, glucose consumption has increased in recent years along with the prevalence of type 2 diabetes. Male worms seem to be more sensitive to glucose stress and display fertility defects at lower concentrations of glucose compared to self-fertilizing hermaphrodites. My project seeks to identify and further understand the male fertility defect and the mechanism(s) that leads to this defect. There are several potential sources of the male fertility defect, including the loss or decrease of male mating ability or behavior, or a decrease in male sperm quality or quantity. To study this problem, I have used a mutant strain known as *fog-2* in my assays, which is wild type in all respects except that it fails to make sperm, resulting in a 'female' worm rather than a hermaphrodite. Because all progeny from matings between *fog-2* "female" worms and male worms must be derived from male sperm, this mutant strain allowed us insight into the mechanism of the male fertility defect. Mating ability assays showed no decrease (~20% of plates had progeny for both high glucose and control plates) in the male worm's mating ability on high glucose compared to control. Fertility assays showed a decrease in male fertility on high glucose (~60% decrease compared to control), which is greater than the fertility decrease previously observed in our lab for matings between hermaphrodites and males (~30% decrease). Our current hypothesis is that sperm quality and/or quantity are the likely mechanism(s) regulating male fertility, and future experiments will address this belief.

This summer research project was generously funded and supported by BD Corporation.

Poster 67

Detection Apparatus for Co-Linear Charged and Neutral Hydrogen Beams

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In preparation for collision experiments between lithium atoms and protons, a neutral particles detector was designed and built and a large aperture Faraday cup was designed. The Faraday cup will be used to measure the number of colliding protons and the neutrals detector will measure the number of hydrogen atoms formed when a proton captures an electron from a lithium atom. In addition, the proton beam was directly observed using a micro-channel plate and phosphor screen assembly which allowed optimization of the proton beam profile. The neutral particle detector consists of a copper back plate, which when struck by fast hydrogen atoms will cause an electrical current to flow. This current can be measured by an ultra-sensitive amplifier to determine the number of hydrogen atoms emerging from the collision site. The Faraday cup for proton detection works in a similar manner to the neutrals detector. Before detection, the protons and hydrogen atoms must be separated from one another since they are travelling along the same path, co-linear with each other. We designed and analyzed a system using the *SIMION* calculation software to do this and integrated this system with the neutrals detector and Faraday cup. Using the micro-channel plate beam viewing system we directly observed several different ions. In addition to protons we have observed several other types of ions, including: H_2^+ , H_3^+ , Ar^+ , and H_2O^+ ions. Knowledge of the ion beam size and shape is crucial for optimizing the collision experiments.

We thank the generous contribution made by Katina Georgopulo and Edward J. Burke, Jr., to the Alumni/Parents Summer 2013 Research Scholarship Fund., Dick Miller for machining assistance, and Prof. Jude Kelley for the use of the *SIMION* software.

Poster 68

Quantitative Bleeding Histories of Severe Subunit-A Factor XIII Deficiency Patients from Newfoundland, Canada

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Factor XIII (FXIII) deficiency is an extremely rare autosomal recessive bleeding disorder. In the literature a prevalence of one in every three to five million people is reported. FXIII is a fibrin-stabilizing factor that is involved in the final step of the clotting cascade. FXIII deficiency can present with a variety of symptoms including neonatal umbilical bleeding, delayed soft tissue bruising, mucosal bleeding, poor wound healing, and recurrent miscarriages. Fatal bleeding events are most likely to be due to intracranial hemorrhage with a reported prevalence of 30%: the highest incidence reported among known congenital bleeding disorders. Delayed umbilical cord bleeding is reported in eighty percent of patients. The first recognized case of FXIII deficiency was reported in 1960 by Duckert et al. Dr. Mary Hanna described the first known cases of severe subunit A FXIII deficiency in Newfoundland when she reported on 3 patients from NL with combined FXIII deficiency and FXII in 1970. We now present a report on the current status of these patients, 2 other adults with a severe FXIII deficiency, 1 adult with suspected acquired FXIII deficiency and 1 adult carrier. Using the MCMDM-1vWD bleeding score, we collected a quantitative report of bleeding histories for these patients. The mean bleeding score for the cohort was 23.7 with a range of 19-29. Bowman et al reported a bleeding score of 0.16 to be normal and any score above 4 to be abnormal. We also found the average bleeding rate to be 17 hemorrhages/year compared to the normal bleeding rate of 0.06 reported by Ridker et al. This rate is also higher than the average bleeding rate for both severe hemophilia A and severe hemophilia B which are 10.8 and 8.4 respectively.

We thank Bayer HealthCare for the research grant given to Dr. Scully in 2002 by the Bayer Hemophilia Awards Program.

Poster 69

Functional analysis of dopamine in the primate eye using PET in an MPTP model of Parkinson's disease

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Parkinson's disease (PD) is a neurodegenerative disorder characterized by the loss of dopaminergic (DA) nigrostriatal neurons resulting in motor and cognitive dysfunction. According to a previous study, patients with PD exhibit significantly lower retinal DA concentrations, which may be a result of retinal cell death. MPTP, a neurotoxin that causes the onset of Parkinsonian symptoms, has been identified as a possible cause of cell death in retinal DA neurons. Previous research has shown a significant decrease in retinal DA content in MPTP-treated macaque monkeys compared to controls. Dopamine transporter (DAT), vesicular monoamine transporter type 2 (VMAT2), and dopa decarboxylase (DDC) are major components of the DA system; therefore, we believe that by measuring their expression we can determine if cell death occurs in retinal DA neurons. Using PET imaging, we aim to measure in vivo expression of DAT, VMAT2 and DDC in the primate eye, specifically the retina and dopaminergic nerve fibers (DNF) that terminate in the iris. Our results suggest that expression in the left and right retina is similar for each of DAT and VMAT2 prior to MPTP administration.

We thank the Mallinckrodt Institute of Radiology for financial support through their MIR Summer Research Program.

Poster 70

Evolution of *Presepio* Art in Naples, Italy

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The Italian art of the *presepio*, or the nativity scene, took humble roots in the thirteenth century with St. Francis of Assisi' public performance of a Christmas Eve mass in Greccio. Throughout its development in the baroque climate of eighteenth century Naples, the *presepio* evolved from devotional art used by churches to elaborate, spectacular displays privately erected by aristocrats. These complex tableaux were popular amongst the wealthy for hundreds of years. After the *Risorgimento* of the nineteenth century, Italy's elite disassembled its displays, selling off pieces to middle-class collectors. My research explores the *presepio* display of one such prominent, Neapolitan collector named Michele Cuciniello. An architect, playwright, and liberal political activist Cuciniello donated his noteworthy *presepio* collection to the Museum of San Martino in Naples in 1877, following his brief exile in Paris due to controversial play themes advocating social reform. For Cuciniello, this donation served both as a gift to the general people of Naples as well as an anti-Bourbon, anti-aristocratic gesture. The Cuciniello *presepio*, a truly theatrical and ornate ensemble, has served as a model and an inspiration for subsequent *presepio* displays throughout the world.

