

COLLEGE OF THE
Holy Cross

Twenty Second Annual
Summer Research Symposium

September 11, 2015
Hogan Ballroom

Dear Members of the Holy Cross Community,

Welcome to the 2015 Summer Research Symposium. Now in its 22nd 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 2015. 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 members of the faculty about conducting research during the upcoming academic year and summer. We hope you enjoy the impressive collection of scholarship on display today.

2015 Symposium Organizing Committee

Elizabeth Landis, Department of Chemistry
Andre Isaacs, Department of Chemistry
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, College Science Coordinator, by Pr. Daniel Klinghard, Director of the Summer Research Program in Humanities, Social Sciences, and Arts, and by Pr. Joshua Congdon-Hohman, Director of the Summer Research Program in Economics.

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Poster 1

Forging a Digital Diplomatic Edition of the *Iliad*

C. Hanley, S. Neville, C. Schufreider, A. Simrell, M. Wauke, B. Clark, M. Ebbott, and N. Smith
Department of Classics, College of the Holy Cross

The *Iliad* was composed and re-composed in performance over several centuries within an oral tradition; no individual produced it. The standard print format of presenting the text of presenting the text hinders our understanding of the work's multiform nature. Under the aegis of the Homer Multitext project, we are creating a digital edition of Book 18 from the tenth-century Venetus A manuscript, the oldest complete manuscript of the *Iliad*. Our diplomatic approach to editing requires recording every visible character on each page of the manuscript. In addition to editing the *Iliad* text, we edit the scholarly commentary, or scholia, surrounding the poetry. These scholia, consisting of alternate readings, grammatical comments, and additional mythological background, provide further insight into the text's multiformity. Furthermore, the way we validate our work ensures us a high degree of accuracy. It allows us to analyze questions about both the manuscript tradition and the oral tradition of the *Iliad*. For example, our validation process isolates every word within the manuscript and records its position on the folio. A systematic analysis of the syntax and content across the different types of scholia can shed light on the process the scribes used when drafting the manuscript. When our project is published in the Homer Multitext (www.homermultitext.org), scholars can access our complete edition of the scholia, see how we came to our conclusions, and replicate our results.

We thank the generous support of the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts and the Center for Hellenic Studies.

Poster 2

Self-Assembled Monolayers on Nanoporous Gold

A. Weller, R. Chevalier, and E. Landis
Department of Chemistry, College of the Holy Cross

Nanoporous gold consists of a gold lattice with structural elements on the order of nanometers. The curved and irregular 3-dimensional structure of the lattice provides different binding sites where molecules can attach, which has made nanoporous gold a popular material to use in sensing and catalysis. Our research involves the study of self-assembled monolayers on nanoporous gold and the characterization of their order and stability. Using Infrared Spectroscopy and Cyclic Voltammetry, trends and quantitative analysis were produced to give us a better understanding of the fundamental properties of nanoporous gold. However, due to the inherent fragility of nanoporous materials, a new method of production is needed to perform experiments that can damage weaker samples. We produced a more efficient and robust method to study nanoporous gold that avoids the inadvertent destruction of samples involved with past methods. We have used high-resolution electron microscopy to qualitatively verify the ability of this new synthesis to create consistent nanoporous gold samples for later testing.

We thank the Robert J. Stransky Student Research Fellowships in the Sciences for financial support.

Poster 3

College of the Holy Cross Beekeeping

A. Criscitiello, M. P. Hamilton, and J. McAlister
Department of Biology, College of the Holy Cross

Decrease in honeybee population is of particular concern because of the insect's crucial role in crop pollination. In 1982 Varroa destructor mites were accidentally carried from Europe to the Americas. The introduction of Varroa destructor has accelerated the decline of honeybee throughout the United States. Chemical treatments have been produced to kill mites. New treatments are developed every few years in attempt to overcome the resistance that mites build to treatment. After years of use it is becoming evident that chemical treatment of mites is a loosing battle. *Hygienic* honeybees have been selectively bred in independent and USDA studies. Most of these strains are successful in warm climates but struggle in the New England area where longer, colder winters make weakened, varroa infected hives many times more susceptible to collapse. The objective of this project is to discern how effective hygienic honeybees are when kept without chemical treatments in the North East and over time, to create a robust strain of bees through natural selection. In the first year of our project, hygienic honeybees were introduced to the Worcester area. The status of these bees was recorded on a daily basis. Hygienic behaviors have been documented and as of July 22, 2015 no Varroa mites or any other disease was found during brood dissections. All beekeeping practices are organic and without the use of chemical treatments. These practices have been recorded and will be published for the benefit of other beekeepers.

I would like to thank The Patricia McGovern Hill '82 and Peter J. Hill '82 Family Summer Research Scholarship for making this project possible.

Poster 4

Synthesis and Electrochemical Properties of Thiols and Amines on Planar Platinum Surfaces

K. Wong, M. Ma, and E. Landis
Department of Chemistry, College of the Holy Cross

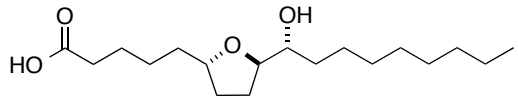
Platinum is a reactive metal that serves as a catalyst in fuel cells that can be used to generate electric power for vehicles. The goal of our research is to improve the overall cell performance at a lower cost by understanding the fundamental catalytic activity of platinum towards methanol oxidation. We have studied how self-assembled monolayers of thiols and amines on the platinum surface affect its reactivity with varied functionalization time. In order to have reproducible results, we constructed robust platinum electrodes with similar surface area. Using cyclic voltammetry and x-ray photoelectron spectroscopy, we were able to analyze the catalytic properties quantitatively and carry out elemental analysis on the platinum surface. We have found that exposure to thiols affects platinum catalytic activity more quickly than exposure to amines.

We thank the American Chemistry Society Petroleum Research Fund for financial support.