I would like to extend my gratitude to the Mellon Summer Research Program at the College of The Holy Cross for offering financial support.

Poster 71

Il Presepio Romano: A Christmas Tradition

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The tradition of the Roman presepe, or nativity scene, began with the marble statues carved by Arnolfo di Cambio in 1289, which were displayed in the Basilica of Santa Maria Maggiore. Until the 1600s, the presepi were located primarily in religious settings throughout Rome. The beginning of the seventeenth century witnessed the exhibition of presepi in the palaces of Roman nobility, and by the nineteenth century, the construction of these sets became more widespread and popular due to low-cost production and molds for terra cotta figurines. The typical Roman presepe consists of a rural landscape as a background to a cave and includes shepherds, farmers, and modest houses and inns amidst the ruins of ancient aqueducts and arches. Following World War II, artists started picturing pre-industrial Rome as a setting of choice. My research focuses on il Presepio dei Netturbini, or the Street Cleaners' Nativity, in the context of Roman presepi history, design, and symbolism. It is a monumental display made up of over 2000 rocks on permanent display near the Vatican and is a hybrid between the old and new models of Roman presepi. Constructed in the 1970s when urban settings were typically used, artist Giuseppe Ianni set his scene in ancient Palestine, invoking Rome through the aqueducts flowing with real water. In this sense, the Presepio dei Netturbini is a contemporary presepe but was built in the traditional style. At first, the presepe simply appears to be a reconstruction of Roman Palestine with a nativity tucked away in the corner, but Ianni filled the scene with an abundance of biblical symbolism hidden in the form of ordinary objects. In this way, Ianni emphasizes the role of both religious symbolism and the representation of secular life in the art of the presepe.

We thank the Mellon Summer Research Program for financial support.

Poster 72

Identifying Unique Regulators of *C. elegans* Insulin Signaling in Response to Glucose Stress

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Diabetes affects 25.8 million Americans and is commonly caused by poor insulin signaling. The nematode worm, *Caenorhabditis elegans*, has been used to explore insulin signaling due to the high homology between the worm (DAF-2) and human insulin receptors. *daf-2* mutant worms have reduced insulin signaling which increases entry into an alternate stage of their life cycle, dauer, and this can be used to indirectly measure the level of insulin signaling. Although insulin signaling in normal glucose conditions has been thoroughly studied in these worms, glucose stress (high glucose conditions) is relatively unstudied, and is very relevant to human diabetes physiology. My goal is to identify genes that regulate insulin signaling in high glucose conditions using RNA interference (RNAi) to knockdown expression of target genes. This data has suggested a connection between diabetes and spinal muscular atrophy (SMA). *smn-1*, which is the causative disease gene in SMA, leads to motor neuron loss, paralysis, and death when mutated in humans. In high glucose conditions that normally suppress dauer formation, knockdown of *smn-1* or its modifier *nekl-3* increased dauer formation by 2-3 fold, indicating that both genes are partially required for the insulin response to glucose toxicity in *C. elegans*. This dramatic increase was not observed in control, suggesting that these genes are glucose specific. In addition, no increase in dauer was seen in *daf-1* mutants, which form dauers via a non-insulin pathway, suggesting insulin specificity. To date, little research connects SMA to Diabetes, so this data could be useful in the development of new therapies.

We thank BD Corp for financial support.

Poster 73

The Effect of the Fourmile Canyon Fire on Housing Prices: A Hedonic Regression Analysis

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The Fourmile Canyon Forrest Fire, which took place in September of 2010 burned 6,181 acres, 169 homes, and caused \$217 million dollars in damages; it was the most damaging wild fire in the history of Boulder County Colorado. In the past three years three more fires have taken place resulting in the destruction of more than 1089 homes and totaling approximately \$535million dollars in property damages. This study examines how these events reshape the risk perception of home owners living in areas similar to the ones that these fires affected. Using sales data from the seven quarters before and eight quarters after the Fourmile fire, we estimate the effect on home prices for those homes built in areas deemed to be at risk for forest fires. With the aid of Geographic Information Systems (GIS), we were able to obtain risk ratings for homes in Boulder County from the County's GIS database. Through hedonic regression analysis, along with the use of the difference in differences technique, we were able to conclude that homes located in Very High Risk areas of Boulder County sold on average for 24 percent less after the Fourmile fire. The results demonstrate the heightened awareness of home buyers to the reality that these are high risk areas and as a result these home buyers are discounting the sales price of these homes to compensate for this risk.

We thank the Office of the Dean of the College for its financial support.

Poster 74

The Impact of Provenance Law Enforcement on the Price of Antiquities

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In 1970, a UNESCO treaty was signed which deemed antiquities with documented provenance from before 1970 as legal for sale. The treaty also stated that any artifact acquired after that date was the property of the country of origin. Despite the near universal support of this treaty, it was widely known within the antiquities community that these laws were not actively enforced. In April of 2005, however, Marion True, a curator at the J. Paul Getty Museum in Los Angeles was indicted by the Italian Government for taking part in a conspiracy that laundered stolen artifacts through private collections in order to manufacture "acceptable" provenance. Ultimately, these charges were dropped in October 2010 after the statute of limitations had expired. We employ a difference-in-differences method with hedonic regressions to determine whether an antiquity having good provenance (documentation of ownership prior to 1970) receives a higher selling price at auction both during the Marion True trial as well as after the charges were dropped. Preliminary results indicate that provenance significantly increased the selling price of antiquities during and after the True trial, though appraisers only significantly increased their estimates during the trial.

We thank the Office of the Dean of the College for its financial support.

Poster 75

American Collegiate Moot Court Association Brief Writing Competition 2013: Fourth Amendment and Article II of the Constitution

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Annually, the American Collegiate Moot Court Association holds a national appellate brief writing competition for undergraduates. These briefs are formatted under the rules of the Supreme Court of the United States, and are based on a fictitious case that addresses two constitutional issues. The case this year addresses the Fourth Amendment and Article II of the Constitution. The questions before the court are: whether the warrantless tracking of the defendant's location through a cell phone violated the Fourth Amendment to the United States Constitution, and whether the President exceeded his authority when he ordered the indefinite detention of an American citizen. Analyzing the case precedent from the 17 Supreme Court decisions contained in the closed library for the competition, I drafted an appellate legal brief for submission. The case concerns an individual, Chester Comerford, whose cell phone's location is tracked by the FBI using special technology after an anonymous tip reports that Comerford is dealing narcotics. When the FBI see him meeting with suspected members of terrorist organizations, they initiate a warranted search which reveals evidence that Comerford arranged to buy a "dirty bomb" from the suspected terrorists. This leads the President to classify Comerford as an unprivileged enemy belligerent and indefinitely detain him without trial at Guantanamo Bay. Comerford argues that the United States violated his Fourth Amendment rights by tracking his cell phone's location without a warrant, and that his indefinite detention without trial exceeds the President's authority.

We thank Agnes Williams and the College of the Holy Cross Pre-Law Program for financial support.

Poster 76

Economic Impact of Primary and Caucus Elections

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There is evidence that early presidential primary and caucus states benefit from their position in the electoral process. These states experience disproportionate influence on candidates' positions for important issues and level of federal spending. Some states consider the purported increase in influence of having an earlier election date worth the cost of moving forward their primary dates, even when facing a loss of delegates like Michigan and Florida in the 2008 primary elections. Beyond these political implications, we believe there may exist direct economic effects tied to primary elections and caucuses. In our research, we analyze whether or not primary and caucus elections have significant statewide effects by analyzing employment in eight sectors of their local economy: construction, professional and business services, government, education and health services, information, leisure and hospitality, trade and transportation, and other services. For our data, we collected monthly data in those eight sectors from the Bureau of Labor Statistics (BLS). To study the economic impact of primary and caucus elections, we examine the months around the event in each state and use fixed effects for individual states, years, and months to control for other economic trends and conditions. We find that primary elections potentially have significant effects in industries like construction, government, and other services, which includes social planning and other items pertinent to primary elections. These employment gains tend to begin months before and remain for months after the primary. However, some of these gains, like in construction, are much larger than we think possible in a primary election. Looking ahead, we hope to account for the total amount of campaign spending in order to gauge the size of the impact relative to the amount of money spent. We look forward to exploring the differences between the economic impacts in states and the timing of their elections.

We thank the Office of the Dean of the College for its financial support.

Poster 77

Endogenous Representative Weights and Redistricting

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Every ten years after the U.S. Census, states are required to redraw district lines to reflect shifts in population and ensure citizens have equal representation at both the state and federal levels of government. In many states, this redistricting process is performed by the legislators, providing an incentive for them to draw these lines to ensure the majority party maintains power through the next election cycle. The manipulation of this process is known as gerrymandering. Gerrymandering has been used in the United States for almost two centuries, and can be shown both theoretically and empirically to suppress votes and disregard large segments of the population. We examined the merits of a possible solution to this problem, and pulled out both the costs and benefits of this system and compared the results to current redistricting processes in the United States. While the results showed endogenous representative weights to be a less perfect solution in more realistic models than initially thought, in simple models the results proved to cure the major problems often associated with gerrymandering.

We thank the Office of the Dean of the College for financial support.

Poster 78

“Loss of Chance” Doctrine: A State-by-State Investigation

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“Loss of Chance” is a doctrine relevant to medical malpractice cases dictating a damage calculation proportional to the victim’s reduction in chance to recover due to the medical professional’s negligence. Though some argue that “Loss of Chance” increases doctors’ liability, holding them responsible for their negligent actions in situations in which the patient had an initial chance of recovery that was less than even, others argue that medical malpractice insurance is already debilitatingly high, and any factor that would increase the financial burden to doctors would do nothing but harm. Using the categorization within Koch (2010) as a starting point, we performed a state-by-state investigation, examining relevant cases in order to provide a comprehensive table with the purpose of displaying the opinion in each state accompanied by supporting case law and excerpts. While the states are almost evenly split between those that have adopted the doctrine (22) and those that have rejected it (18), there are still others that have either deferred opinion on the matter for a later date (4), or have failed to address the doctrine entirely (6).

We thank the Office of the Dean of the College of the Holy Cross.

Poster 79

Lipid Catabolism and Acetaldehyde Induced Hepatic Steatosis in Liver Cells

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It is known that chronic and acute exposure to ethanol enhances the accumulation of lipids, specifically, triglycerides in the liver. This occurs because ethanol accelerates lipid synthesis and probably decreases lipid degradation. There is also strong evidence that ethanol oxidation, rather than ethanol itself brings about these changes. Here we present evidence that the acetaldehyde, the primary oxidation product of ethanol, strongly influences hepatic steatosis (fatty liver). In addition, we present the results of studies that examined triglyceride catabolism during and after alcohol exposure.

We thank the University of Nebraska Medical Center Department of Internal Medicine.

Poster 80

Aortic Arch Width and its Association with Cardiovascular Disease Risk Factors and Events

*R. M. Musgrave, M. L. Chuang, C. J. O'Donnell
The NHLBI's Framingham Heart Study*

The aorta is the largest artery in the body and it forms an inverted U-bend or arch in the thorax before proceeding to the abdomen. Increased diameter of the aorta in the ascending or descending thoracic segments, or in the abdomen, have been associated with cardiovascular disease (CVD) risk factors and with excess CVD morbidity and mortality, but it is not known whether aortic arch width (AAW) is predictive of adverse CVD outcomes. We hypothesized that: 1) AAW is associated with increasing age and other CVD risk factors, and 2) increased AAW is independently predictive of adverse CVD outcomes. A total of 3430 adults from the Framingham Heart Study (FHS) underwent computed tomography (CT) scans of the chest during 2002-2005. We measured AAW, as the distance between the centroids of the ascending and descending thoracic aorta at the level of the main pulmonary artery bifurcation, on a dedicated imaging workstation (Aquarius, TeraRecon, CA). We will identify a healthy referent subset of the FHS CT-scan participants who are without major CVD risk factors (including hypertension, smoking, high cholesterol, diabetes, obesity) to determine sex-specific upper limits for "normal" AAW. Using these upper cutpoints, we will then identify increased AAW in the overall FHS CT population. To test hypothesis 1, we will use multivariable-adjusted logistic regression analyses to identify risk factors associated with increased AAW. Finally, we will test hypothesis 2 using Cox proportional hazards models to determine whether increased AAW is predictive of incident (occurring after CT scanning) CVD events (death, myocardial infarction, stroke, heart failure).

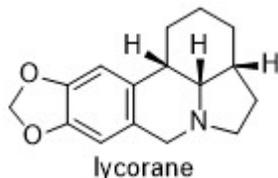
We thank the National Heart, Lung, and Blood Institute of the National Institutes of Health for financial support.