Poster 5

Efforts Toward Total Synthesis of (+)-Bovidic Acid

M. F. Brown, K. A. Nicastri, and K. J. Quinn
Department of Chemistry, College of the Holy Cross



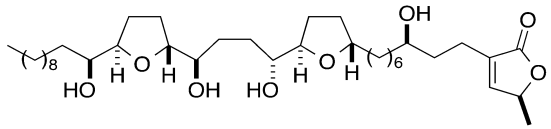
(+)-Bovidic acid is a 19-carbon hydroxyfuranoid acid that exhibits insect repellent activity and is isolated from the hair and skin of the gaur (*B.Frontalis*), a bovine native to Asia. On this poster, we will present an approach to the synthesis of bovidic acid, in which a size-selective ring-closing metathesis/cross metathesis is employed to construct the central five-membered ring in the form of a lactone. Functionalization via Bi(III)-catalyzed allylation is expected to allow for the establishment of the 2,5-*trans* stereochemical relationship of substituents on the target tetrahydrofuran (THF) ring as a result of in situ formation of a geometrically rigid bicyclic acetal. If successful, this strategy would provide an efficient synthesis of bovidic acid that may be applicable to numerous other THF natural products.

Financial support of this research from the Richard B. Fisher '47 Summer Research Fellowship Program is gratefully acknowledged.

Poster 6

Synthetic Studies on Squamostanin C

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Squamostanin C is a cytotoxic member of the Annonaceous acetogenin family of natural products, isolated from the seeds of the *Annona squamosa* tree. We have developed a two-directional synthesis of the non-adjacent bis(tetrahydrofuran) core of squamostanin C that takes advantage of its local C_2 symmetry. The key step in our approach is a size-selective, silicon-tethered triple ring-closing metathesis (RCM), which forms both oxygen heterocycles and the central C17-C18 bond. Reduction and Wittig homologation of the RCM product provides a bis(enoate) that is suitable for stereocontrolled establishment of the core tetrahydrofuran rings. The efficiency of this strategy suggests a short synthesis of the target natural product, which requires only desymmetrization of the C_2 symmetric core to append the alkyl and the butenolide-containing side chains.

Financial support of this research from the Richard B. Fisher '47 Summer Research Fellowship Program is gratefully acknowledged.

Poster 7

Studying the Effect of Cellular Crowding on AVV

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Alpha synuclein (α-syn) is an abundant neuronal protein, whose hydrophobic core has a tendency to form β-sheets which go on to aggregate. These amyloid-like aggregates make up Lewy Bodies found in Parkinson's Disease. Previous research have shown peptide segments of this protein, such as AVV, are able to form β-sheets in isolation suggesting that they may be responsible for nucleating amyloid formation in the protein. Very little is known about other factors effecting the aggregation of α-syn such as peptide concentration or cellular crowding. This research aims to understand the effects of crowding on the β-sheet formation of AVV. The peptide was synthesized using a solid phase peptide synthesis regime. Ficoll was chosen as a crowding agent for its ability to mimic the crowded cellular environment without chemically interacting with the peptide. Samples with various concentrations of peptide and Ficoll were prepared and analyzed using infrared spectroscopy, focusing on the Amide I region which is indicative of secondary structure. The spectra were fit to multiple Voigt bands using Origin software. The peak near 1615 cm^{-1} was assigned to antiparallel β-sheet and the area of that peak was used to ascertain the percentage of peptide in the β-conformation. Results show an increase in β-sheet formation with an increase in both Ficoll and peptide concentration. However, Ficoll concentration does not have an effect on 0.05 M AVV where beta-sheets are unable to form.

The authors acknowledge financial support for this project from Dr. Daniel J. Polacek M.D. '73*P* of the Alumni / Parent Summer Research Scholarship Fund.

Poster 8

An Investigation of Biodiesel Diesel Blends using GCMS and PCA

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Biodiesel, a renewable and clean-burning alternative fuel, provides the prospect of reducing the dangerous pollutants caused by traditional fossil fuels. In this research, various feedstocks (coconut oil, flaxseed oil, sunflower oil, etc) were used to synthesize biodiesel by a trans-esterification reaction using methanol and a base catalyst that converts triglycerides into fatty acid methyl esters (FAMEs). For each feedstock, B100 and B20 (20%) biodiesel-diesel blends were prepared and analyzed using gas chromatography with mass spectrometry detection (GCMS). Each blend was run in triplicate. A nitroterephalic acid polyethylene glycol column chemistry was utilized to isolate the FAME components. Columns of two different lengths and film thickness (30 m x 0.25 mm x 0.25 um Zebron ZB-FFAP, 15 m x 0.1 mm x 0.1 um Agilent J&W DB-FFAP) were utilized. Temperature programs were optimized on each column to balance resolution and run time. Principal Component Analysis (PCA) was performed on the data sets from the differing column types to determine whether a shorter column with a thinner film (and subsequently shorter run time) is equally suitable for FAME analysis and feedstock identification as the longer, traditional column. This study provides a fast and capable technique of identifying many pure or blended biodiesels based on chemical fingerprinting.

We are very appreciative of financial support provided by Mr. Jack D. Rehm, Jr. '88 and Mrs. Kathleen Millard Rehm '89 (RB) and Katherine L. and Paul S. Stuka '77 (CB).

Poster 9

Vladimir Putin's Tools of Power – Creating a New Russia

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Stephen Cohen, a notable Russianist, recently called Vladimir Putin the most preeminent politician of the twenty first century, a claim corroborated by Putin's appointment as *Time Magazine's* person of the year in 2007. For the past fifteen years, there has been a revival in Kremlinology as scholars are perplexed by the actions and posturing of the Putin regime, actions that become more confusing year after year. More recently, Russianists have been attempting to understand why Vladimir Putin sees vibrant domestic support while Russia suffers internationally, shunned by Western powers. Through a historiographical review of the most recent scholarship on the Putin regime along with unique research on the tools that Vladimir Putin uses to create and maintain power, this project seeks to illustrate how Vladimir Putin, the once unknown bureaucrat from Leningrad, has won the hearts and minds of Russians and simultaneously shocked Western audiences with his language and performances of power.