Poster 81

Studies Toward the Total Synthesis of Lycorane

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Lycorane is a natural product that is isolated from the Amaryllidaceae species of plants. The natural products isolated from these plants have been shown to exhibit a range of interesting biological activities. The lycorane family of natural products has been used in the past to showcase new and interesting synthetic methods. In this poster, we aim to display the progress that we have made in the total synthesis of lycorane. We have exploited different paths to achieve the synthesis of lycorane in a convergent fashion from two relatively simple precursors. We propose an enyne metathesis to obtain one of our precursors in which an alkene and alkyne engage in a metal-mediated process to synthesize one of our precursors. The use of an enyne metathesis is a new approach to this molecule that has not been shown before with our specific substrate. This metathesis is the apex of our synthesis.

We would like to thank the Alumni / Parents Summer 2013 Research Scholarship Fund for their financial support.

Poster 82

Induction versus Expectant Management in Gestational Diabetes at Term—Does it matter?

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We conducted a retrospective cohort study of pregnant women with gestational diabetes mellitus (GDM) comparing those with scheduled deliveries versus those who were managed expectantly. We also compared induction rates and mode of delivery in diet controlled (GDMA1) versus medication dependent (requiring medical therapy: insulin therapy or oral hypoglycemic medication) (GDMA2) patients. The objective of this study was to determine an optimal time to deliver patients diagnosed with GDM at Hartford Hospital, however, this is an ongoing project and this presentation will focus on a description of the population and analysis of induction of labor with respect to mode of delivery in GDMA1 and GDMA2 patients. Maternal and infant data was collected from January 1, 2006 to December 31, 2012, inclusive, from Hartford Hospital's MFM and Connecticut Children's Medical Center (CCMC) NICU databases. Data was examined from mothers who delivered between 37 0/7- 41 6/7 weeks of gestation with a diagnosis of GDM. Optimal time to deliver patients with GDM cannot be determined at this point in the study however, it was found that GDM patients induced for diabetes were more likely to have vaginal deliveries than cesarean sections than were GDM patients not induced for diabetes. GDMA1 patients were found to have increased vaginal delivery rates and decreased cesarean section rates when compared to GDMA2 patients, and of the patients induced for diabetes, similar vaginal delivery rates and cesarean section rates were found when GDMA1 and GDMA2 populations were compared.

We thank Hartford Hospital for financial support.

Poster 83

Germ of Truth: Friedrich Schelling on the Deep Past

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What if so-called anthropomorphic language expresses more about God than we are willing to admit? This project returns to this fundamental theological question via Friedrich Schelling's drafts of the *Ages of the World*. The question concerns the truthfulness of truth. This depends on our correct conviction that what is true must always prove true. A genuine voice given to truth is never primarily self-constructed, but found. The same might be said about our humanity. As much as it is something we must work on, it is in the first place given. And insofar as our human being is principally given, anything we say need not reflect our species alone. Language is just as much "natural language" as it is "human language": what is human is thus not our own. It belongs to a primordial history deeper than the past. This deep, ontological past grounds the present; in fact, there is no present if there is no original contingency to transcend. Therefore, past and present must be simultaneous in order for there to be a revelation, or existence. Hence this research project on the past [re]searches the conditions for the life of life – the past in which lies life's essence. Just as the developmental biologist might research the conditions for the flourishing of an embryo, the true theologian considers the conditions for the birth to existence. Revelation must coexist with its predecessor *as* predecessor. Only by [re]searching the different yet simultaneous times can we hope to understand the germ of truth – our God.

We thank the Andrew W. Mellon Foundation for financial support.

Poster 84

Paleontological Fieldwork in the Western United States

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We undertook paleontological fieldwork, excavated fossils, and examined the anatomy of ornithomimid dinosaurs to better understand their biology and evolutionary relationships. Our fieldwork took place at different locations in Arizona, Wyoming and Utah. In Arizona, we worked in the Chinle Formation of Petrified Forest National Park to excavate Late Triassic reptiles, including phytosaurs, paracrocodylomorphs, and aetosaurs. At the Bridger Basin in Wyoming we prospected for Eocene mammals and turtles, and in the preparation laboratory, we reconstructed the carapace and plastron of one of these ancient turtles. In the Cretaceous North Horn Formation of Utah, we found unidentifiable bone fragments but did not uncover complete fossils. At the Dinosaur National Monument of Utah, we prospected a Triassic rock formation and found fossilized phytosaur tracks. We transported fossils from the field to the fossil preparation laboratory of the Natural History Museum of Utah where we further prepared fossils and catalogued new specimens. A focus of our work at the museum was studying new skeletal material of *Ornithomimus*. Ornithomimids are highly cursorial, edentulous, late Cretaceous theropod dinosaurs. During our time at the Natural History Museum of Utah we photographed and documented all ornithomimid material collected in the last four years. We will continue our study in anatomy and systematics of this insufficiently understood dinosaur group during the academic year at Holy Cross. Further study of these specimens will lead to a greater understanding of the biodiversity that existed in the past, and of vertebrate evolution today.

We thank Herman R. and Mary R. Charbonneau and The Alumni / Parents Summer 2013 Research Scholarship Fund for their financial support, and the Yale Peabody Museum and the Natural History Museum of Utah for providing us with our fieldwork experiences.

Poster 85

Analysis of Cytotoxicity and Transfection Efficiency of Novel Transfection Reagents

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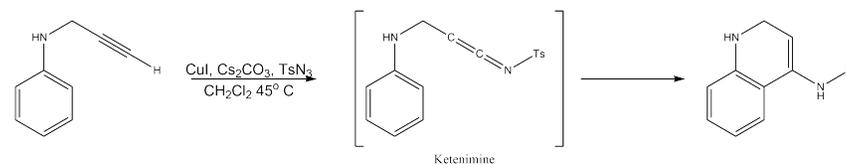
Polyethylenimine (PEI) is a common transfection reagent, allowing for the uptake of DNA into various cell lines. Despite the advantages of PEI as a transfection reagent due to it being inexpensive and relatively easy to use, one of its drawbacks is cytotoxicity. High concentrations of PEI can yield high transfection rates, yet they also can be toxic to the cell. Through grafting polyethylene glycol (PEG) groups onto both linear-PEI and branched-PEI, members of our research team have sought to lower cytotoxicity and maintain transfection efficiency. In order to assess the cytotoxicity of both commercial PEI and PEG-PEI conjugates, we have been working on a series of both transfection and toxicity assays. To assess complexation, gel retardation assays involving complexed PEI have yielded promising results. Through testing cell viability via 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide colorimetric assays (MTT), we were able to determine the cytotoxicity of L-PEI, B-PEI, and a series of our PEG-PEI derivatives. Additionally, through confocal analysis, transfection has been qualitatively analyzed by observing the expression of a red fluorescent protein. Through developing these assays, in addition to optimizing polymer synthesis and purification, we were able to better understand toxicity and the transfection efficiency of both commercial PEI and our PEG-PEI derivatives. Future research will involve grafting receptor specific molecules onto PEG-PEI in order to target specific cells for gene delivery.