The Summer Research Program in the Humanities, Social Sciences, and Arts is thanked for its generous financial support of this project.

Poster 10

Effects of Mixing Beta Sheet and Random Coil Peptides Isolated from the Protein α-Synuclein

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The aggregation and misfolding of the neuronal protein α-synuclein with itself and other proteins is linked to the onset and progression of neurodegenerative diseases, particularly Parkinson's disease (PD). It has been found that deletions from the amino acid sequence of α-synuclein have prevented the formation of beta sheet aggregation altogether, one of these being the segment Δ67-71 (GGAVV). Previous research on this sequence has shown that random coil proteins GGA and GAV have the ability to disaggregate beta sheet forming peptide AVV. This project focused on random coil peptides GGAV and GGA and a beta sheet forming peptide, GAVV, from this sequence. The two different peptide structures were mixed in different concentrations and ratios and infrared spectroscopy was used to determine the structure of the peptide mixtures. Our goal was to determine whether the random coil peptides would have a disaggregating effect on GAVV, as previously observed with shorter peptides, or whether GAVV would induce aggregation in the random coil peptides. Either observation would give further insight into the first steps of α-synuclein misfolding. The results, with particular focus on the comparisons between the mathematical and experimental additions, showed that these peptides had little to no effect on each other.

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

Poster 11

CSI Worcester: An Exploration of Gas Chromatography Column Chemistry in an Arson Experiment

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Between 2007 and 2011 more than a quarter of a million intentional fires were reported annually, accounting for annual losses of more than 400 lives and over a billion dollars in property damage. A disproportionate amount of these fires start from flammable liquids or accelerants. Gas chromatography (GC) is typically used by forensic analysts to determine the presence of an accelerant from the remains of a fire, which could help determine whether the fire was intentional. The goal of this work is to create a lab that will show students a valuable real life application of gas chromatography. Several column chemistries are used to demonstrate versatility in gas chromatography while analyzing both neat accelerants (lighter fluid, gasoline, diesel) and accelerant soaked charred wood samples. Various sample injection strategies (liquid, headspace, solid phase microextraction) are also examined. Students will learn about temperature programming and be able to compare chromatograms acquired on all column chemistries. Ideally the real life application of this experiment will reinforce the analytical methods learned in class while also bringing a newfound excitement to an upper level chemistry lab.

We are very appreciative of financial support provided by Jacqueline H. and George A. Paletta, Jr., M.D. ‘84.

Poster 12

Fenamate Class NSAIDs Induce Cell Death in LNCaP Prostate Cancer Cells Independent of COX-2 Inhibition

L. Yacobucci and B. Orlando
Hauptman-Woodward Medical Research Institute

Hormone therapies are not sufficient to treat advanced prostate cancer because as the cancer progresses, the main cell type switches to being androgen-independent. COX-2 is a membrane protein recently linked to cancer angiogenesis. Therefore, inhibition of COX-2 activity could serve as a novel anti-tumor therapy. The fenamate class of NSAIDs has been shown to limit cancer cell vitality and is similar to diclofenac which is now being used as a topical NSAID. Additional assays were performed on human dermal fibroblasts to determine if applying these drugs topically is adversely affecting the skin cells. Fibroblasts are also associated with cancer cells at all stages of progression so they represent an important target for cancer therapies. The LD50s were determined for the 4 fenamte drugs and diclofenac in LNCaP cells. These were meclofenamic acid (41.97 μM), mefenamic acid (171.7 μM), tolfenamic acid (24.81 μM), flufenamic Acid (70.12 μM), and diclofenac (167.6 μM). Western blot results showed that the fenamates did not induce COX-2 expression to any appreciable level indicating a mechanism of cell death independent of COX-2 expression. Results also show that the fenamates induce cell death at varying levels in human dermal fibroblasts. The fenamates induce extreme morphological changes in the cells and rapid decrease in cell density is apparent. Western blot analysis revealed that the drugs did not induce COX-2 expression so alternate possibilities for the mechanism for cell death are being investigated.

We thank the National Institutes of Health for funding.

Poster 13

Beliefs and Behaviors of Adolescent Caffeine Use: A Focus Group Study

E. O'Brien and A. Ludden
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Previous studies on adolescent caffeine use have predominantly focused on the acute physiological effects of caffeine, rather than the psychosocial context and beliefs regarding different types of caffeinated beverages (e.g., coffee, energy drinks, soda). In this study, we used a qualitative approach to investigate individual beliefs and behaviors as well as context and group behaviors related to adolescent caffeine use. Eleven focus group interviews (49 total participants), from two different high schools in Massachusetts of similar size, were transcribed and coded for common themes. The questions moderators asked during the focus group discussions concerned motivations behind caffeine use and questions about specific beverages. We found that coffee and energy drinks were perceived to be the most popular caffeinated beverages. Reasons for consuming caffeine included the effect of caffeine as a stimulant (energy), the pleasant feelings experienced when drinking it (i.e., taste, mood), and the fact that caffeine was available. As for context, coffee was consumed in more diverse social contexts than other caffeinated beverages. Friends and sports were the most popular contexts for energy drink use. Wanting to fit in, be cool, and wanting to be like older siblings or college students are all reasons mentioned by students that emphasize the social status value of using caffeinated beverages. Finally, males tend to consume more soda and energy drinks than females.

We thank the Summer Research Program in Humanities, Social Sciences, and Arts for funding this work.

Poster 14

Preparing New Aminophenol Ligands Using the Mannich Condensation

J. Farrell, N. Maniatis, and M. Wallace
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The Mannich condensation is a multi-component reaction that uses a primary or secondary amine, an aldehyde, and a phenol to form a new carbon-nitrogen bond. We have been exploring the utility of this reaction to prepare a library of aminophenol ligands that will bind metals and control their reactivity. We will report the results of using a variety of diamine starting materials (ethylenediamine, 1,2-diaminopropane, 2-methyl-1,2-diaminopropane, and hexamethylene-diamine) and demonstrate how subtle changes in these compounds results in vastly different reactions and products. These products have been characterized by ^{1}H and ^{13}C NMR. Preliminary reactions of these novel ligands with Zn(II) will be presented.

We thank the Robert J. Stransky Student Research Fellowships in the Sciences for financial support.

Poster 15

Effects of the Affordable Care Act on the Award of Life Care Expenses

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Future medical care is often the largest single expense in personal injury cases. Prior to the Affordable Care Act, it was unreasonable to assume injured persons had access to insurance. The full roll-out of the Affordable Care Act provided nearly all Americans with access to health insurance. This brought rise to whether the plaintiffs in personal injury cases should still be awarded full expected medical expenses or whether their awards should be reduced down to the portion the plaintiff would actually be expected to pay. We looked state by state at different court cases pertaining to the Affordable Care Act in conjunction with the Collateral Source Rule. Relevant cases were found in seven states. The majority of them ruled that evidence of future insurance under the Affordable Care Act is inadmissible, but two states did rule in favor of allowing evidence of future medical insurance to be included in the trial. Due to the law still being relatively young, many states will still need to make a decision regarding the issue. So far, the common theme has been to not consider these health benefits, but only time will tell if more states admit evidence of future health insurance in personal injury cases and drastically change the amounts awarded for future medical expenses.

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

Poster 16

From Perón to Francis: A History of Political Theology in Argentina

A. John and R. Carrasquillo
Latin American and Latino Studies, College of the Holy Cross

In Argentina, the Catholic Church and the State have had a collaborative relationship since the nineteenth century. This peaceful association slowly began to erode during the first and second presidential terms of Juan Domingo Perón (1946-55) when class warfare reached unprecedented levels and continued for decades. How Catholic theology influenced this process and Argentine politics during the twentieth and beginning of the twenty-first century are the main questions of my research. I investigated the development of this process focusing on three historical periods: (I) the rise of Peronism in the 1940s and the upsurge of the revolutionary Catholic left in the 1960s, (II) the Process of National Reorganization, also known as the Military Dictatorship, between 1976-83 and (III) the Reconstruction Era from 1983 to the present, which includes Cardinal Jorge Mario Bergoglio's election to the papacy in 2013, as well as this year's presidential elections. I argue that Catholic theology's influence within the sphere of Argentine politics during the twentieth century divided porteños (residents of Buenos Aires) into two groups: one (the majority) that favors Catholic social action through government programs, and the other that believes the church's only position is to serve as the moral conscience of the nation. Moreover, Pope Francis' denunciation of unjust political structures and commitment to the oppressed has greatly affected these two groups of porteños, exacerbating the divide between them.

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

Poster 17

Biomedical Nanofiber Scaffolds Formed by Electrospinning and STRAND Spinning Technique

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[2]GNμ Lab, Department of Physics, Georgetown University

Intrinsic biological conditions place specific requirements on the materials used in cell transplants, which vary with changing environments. A biodegradable polymer called poly glycerol-sebacate (PGS) fits many such requirements. The biocompatibility of the polymer, as well as its mechanical toughness and versatility makes it a suitable candidate for many biomedical applications. PGS microfibers and nanofibers can be fabricated using two techniques, electrospinning and the "STRAND" technique (Substrate Translation & Rotation for Aligned Nanofiber Deposition)—each giving fibers with tunable properties. Whereas electrospinning uses a high-voltage electric field to draw a fiber out of solution, STRAND relies on the mechanical and tensile durability of a polymer to fabricate a scaffold. Electrospinning results in random or generally aligned fiber collection, and STRAND allows for highly aligned fiber collection. STRAND also enables multi-directional cross-hatching of fibers and the ability to control fiber morphology, diameter, and spacing to high accuracy.

We thank the NSF for their financial assistance through Grant # DMR-1358978.

Poster 18

Copper-Catalyzed Reactivity of Ketenimines

A. Bosse, T. Correia and A. K. Isaacs
Department of Chemistry, College of the Holy Cross

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. We tested ethynyl ethers in an intramolecular fashion to synthesize various beta-lactam precursors. Beta-lactams are important synthetic intermediates as they are the cores of various antibiotics. In the Isaacs lab, we performed experiments that effected a cascade reaction that engaged the ketenimine with our nucleophiles in a strained ring system via an intramolecular process. This methodology enables the synthesis of previously unattainable complex compounds that include non-carbon elements.

This research was made possible by a generous donation to the Alumni / Parent Summer Research Scholarship Fund by Katina G. and Edward J. Burke, and by Wendy R. and Kenneth J. Edwards M.D.

Poster 19

A Probabilistic Change Point Analysis to Find the Steroid Era in Major League Baseball

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College of the Holy Cross

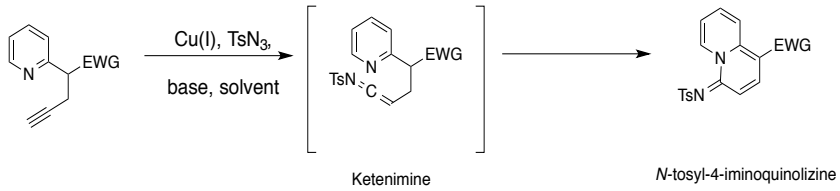
For long data sets, one regression model might not fit perfectly. Change point analysis allows a piecewise regression model to fit long data sets. However, the number of change points as well as their location in a data set is unknown. We have written an efficient algorithm in MATLAB to analyze data sets and give a probability distribution for the most likely number of change points and their best fit locations using Bayes' Rule. Using this probabilistic change point algorithm, we were able to analyze several MLB data sets and try to pinpoint the Steroid Era. To make our findings more credible, we decided to analyze data sets that we would expect to change during the Steroid Era (such as average home runs per year or average pitching ERA per year) as well as analyze data sets that would stay the same during this period (such as average batting average per year). Our final results showed the same change point in the same location for most of the data sets we analyzed.

We thank the National Science Foundation (DMS-1407670) for financial support.