We thank the BD Corporation for financial support.

Poster 86

Copper-Catalyzed Reactivity of Ketenimines

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Ketenimines are reactive synthetic intermediates that can engage with nucleophiles, electrophiles and radicals. We applied the recently discovered ‘click chemistry’ that utilizes copper as a catalyst to generate desired ketenimines from the reaction of an alkyne with tosyl azide. In a one-pot copper-catalyzed process, the acyclic substrate is transformed into a 1,4-disubstituted 1,2,3-triazole that spontaneously decomposes to the ketenimine intermediate which can then be engaged by a nucleophile at the electrophilic carbon. A limited number of nucleophiles are known to react with the electrophilic carbon of the ketenimine. We sought to expand the substrate scope of nucleophiles that can engage with the ketenimine by utilizing ethynyl ethers, epoxides, aziridines, and activated benzenes. This methodology enables the synthesis of previously unattainable complex compounds that include non-carbon elements.

We thank Jacqueline H. and George A. Paletta, Jr., MD; and Mora M. and Timothy J. Babineau, MD for their generous support of the Alumni/Parents Summer 2013 Research Scholarship Fund.

Poster 87

Construction of a Portable Cosmic Ray Telescope

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Cosmic rays were among the first high-energy particles ever detected, and have various environmental and technological impacts. Existing cosmic ray detectors are often not portable, reliant on a desktop computer and AC power, and provide only a basic sense of the directionality of the cosmic rays. We plan to develop a compact telescope that runs on two 12 volt batteries. One cosmic ray detector has been constructed and tested, and we have prepared four more for assembly, which will be combined into a single telescope with a narrowed field of view. We have also begun setting up a microcontroller to receive and store data from the detectors, along with a GPS time and location stamp.

Poster 88

Examining Aggregation and Hydrogen Bonding in Beta Sheet Mimics

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Beta sheets are structures that occur in proteins and consist of chains of amino acids linked together by hydrogen bonds. In order to examine beta sheets, we are creating beta sheet mimics and examining their structure. In doing so we can gain a better understanding of how beta sheets work naturally. Towards this goal of studying beta sheets, a beta sheet mimic has been synthesized in the past. However, there can be changes made on its structure to make it better, which is one focus of our research. We are synthesizing a new beta sheet mimic, which resembles the one previously made, however, there are aromatic spacers added to its central structure. After synthesizing it we will examine how the aromatic spacers affect the structure of the molecule. By adding aromatic spacers it may provide the molecule more stability and rigidity. Moreover, the other focus of our research is examining the hydrogen bonding and aggregation that occurs. Smaller controls are synthesized and the hydrogen bonding and aggregation is studied in order to compare them to the bigger structure. By doing so we can gain a better understanding of where the hydrogen bonding is coming from and the aggregation that occurs. Additionally, variations on this beta sheet mimic have been made for the purpose of blocking the exterior hydrogen bonding face. In doing so, we are attempting to change the aggregation of the molecule and eliminate intermolecular hydrogen bonds.

We thank Richard B. Fisher '47 Summer Research Fellowship Program for financial support.

Poster 89

The Development and Completion of an X-ray Detector

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X-ray detectors are relatively new invention in the field of astrophysics. The development and completion of such a device would allow for a large amount of research to be conducted on interstellar objects, such as black holes and neutron stars. In order to complete the building of an X-ray detector, three objectives need to be met: 1) Have a working evaporation chamber for the development of a CCD cell, 2) engineer an X-ray detector that is moveable, accurate, and able to handle the amount of energy from an X-ray source, and 3) test the device for these functions. The evaporation chamber was in need of cleaning and re-oiling, as well as replacing several key components. Once that was complete a CCD cell could be developed by evaporating gold onto a glass plate, which would be used in an early model of an X-ray detector. Finally the detector was tested by using the effects of Compton Scattering with two radioactive sources, Cesium-137 and Americium-241. In completing the process we were able to complete an early version of an X-ray detector.

We thank Diane D. Brink for her generous contribution to the Alumni/Parent Summer Research Scholarship Fund.

Poster 90

Effects of Chronic Alcohol and Hepatitis C Virus on Monocyte Plasticity and Polarization

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Monocytes are a type of leukocyte and are a part of the innate immune system. Circulating monocytes differentiate into macrophages that identify and eliminate pathogens through phagocytosis, as well as, signal and recruit other immune cells of the innate and adaptive immune systems. Macrophages can differentiate into pro-inflammatory (M1) or anti-inflammatory (M2) phenotypes depending on the tissue microenvironment. A number of diseases are associated with monocyte plasticity and polarization into M1 macrophages or M2 macrophages. It is known that patients chronically infected with Hepatitis C virus (HCV) show high expressions of proinflammatory (TNF- α) and anti-inflammatory (IL-10) cytokines in the blood serum. It is also known that chronic alcohol consumption is associated with high levels of TNF- α and IL-10. In the present study we hypothesized that alcohol and HCV alone or together can activate healthy monocytes and polarize them into M1 or M2 macrophages. In our experiments we isolated and cultured human peripheral blood monocytes from three healthy donors and treated them with chronic ethanol and JFH1 (HCV) concentrate alone or together to study their effects on monocyte plasticity and polarization. We measured mRNA levels of monocyte/ macrophage activating marker CD14, proinflammatory M1 markers (TNF- α , IL-1 β , IL-12), and anti-inflammatory M2 markers (IL-10, TGF β , MRC-1). The results suggest that chronic ethanol polarizes monocytes into macrophages with a mixed M1/M2 phenotype; however, HCV alone skews the monocyte differentiation towards an M2 phenotype. Further, chronic ethanol exposure seems to counteract the effects of HCV, reducing the M2 macrophage phenotype marker IL-10.

We thank the Center For Aids Research for their financial support.

Poster 91

Influence of Race and Ethnicity on Stage Presentation and Overall Survival in Patients Diagnosed and Treated for Colorectal Cancer

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Over the past two decades, racial and ethnic disparities have existed in presenting stage and overall survival of patients diagnosed and treated for colorectal cancer. Many such disparities have been attributed to differences in access to available screenings, timely diagnosis and proper treatment, tumor biology, and co-morbidities. Our retrospective study examined these disparities over a 20-year period spanning between 1989 and 2008 at one of the largest community teaching hospitals in the northeast with a nationally recognized NCI Community Cancer Centers Program (NCCCP) that has developed strategies to reduce such disparities. 3604 patients with complete clinical data were collected from the Hartford Hospital Cancer Registry and categorized into four five-year cohorts and subdivided by race and ethnicity into three subgroups: Caucasian, African American, and Latino. Pearson Chi-Square tests were conducted to analyze disparities in presentation stage and 5-year overall survival. Our results indicated that stage presentation remained relatively consistent while a significant number of cases presented as local (stage II) and regional (stage III). 5-year overall survival disparities in the early cohort largely trended toward disappearing by the end of the study period. This suggests that better management of co-morbidities, advancements in adjuvant treatments, and outreach efforts through our institution may have contributed to the aforementioned outcomes of our study.