Poster 20

Copper-Catalyzed Synthesis of *N*-tosyl-4-iminoquinolizines

L. T. Lauchert and A. K. Isaacs
Department of Chemistry, College of the Holy Cross



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. Previously, there were many examples of amines, alcohols, water, pyrroles, etc. being used as nucleophiles to attack keteninime intermediates. We added pyridine to this nucleophile scope by utilizing a novel methodology to perform an intramolecular cyclization of an in situ generated ketenimine and a tethered pyridine, followed by a base-promoted oxidation to produce our desired *N*-tosyl-4-iminoquinolizines in moderate to good yields under mild reaction conditions.

We thank Mrs. Laurie D. and Dr. William C. Goggins for their generous contribution to the Alumni / Parent Summer Research Scholarship Fund.

Poster 21

Point Your Face At This: A Personal Journey In Humor Writing

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Andrew Stott states, comedy is like "water in rocks. It has a particular talent for finding the cracks in the world and amplifying them to the point of absurdity, rendering life strange and open." Stott's idea of using comedy to make issues more accessible was a key principle in the development of my summer research project. Over the course of nine weeks, my main goal was to produce original, creative work that communicated issues that resonated with me. My process was relatively simple: I absorbed myself in all things comedy: books, stand-ups, sitcoms, talk shows, sketches, cartoons, plays, films, and interviews all became sources of inspiration and content. I also embraced and studied a number of key members of the comedic community, including Woody Allen, David Sedaris, and Steve Martin, among numerous others. Having these individuals as comedic role models helped me understand how my message could be relayed in a number of different formats, tones and points of view. The result of this comedic immersion was the production of over twenty original pieces in various formats. They ranged from short stories to sketches, personal essays and even stand-up jokes, all working to communicate my ideas in unique ways. As I reflect back on the nature of my work, I realize that comedy is ultimately a personal genre, and one that allows each individual the space to explore issues that are important to him. At the end of this nine-week process, I can conclude that both the immersive and written aspects of my comedic journey have allowed me to developed my own unique comic voice.

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

Poster 22

Examining Components Needed In Order to Comprehend Chinese Text

H. Nord, K. Cunningham, C. Ross, and B. He
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College of the Holy Cross

Our research was concerned with what Chinese as a Foreign Language learners need to know in order to read and understand texts. To this end, we created exams for students at the College of the Holy Cross enrolled in first- and second-year Chinese consisting of two tasks. The first task was for students to read and translate a Chinese dialogue, circling the characters they did not recognize. This task contained grammar structures and vocabulary that students had learned in their respective textbooks, and also a small number of unfamiliar characters. The second task was for students to provide the Mandarin pronunciation and English meaning for characters presented in a list. This task included only characters students had already learned from their textbooks. Students in the first-year Chinese class completed both tasks, but students in the second-year class completed only the second task. First- and second-year students worked on different dialogues. We used a Pearson correlation model to analyze the results. It showed a very strong correlation between knowing the pronunciation and English meaning of characters. There was also a strong connection between character recognition and reading comprehension. Moreover, each of the tests revealed that many students have difficulties distinguishing word boundaries and rely on partial recognition when they are unsure of what the text means. We hope our finding will better inform CFL students, teachers and textbook authors about the needs of CFL learners.

We thank the Summer Research Program in the Humanities, Social Sciences, and Arts for supporting our research.

Poster 23

The Effects of Concealable Stigmatized Identities and College Campuses on Sense of Belonging

K. Marano, E. Addonizio, M. Rodriguez, and S. Chaudoir
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A concealable stigmatized identity (CSI) is a socially devalued and negatively stereotyped identity that can be hidden from others, such as a history of mental illness (Quinn & Chaudoir, 2009). One of the possible psychological implications for students living with CSIs is a lower sense of belonging on their college campus. Previous research has examined factors related to belonging among people with CSIs, but none has examined whether sense of belonging is lower among these individuals compared to individuals without CSIs, or whether college campus moderates these effects. In the present study, 608 participants from College of the Holy Cross, Clark University, and Worcester Polytechnic Institute participated in a web-based survey, which included a measure of sense of belonging. Examining effects of CSI status (yes and no) and college campus (Holy Cross, Clark, and WPI) on mean sense of belonging ratings, we found a significant main effect of CSI status: participants with CSIs had a significantly lower sense of belonging on their college campus than those without. There was no effect of college campus on sense of belonging. Because a sense of belonging is associated with academic outcomes, our results suggest that individuals with CSIs may have poorer academic outcomes and be more likely to drop out of college (Walton & Cohen, 2007). Future research is important for the development of interventions to help individuals with CSIs feel more connected and committed to their college.

We thank the National Science Foundation for financial support.

Poster 24

Suspended Sediment Concentrations in the Upper Blackstone Valley Watershed

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The Blackstone River, which spans 46 miles from Worcester, MA to Narragansett Bay in Rhode Island, has experienced continued urbanization of its 70 mi^2 basin area since the start of the Industrial Revolution. Many of the structures and systems needed for urbanization, such as pavement and storm drains, add impervious area and otherwise alter the hydrology of the watershed, which can then negatively impact the ecological health of the river. In this study we investigate the relationship between suspended sediment concentration (SSC)(mg/L) and discharge (ft^3/s) and attempt to determine the primary source tributary or tributaries of suspended sediment in the main stem Blackstone River. We sampled at 8 sites on 6 tributaries in the Blackstone River watershed from June 1st to July 15th, 2015. We collected water samples at a range of discharges using a depth integrated sampler and then used standard vacuum filtration and oven techniques to measure the SSC. The SSC in this study range from 0 to 126 mg/L. Suspended sediment concentrations in the main stem increase during storm events as the discharge of the river increases. Furthermore, we calculate that 308.7 metric tons of sediment came through the system during the course of the 45-day study, 87% of which came through during the 7 storm events. We also conclude that two heavily urbanized tributaries, Mill Brook and Beaver Brook, contribute a proportionally higher amount of sediment to the main stem Blackstone River.

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

Poster 25

Personal Information and Physiology

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Disclosing a negative personal secret can result in emotional and physiological stress. Goals have the ability to change people's perceptions during disclosure. While previous research has shown the effects of disclosure on physiology and the benefits of using goals, it has not focused on how goals can affect cortisol reactivity during disclosure. The purpose of the current study was to examine the effect of approach and avoidance goals on cortisol reactivity during a simulated disclosure task. We hypothesized that participants who set approach goals would have blunted cortisol reactivity than participants who set avoidance goals. Twelve Holy Cross students completed a simulated disclosure task with either approach or avoidance goals in mind and then completed measures of mood, approach/avoidance, perceived stress, confidant relationship and provided saliva samples of cortisol. Participants with approach goals expected a more positive response (M = 4.33, SD = 0.82) than those with avoidance goals (M = 2.67, SD = 0.82), t (10) = 3.54, p = .005, d = 1.83. However, there was not a significant effect of goal type on mood, trait approach/avoidance motivations, or perceived stress. After cortisol assays have been completed, we predict that approach goals will lead to less cortisol reactivity than avoidance goals.

We thank the generous contribution made by Anne E. and John Kirby Bray '79, P10 to the Alumni / Parent Summer Research Scholarship fund.

Poster 26

Inspiration from the Word: A Creative Response to Scholarly Text and Sacred Verse

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When describing the creation of what he calls the Science of Language, Max Mueller remarks that the discipline only came into its own when the poet Schlegel offered his insights. Mueller says, "When a new science is created, the imagination of the poet is wanted, even more than the accuracy of the scholar." The contemporary scholarly ethos in many cases diminishes the importance of the poet in the process of research and discovery. The aim of this project has been to explore the nature and importance of the poet's contributions and the value of creative activity in connection with scholarly pursuit. The works considered in this project were Mueller's collections of lectures *Chips from a German Workshop* and *Science of Language*, the oldest hymns of Zoroastrianism called Gathas, and Nietzsche's *Thus Spake Zarathustra*. Mueller's lectures demonstrated how poetry and philosophy can live within scholarship and *Thus Spake Zarathustra* is an example of a creative response to a sacred text. The Gathas are the inspiration from which I have drawn my own creative response. My creative response takes the form of a novel inspired by and grounded in the ethos and spiritual conceptions of the ancient world. During the research period, I wrote over 100,000 words of this novel.

We thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts for funding.

Poster 27

The Power of a Fair Chance: Ban the Box laws and the Labor Market Outcomes of Ex-convicts

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Past literature has established that incarcerated individuals face difficulties reentering the work force following their release. Finding and keeping a job can significantly reduce recidivism amongst ex-offenders. For this reason, several programs have been established that attempt to aid in ex-offender employment outcomes. "Ban the Box" initiatives that delay inquiries regarding criminal history on job applications have been gaining momentum across local and state governments in the United States. Concurrently, the Equal Employment Opportunity Commission has endorsed removing the conviction question in its 2012 guidance suggesting the law could become federal. This study uses data from November CPS reports in 2006, 2008, 2010, and 2012 to estimate the impact of Ban the Box laws on labor market outcomes for ex-offenders. We use a unique way of identifying individuals with past criminal convictions by identifying citizens who are ineligible to vote but over the age of eighteen in the CPS voting supplement. State, county, and city level data regarding Ban the Box laws from the National Employment Law Project is used to determine where Ban the Box laws are most effective. The empirical method used is a difference-in-difference model that measures labor force outcomes against the presence of a Ban the Box law. We do not find strong evidence that Ban the Box laws have an impact on labor market outcomes such as employment, labor force participation, and unemployment duration. However, there is some evidence that the laws draw more ex-convicts into the labor force.

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

Poster 28

Jenne Magafan's Worcester Murals: Investigating their Past and Securing their Future

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Jenne Magafan (1916-1952), pioneer female muralist active during the New Deal era, painted a set of four murals for the foyer of Worcester East Middle School in 1948 and 1949. The murals portray American education at its roots, and continue to mark its evolution as a result of their juxtaposition with the school's changing student population. Specifically, the murals commemorate Jonas Rice, Worcester's first permanent settler and schoolmaster. Rice taught children in his home two centuries prior to the murals' installation in the school located on the same hill where he lived. Although in relatively good condition, the murals are in need of conservation work, as they are covered with more than sixty years of grime, suffer from minor paint loss, and sport some graffiti. Conserving these murals will replenish their integrity as a piece of Worcester's cultural heritage for future generations. In order to instill the school community and the public with a greater appreciation of the artist and her work, we have prepared a lecture to deliver to audiences at Worcester institutions and have produced a set of didactic panels to be installed next to the murals. Our research has brought us to Woodstock, NY; Washington, D.C.; New York City, and Boston, where we have gained insight into Magafan's life, her artistic process, her other works, and her contemporaries. In addition, we have visited a multitude of museum conservation labs in order to gain exposure to the field of art conservation.

We thank the Holy Cross Summer Research in the Humanities, Social Sciences, and Fine Arts Program for supporting this work. We also thank Philip Klausmeyer and Birgit Strähle, Conservators at Worcester Art Museum, and Kenneth Salins, art teacher at Worcester East Middle School, for their guidance.

Poster 29

The Effect of Legalized Drugs on Housing Prices: An Hedonic Analysis of Marijuana Dispensaries in Colorado

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In November 2000, Colorado permitted the establishment of medicinal cannabis dispensaries. More recently, in January 2014, the use of recreational marijuana became legal and recreational dispensaries opened. This research examines the impact of marijuana dispensaries on housing values in Jefferson County, Colorado by isolating the change in price of houses in close proximity areas (compared to not close proximity areas) before and after the dispensaries were built. The recent legalization of medicinal and recreational marijuana use in many states has increased the importance and feasibility of this study. Data were collected for 16,361 single family housing sales occurring between July 2012 and June 2014 in Jefferson County. Geographic Information Systems (GIS) software was used for spatial analysis of these houses. Our method utilized the Hedonic Pricing Model and a difference-in-differences technique. Multiple regression analysis indicates that dispensaries tend to locate in areas of high property value; however, after a dispensary opens, the houses in close proximity to the dispensaries decrease in value. This negative correlation is magnified when considering only the houses close to recreational dispensaries. Thus, some of the benefits of the tax revenue from the dispensaries are negated by a decrease in housing values.