We thank the Hartford Hospital Summer Student Research Fellowship Program for financial support.

Poster 92

Behavioral Effects of Prenatal Maternal Immune Activation in Mice

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Epidemiological studies have shown that a disproportionately large percentage of people who develop schizophrenia are born between the months of January and March each year. A seasonal increase in pathogen exposure has been hypothesized to underlie this season-of-birth phenomenon, such that fetal exposure to maternal immune activation during the second trimester of pregnancy increases the risk of developing schizophrenia. The purpose of this study is to establish a mouse model of prenatal maternal immune activation, through which relationships between immune activation, neurodevelopment, and behavior may be explored experimentally. We will activate the maternal immune system in pregnant C57BL/6J mice and conduct behavioral assays on the offspring in adulthood. On gestational day 19, pregnant mice will be injected with the immunostimulant polyinosinic : polycytidylic acid (Poly I:C). Their offspring will then be reared under normal laboratory conditions until 8-12 weeks of age, at which time their social interaction, sensory gating, and spatial learning and memory will be observed. We have treated female mice of the C57BL/6J strain with 20mg/kg Poly I:C and measured levels of immunomodulatory cytokines in the trunk blood at 6 hours post-injection using specific enzyme immunoassays. Our preliminary results indicate that in our hands, this treatment is effective in inducing immune activation as evidenced by upregulation of the proinflammatory cytokine monocyte chemoattractant protein 1 (MCP-1) and the anti-inflammatory cytokine interleukin 6 (IL-6).

This work was made possible by a Robert J. Stransky Student Research Fellowship in the Sciences.

Poster 93

The Role of D-serine in Learning and Memory of Contextual Fear

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The Hebbian theory of learning posits that when two neurons connected by a synapse fire simultaneously, their connectivity is enhanced. The NMDA receptor, which responds to the excitatory neurotransmitter glutamate, is believed to mediate learning by strengthening synapses under these conditions. For activation of the NMDA receptor, three conditions must be met: depolarization of the postsynaptic cell, binding of glutamate, and binding of glycine or D-serine. Genetically mutant mice that have less D-serine in the brain than wild type (WT) mice make it possible for us to study the role of NMDA receptor modulation in learning and memory. Pavlovian fear conditioning has been used to test how animals learn to make associations between different stimuli. The process of extinction or reversal of Pavlovian fear conditioning is also a form of learning that is dependent on the NMDA receptor. We have focused on contextual fear conditioning, which is heavily dependent on the hippocampus. Our preliminary results indicate that over the course of contextual conditioning, mutant mice froze less than WT mice. During the extinction protocol, freezing decreased in WT mice, whereas it increased in mutant mice. On the first testing day post-extinction, both WT and mutant mice froze when exposed to the test chamber, indicating spontaneous recovery of fear memory.

This work was made possible by a Robert J. Stransky Student Research Fellowship in the Sciences.

Poster 94

Discourses of Gastronomy: An Analysis of Food and Culture in 20th Century American Literature

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The twentieth century witnessed major progress in food production and consumption, and each phase of gastronomic development has impressed itself on the minds of many poets, authors, and visionary ‘foodies’ of the time. In my research, I have sought to identify public opinion through the unflinchingly honest lens of literary discourses. Specifically, I have identified and explored several major food movements from their origins up through today and the relationship that these movements have with pertaining literature and other notable discourses of the times. The food-based narratives that have developed have directly influenced and impacted the way that Americans connect with their food. By developing a greater awareness of common attitudes, sentiments, and values of food in American literature, I have gained a better understanding of literature as a social force that both motivates and defines the unique relationship Americans have with what they eat.

We thank the Andrew Mellon Foundation for providing financial support for this work.

Poster 95

Analysis of Biodiesel Using Comprehensive Two-Dimensional Gas Chromatography (GCxGC)

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In the search for alternative fuels, renewable biodiesel fuels are being blended with conventional petro-diesel fuels. The main components in biodiesels, fatty acid methyl esters (FAMES), vary from feedstock to feedstock in both concentration and identity. When blended with petrodiesel, the mixture becomes even more complex. These complex blends can be analyzed using comprehensive two dimensional gas chromatography with time-of-flight mass spectrometry (GCxGC TOF-MS). For this project, diesel and biodiesel samples were blended in several different combinations and analyzed. Using GCxGC TOF-MS, the FAMES were separated from the petro-diesel components and identified using the mass spectral data. Unknown blends were also analyzed to determine if the biodiesel feedstock can be determined.

Funding was provided by the Summer Undergraduate Research Fellowship Program at the National Institute of Standards and Technology.

Poster 96

The Physics of Baseball: Effect of Rotation Rate

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America's national pastime, baseball, has been scientifically investigated for many years. The subject of our research in particular is the rotation decay rate of baseballs in flight. We accomplished the measurements by creating our own lightweight baseballs with a magnetic levitation system coupled with high speed cameras. With this set-up we were able to plot and explore the data. We levitated the light baseballs using a Levitron™ electromagnet platform and a disk magnet inside the baseball. Using compressed air and a low-speed wind tunnel, we imparted to the baseballs an initial rotation rate and recorded their rotation rate over time. We found that the trendline that describes the rotation rate over time does not follow an exponential model as was previously assumed as acceptable. Our data appears linear at high speeds then exponential when below 10 rev/s. We have recorded data for both two and four seam orientations with initial rotation rates that resemble average rotation rates for fastballs thrown by major league pitchers.

Special thanks to Richard B. Fisher '47 Summer Research Fellowship Program, Paul S. and Katherine L. Stuka of the Alumni/Parents Summer 2013 Research Scholarship Fund, The Massachusetts Space Grant Consortium, Timothy Roach, Paul Oxley, De-Ping Yang, Steven Levandosky, Diane Jepson, Tony Sacovitch, and Dick Miller.

Poster 97

Catalysis

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The reaction of a nitroketone enolate with methyl vinyl ketone was found to yield three different products; a single addition product, an acyl-shift product, and a third product that contained the acyl-shift and a second addition of electrophile. A series of trials were undertaken to determine which factors control which will be the major product under different reaction conditions. These results were used to consider the potential mechanistic and energetic consequences of this novel reactivity. In an effort to synthesize acyl-ureas, we reacted hexanoyl chloride with silver cyanate, and then added n-butylamine or t-butylamine. We attempted to maximize the yield of the acyl urea product while minimizing the amide and hexanamide byproducts. It was revealed that the time duration of the reaction took part in how much amide was produced in comparison to the acyl urea. As the reaction progressed, more amide was being produced and less acyl urea was being made.

We thank the Richard B. Fisher '47 Summer Research Fellowship Program for financial support.

Poster 98

On the writing of a research manuscript: Facilitative effects of reboxetine on prepulse inhibition in mice

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The process of writing a research manuscript consists of many stages. First, we surveyed data from our laboratory's previous unpublished experiments. After selecting the appropriate experiments, we wrote the methods section of the paper, describing the protocols we used. The results were transformed into figures and described without interpretation in a results section. We then set our sights on writing the introduction. We focused on sharing information we had combed from the relevant literature that would provide a rationale for the studies that were conducted. Lastly, we turned to writing the discussion, this time relying strongly on previously published results in order to provide support or refutation of our hypotheses. Currently, our manuscript is nearly complete; the most difficult portion of the discussion section – that which takes stock of competing hypotheses – remains to be written. The experiments I am writing about concerns an understanding of how antipsychotic drugs exert their beneficial effects in the treatment of schizophrenia. We do this by measuring a response in laboratory mice, termed prepulse inhibition (PPI), a form of sensorimotor gating. It is the phenomenon through which the startle response to a stimulus (pulse) is decreased when preceded by a non-startling stimulus of lower intensity (prepulse). PPI is disrupted in people with various mental disorders, including schizophrenia. Our laboratory's main objective was to characterize the effects of reboxetine, a norepinephrine reuptake inhibitor, on PPI in mice. We further tested the efficacy of reboxetine against pharmacological agents known to disrupt PPI: reboxetine was able to increase PPI in the presence of amphetamine, a dopamine releasing agent, but not in the presence of TCB-2, a 5-HT_{2A} receptor agonist, or dizocilpine, an NMDA receptor antagonist. Our results suggest that the reboxetine acts by enhancing cortical dopamine outflow.

We thank Richard B. Fisher, '47 Summer Research Fellowship Program for sponsoring this research.

Poster 99

Frequency Analysis of SN-1987a

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SN-1987a is a supernova that became visible in 1987. It is the closest supernova that has occurred in just over 400 years, and is the most well studied supernova of all time. Ironically, with all of this attention, its core remnants have yet to be definitively defined. According to initial observation of neutrinos, scientists believe a spinning neutron star called a pulsar was formed. The task then is to analyze the signal emitted from the purported pulsar, deriving a frequency and then a pulse profile to more definitively characterize it. We developed and utilized Fast Fourier Transformation and Folding algorithms to do a frequency analysis of the supposedly 2.14 ms period pulsar remnants of SN-1987a. In theory, a pulsar's signature, known as a pulse profile, must be effectively constant in our time frame, but surrounding radiation could heavily mask the pulsar. This makes the observed pulse profile less consistent. To test our algorithms we ran them with artificially generated pure and noisy data, and also with data from the well-known Crab Pulsar.

We thank the Holy Cross Summer Science Research Program for funding for this research.

Poster 100

Mobile App Development: Holy Cross Dining

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Mobile application development is a new and fast-growing field, requiring the use of unique programming languages, tools, and concepts to achieve wide-ranging types of applications. However, app development is not currently taught at the College. We created an iPhone/iPad application that conveniently displays the current week's menus for the different dining locations on campus. This project provided both a means to gain local experience developing apps and a base for future exploration in development. Additionally, the app is intended to be immediately useful to the Holy Cross community, as it displays dining information as a native mobile application rather than as a webpage (as is current practice). The app consists of two components: a platform-side, to handle data distribution, caching, and all visual design and formatting elements; and a server-side, which generates and publishes the data. The platform-side component runs on Apple iPhone and iPad devices and is written in Objective C. The server-side component is written in Java and uses a standard web-server for publishing. The two components work together to monitor the officially published menus and pull the data down to devices. The app also provides interactive features for the user, such as individually selectable "favorites" lists. In the future, more interactive features may also be incorporated, such as a rating system for specific food items, push-notification when highly rated meals are being served, and other social features.

We thank Rhonda L. Larsen and Robert A. Harrington, M.D. for their generous contribution to the Alumni/Parent Summer Research Scholarship fund.

Poster 101

Nationalism, Identity and Religion: Italian Americans from 1870-1920

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We studied newspapers, at first in an effort to find evidence of the divide between northern and southern Italian immigrants to the United States, however, we found newspapers written for Italian American communities aimed at disrupting traditional regional barriers between Italians. Historically, there existed a cultural gap between northern and southern Italians, and centuries of mistrust and economic inequality had prevented both sides from uniting even as Italy became a sovereign nation during the 1860s. Upon their arrival to the United States, the Italian immigrants worked to mimic their lives in the Old World by living only with people from their own village. In time however, Italian American newspapers worked to break down the historic prejudices and unite Italians to form a common identity and maintain their culture against the pressure to conform to American society and abandon their centuries old traditions to survive in the New World. It is futile to study the Italian American immigrant experience in the United States without looking at the religious aspect of their culture and its clash with the establishment Catholicism filled with a hierarchy of Irish and German Americans. We studied specifically the experience of Italians in the immigrant communities of Italian Harlem in New York and South Philadelphia. In those communities, religion took center stage, and religious celebrations served as social gatherings. In maintaining their methods of worship, Italian Americans also managed to hold on to their traditional lifestyle against the members of the Church hierarchy and the American Civil Society who wished for the Italian immigrants to conform.

We thank the Mellon Summer Research Funding for its support.

Poster 102

Presepe Medium: Variants Across Time and Regions

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Presepi, or Nativity Scenes, have been a peripheral yet predominant aspect of Italian Art. Since the time of Saint Francis, who is credited with staging the first presepe in the thirteenth century, artists from varying regions across Italy have stylized this art form to make use of the natural resources around them which add significance to ideas they tried to convey. This is key when attempting to understand an individual artist's piece because the materials they use is a conscious choice. Harnessing the characteristics of the materials they use provides and insight that we might not have otherwise recognize. Being diverse in natural materials, one can expect that there are clear differences in the materials that are used region to region when making presepe. My research focuses on materials used for presepi in the southern regions of Apulia and Basilicata. When looking at Basilicata (located in central south), examples as well as historical documents indicate the usage of local stone to create presepi that have been on display since the sixteenth century in churches around the region. Stone is not the only material used for presepi in these regions, however.. Cartapesta (papier-mâché) is a technique that developed in the Salento region (located in Apulia the "heel" of Italy) in the 15th century. I have paid particular attention to the city of Lecce. Cartapesta figurines vary in size and have significant durability. Cartapesta was popularized due to the demand of processions for figures light enough to carry yet durable enough to survive unexpected situations.