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

Poster 30

Idiopathic CD4 Lymphopenic Patients and the Effects of IL-7 Treatment

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Idiopathic CD4 Lymphocytopenia (ICL) is a rare disorder in which patients have low CD4 T cell counts in the absence of HIV or other known triggers of lymphopenia, making them susceptible to potentially life-threatening opportunistic infections. ICL patients likely represent a number of unknown diseases connected by their shared phenotype of having low CD4 T cells. The two ultimate and related goals in ICL research are to discover its etiologies and to identify potential treatments. One potential explanation for ICL is impaired T cell production by the patient's thymus. This summer I tested this hypothesis by quantifying the percentage of naïve CD4 T cells that express CD31 in both ICL patients and healthy controls (HC). After leaving the thymus, naïve CD4 T cells lose CD31 expression once they receive a signal through their T cell receptor. Therefore, CD31 can be used to identify recent thymic emigrants (RTE) as a read out of thymic function. We found that although most of the ICL patients did not have different proportions of CD31+ naïve CD4 T cells compared to HC, two of the ICL patients had significantly lower proportions, suggesting that either thymic output or the survival of RTE are affected in these patients. Unexpectedly, we also found that some ICL patients had lower proportions of CD31+ CD8 T cells than HC. I also examined the effects of IL-7 (a critical cytokine for T cell development, proliferation, and survival) administration on ICL patients. Only one of six patients experienced a small increase in CD31+ naïve T cells after IL-7 treatment, suggesting that the treatment did not increase thymic output in the majority of patients despite improving their CD4 T cell counts. Altogether these data provide new insights on ICL pathogenesis and direction for future treatments.

I thank the National Institute of Health for supporting this work.

Poster 31

H. Salinarum: An Investigation of Salt-Dependent Protein Splicing

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Protein splicing is a post translational modification where an internal polypeptide, called an intein, catalyzes its excision from two flanking polypeptides, called exteins, concomitant with extein ligation. Usually, when intein fusion proteins from other organisms are overexpressed in *E. coli*, splicing is spontaneous *in vivo*. However, despite a very similar sequence to the *Mma* PolII intein, which is capable of splicing, the *Halobacterium salinarum* (*Hsa*) PolII intein did not splice upon *in vivo* expression in *E. coli*. *Halobacterium salinarum* is a halophilic organism, so it lives in an environment with extremely high salt concentrations. In an effort to induce reactivity, two fusion proteins of the *Hsa* intein were incubated at 28°C for 16 hours with increasing amounts of NaCl. The fusion protein with a wild type intein has glutamine as the last residue of the intein, whereas the second intein, termed MIHQN, replaces this glutamine with asparagine. After incubation, *in vitro* splicing was observed in both intein fusion proteins on incubation with 2 M and 2.5 M NaCl.

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Poster 32

Cogito Ergo SUMO? Investigating the Solubility of *C. elegans* Groundhog Protein

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C. elegans groundhog is a hedgehog-related protein that consists of an N-terminal signaling domain (Ground), an intein-like HINT domain, and a C-terminal sterol recognition domain (SRD). The protein is largely insoluble upon overexpression in *E. coli.* We hypothesized that the SRD might influence the solubility, and therefore created plasmids for over-expression both with and without this domain. In addition, we added an N-terminal small ubiquitin-like modifier (SUMO) tag to hopefully enhance the solubility of both fusion proteins. Even with the SUMO tag, both proteins were expressed as insoluble inclusion bodies. We were able to solubilize the inclusion bodies, but are still searching for refolding conditions that permit activity.

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Poster 33

The Act of Conversation in Maria Edgeworth's Ennui

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Colonizers often believe that they are the only source of influence in their relationship with the colonized. 19th Century novels often examine colonizers' difficulty accepting that the colonized possess a similar capacity to exert cultural and political influence. As in *Heart of Darkness* (1899), Maria Edgeworth's novel *Ennui* examines the dangers of imperial domains where conversation has been strangled. I posit that conversation may be defined as an interchange between two parties in a shared space in time upon a mutually agreeable topic. By this definition, conversation creates a state of mutual influence, where two parties allow each other political and cultural influence. *Ennui* stresses the importance of conversation by setting a course by which true, open, mutual influence between colonizers and colonized might be achieved. Prompted by representations of conversation in *Heart of Darkness*, my analysis examines the steps Edgeworth takes to make this mutual influence possible. Contemporary political and social issues influenced Edgeworth's representation as did her didactic mode of writing. Storytelling, as well as her attention to Irish oral culture in relation to British print culture helps facilitate the inclusion of native Irish voices in *Ennui* and thereby promote conversation between the Anglo-Irish, the British, and the native Irish populations. In contrast to *Heart of Darkness'* gloomy vision of colonialism and the lack of conversation, *Ennui* provides a more complex view of what conversation requires and enacts.

Funding for this project was provided by the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts.