We thank the Mellon Summer Research Program for funding this work.

Poster 103

Septic Arthritis: A diagnostic accuracy study of synovial tests in patients with clinically suspected septic arthritis

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In patients with clinically suspected septic arthritis synovial fluid tests are needed to back diagnosis. While many tests (ie gram stain, white blood cell counts (WBC), physical exams) can be implemented in diagnosis, the accuracy of the tests have proven to be not so accurate, leaving uncertainties in diagnosis of septic arthritis. Synovial lactate and polymerase chain reaction could replace these methods with their accuracy and speed but the studies have either left out important facts (ie which kind of lactate) or too few trials have been performed and not been performed in the ED setting. The septic arthritis study was designed to assess the diagnostic accuracy of lactate and conventional tests, such as WBC, in patients with suspected septic arthritis in the general population. This study will be a convenience sampling of patients, based upon the availability of research assistants to consent and enroll patients in the study, in Barnes Jewish Hospital's ED. Eligible patients in this study include patients who are suspected of septic arthritis. Exclusion criteria include patients who have taken antibiotics within the previous week, been diagnosed with septic arthritis or failed to get informed consent. The study will recruit 181 patients based on prevalence, sensitivity and specificity. Results are pending.

We thank National Center for Research Resources (NCRR) at the National Institutes of Health (NIH) for funding our research (Grant Number UL1 TR000448) and support from the CTSA and the ASPIRE Program at Barnes Jewish Hospital.

Poster 104

Lewis Base Activation of Lewis Acids: Enantioselective Sulfenocyclization of Symmetric Dienes

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The Lewis base activation of Lewis acids, in which electron density is added to an acid, but counter-intuitively renders the Lewis acid more electrophilic, has allowed for the development of chiral Lewis basic selenophosphoramidate catalysts that can enantioselectively deliver electrophilic sulfur (II) reagents to olefins. The enantioenriched thiiranium ion intermediates can then be trapped with nucleophiles, intra- or intermolecularly, with complete enantioselectivity. The transformation of prochiral olefins into products bearing vicinal stereocenters is a useful method in many target-oriented syntheses. Previous work by Denmark and co-workers has established a chiral catalyst system capable of distinguishing between the two faces of an alkene; however, the discrimination between two enantiotopic groups of a prochiral diene has not yet been explored. The desymmetrization of dienes via sulfenocyclization would be particularly valuable in the formation of heterocycles bearing all-carbon quaternary centers, a motif present in many natural products. Current efforts are aimed at efficient synthesis of symmetric dienes as substrates will be presented.

Funding of this research by the National Science Foundation and 3M is gratefully acknowledged.

Poster 105

Regioselective Ring Openings of Cyclic Esters using Hydrogenbonding Catalysts

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In recent years, the field of organocatalysis has become an important and useful mean to controlling the stereoselectivity, regioselectivity and rate of many organic reactions. Thiourea derivatives, a class of organocatalysts, have been shown to catalyze many different types of reactions such as Diels-Alder and asymmetric Michael additions through unique dual-hydrogen bonding functionality. Uncatalyzed, cyclic esters react with amines to form mixtures of hydroxyl amides and amino acids. This research sought to employ various thioureas as a means to controlling the regioselectivity of cyclic ester ring openings through transition state stabilization, leading to the promotion of the amino acid products over the hydroxyl amides. Various thiourea derivatives were synthesized and used to catalyze the reactions of cyclic esters with a variety of amines. We have found that a number of thiourea derivatives are effective at catalyzing cyclic ester ring openings, affecting both product ratio and rate of the reaction. This approach may also offer a viable method to synthesize a wide variety of amino acids without much difficulty.

We thank the National Science Foundation and the American Chemical Society, Petroleum Research Fund for financial support.

Poster 106

Modeling Mesenchymal Glioblastoma Multiforme in primary Human Astrocytes and Neural Precursor Cells

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Advances in stem cell biology have resulted in novel ways to model human diseases. We have developed hES-derived Neural Precursor Cells (NPCs) at different stages of development, which we can use to study the etiology and progression of various neural disease. Glioblastoma Multiforme (GBM) represents the most common malignant primary brain tumor in adults, and patients with GBM have uniformly poor prognosis, with a median survival of one year. GBM is divided into transcriptional classes, with the Mesenchymal (MES) subtype having the worst clinical prognosis. Our goal is to determine the minimum genes required to model MES GBM, by testing the effects of various combinations of potential MES oncogenes on primary human Astrocytes (HA) and NPCs. Novel short hairpin RNA (shRNA) constructs designed to knockdown genes of interest were generated and incorporated into lentivirus vectors. Primary Human Astrocytes were transduced with individual lentivirus vectors expressing RHPN2 oncogene or shRNA constructs (PTEN, p53, and NF1) to evaluate the efficacy of the constructs. RT-qPCR was subsequently performed to analyze functionality of overexpression and knockdown. Additionally, Immunofluorescence staining and qPCR was performed on RHPN2 transduced astrocytes to detect the presence of MES marker genes. After oncogene verification, astrocytes were transduced with various combination of lentiviral vectors, and then analyzed for the presence of MES markers. Subsequent experiments will focus on optimizing the oncogene combination to transform NPCs and astrocytes. Successfully transformed experimental cell lines will then be stereotactically implanted into immune-compromised mice.

Evolution and development of insect body plan and appendage diversity

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There are many genes involved in development of insect appendages, and the study of these genetic patterns is the key to understanding the evolutionary diversification of insects. Two previously studied genes that are relevant to our interest are decapentaplegic (dpp) and wingless, responsible for body/appendage growth. Current understanding of the functionality of these genes comes from morphological development in *Drosophila*. However, we will be testing the effect of a gene called glass bottom boat (gbb) in *Tribolium castaneum*, which we hypothesize to be responsible for leg development, as opposed to dpp in *Drosophila*. Differences in developmental pathways will provide us with insight into the evolutionary diversification of beetles. The technique used to accomplish this is a method called RNA interference (RNAi), in which the presence double stranded RNA of a specified gene (gbb), silences the effect of that gene. This process involves isolation of the desired gene, and polymerase chain reactions to convert and amplify the DNA product to the double stranded RNA product. This will be followed by a series of injections into abdominal segments of female pupae as well as virgin female adults. Breeding of these beetles will produce offspring with gbb silenced, which can then be compared to offspring that have not been treated with the RNA. Examinations will entail looking for evidence of morphological differences in developing embryos.

We thank the generous contribution made by David M. and Michele Keenan Joy to the Alumni/Parents Summer Research Scholarship Fund.