Poster 34

Judicial Leakage: An Event Study of Stock Price Responses to Patent Litigations

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In the United States, legal cases of all types are heard by both judges and juries. Since these cases can have an enormous impact on the parties involved, the state guarantees that both judges and jurors consistently deliver both fair and impartial decisions. While the guidelines for this impartiality are clearly defined, large scale cases may provide court officials with the incentive to sell inside information prior to the date of the verdict. Utilizing an event study methodology, we scan for leaked information by analyzing the effect of patent infringement verdicts on the security prices of the parties involved. When conducting the study on district court jury decisions, we find no signs of any leakage. However, when conducting the event study for judges at the United States Court of Appeals, we find empirical evidence to suggest that judges are indeed leaking information prior to the public release dates of their verdict

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

Poster 35

Influence of Intein Flexibility on Temperature Dependence of Splicing

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Protein splicing is a post-translational modification by which intervening polypeptides called inteins catalyze their own excision from two flanking polypeptides, the exteins, concomitant with the ligation of the exteins. We studied the activity of DNA Polymerase II (PolII) inteins from the deep-sea thermophiles *Thermococcus kodakarensis* (*Tko*), *Thermococcus barophilus* (*Tba*), *Thermococcus sibiricus* (*Tsib*), and *Methanococcus infernus* (*Minf*). *Tko* and *Tba* PolII inteins contain a homing endonuclease domain, while a flexible loop replaces this region in the *Tsib* and *Minf* inteins. This flexible loop, also found in *Pyrococcus abyssi* (*Pab*) and *Pyrococcus horikoshii* (*Pho*) PolII inteins, was hypothesized to be linked to the temperature dependent activity of these inteins. However, unlike *Pab* and *Pho* PolII inteins, we have shown that protein splicing and cleavage side reactions in the *Tsib* and *Minf* inteins occur *in vivo* in *E. coli* without the need for high temperature incubation *in vitro*. On the other hand, the *Tba* and *Tko* inteins splice poorly in *E. coli* and can be induced to splice *in vitro* at higher temperatures. We also have demonstrated that the *Tba* intein splices while the *Tko* intein undergoes a mixture of splicing and N-terminal cleavage.

This material is based upon work supported by the National Science Foundation under grants MCB-0950245 and MBC-1244089 and by the Dreyfus Foundation.

Poster 36

Influence of the Hyperthermophilic Thermophilic Hairpin (HTH) domain on protein splicing

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Protein splicing is a self-catalyzed reaction in which an intein is excised from a precursor flanking polypeptide (extein) through a series of bond rearrangements and cyclizations. As a result, the exteins are ligated together to produce a mature protein. Side reactions such as N-terminal cleavage can occur if steps of protein splicing are slowed or prevented. We are interested in how particular intein residues affect protein splicing and other side reactions. The DNA Polymerase II intein from *Pyrococcus abyssi* (Pab PolII intein is a thermophilic intein of interest because of the Hyperthermophilic/Thermophilic Hairpin (HTH) domain. This extra beta-hairpin may add stability to thermophilic inteins by extending the central beta sheet. We hypothesized that destabilizing mutations to this hairpin may alter activity. The rate of splicing as well as intein dynamics of the Pab PolII intein were studied via SDS-PAGE analysis of splicing and DTT-dependent N-terminal cleavage as well as susceptibility to proteolysis. We found suppressed activity in the R40E mutation for N-terminal cleavage when compared to the corresponding wild type inteins. This leads us to believe that the distant HTH domain may be capable of influencing the active site.

This material is based upon work supported by the National Science Foundation under grants MCB-0950245 and MCB-1244089 and by the Dreyfus Foundation.

Poster 37

What's It Worth? Students' Choices in College Majors in Response to Changes in Wages

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Past empirical studies (Long, Goldhaber, and Huntington-Klein 2014) suggest that students' choices of college majors respond – though not very sensitively – to changes in the average wage associated with this major. That is, if there is a 10% rise in the relative salaries of major A, approximately 0.14% more students choose to major in that field. There is also a theoretical model which shows that the most salient wages to students are not average wages, but "worst-case" wages (Congdon-Hohman, Nathan, and Svec 2015). We thus use the empirical method outlined in the paper by Long et al., to test whether changes in the lowest wages have a greater impact on students' choices of major than changes in the average wage. We collect data on the number of students in each major, the mappings of majors to occupations, and data on the wages earned by each occupation to get both the average wage and the lowest quintile wage of each major in each year between 1984-2013. We then test whether the lowest quintile wages Granger cause future shares of students across majors and whether the impact of the changes in the lowest quintile wages is greater than changes in the average wage. We find that only 60.6% of majors have a P-value lower than 0.1. This implies both that changes in the bottom quintile wages do positively influence the future number of students in each major, but that the impact is smaller than that of the average wage, contrary to the theoretical model of Congdon-Hohman et al.

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Poster 38

Unemployment and Public Budget Impacts of the Auto Bailout

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We estimate the impact of the 2009 financial rescue of two large American automobile companies (General Motors and Chrysler) on unemployment in Michigan. We conservatively estimate that the auto bailout saved about 7,700 workers from unemployment each month over a period of four-and-a-half years. This translates to a public savings of between $1.3 and $1.6 billion via lower transfer payments and higher tax revenues.

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

Poster 39

Inhibition of Beta-Sheet Formation by a Short, Random Coil Peptide

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Aggregation caused by the misfolding of the protein alpha-synuclein (α-syn) is believed to be one of the causes of Parkinson's disease. While α-syn normally adopts a natively disordered structure, some residues have a propensity to adopt beta-sheet structures. It is this beta-sheet structure that results in the insoluble α-syn proteins, Lewy bodies, being deposited in the nervous system, resulting in Parkinson's disease. Previous studies in the Petty laboratory have found that GGA, a short peptide found within the hydrophobic core of α-syn can inhibit beta-sheet formation in another peptide from the same region of the protein. Our goal was to determine whether GGA was an effective inhibitor of beta-sheet formation in other beta-forming peptides, for example a simple peptide containing four alanine residues (AAAA). The peptides GGA and AAAA were synthesized using solid-phase peptide synthesis and were analyzed independently using FTIR spectroscopy to confirm their secondary structure based on the vibrational frequency of the Amide I band. The two peptides were then combined at different concentrations to see whether GGA was able to inhibit the formation of beta-sheets in AAAA. Results of the experiments have shown that GGA will hinder the adoption of beta sheets if the concentration of AAAA is less than the concentration of GGA in a net 0.2M solution.

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Poster 40

The Formation of a Co-adsorbed Molecular Surface System

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The preparation and subsequent characterization of co- and sequentially-adsorbed buckminsterfullerene (C_{60}) and 4-[4'-(phenylethynyl)-phenylethynyl]-benzenethiol (PPB) (an aryl thiol derivative) monolayers on the Au(111) surface is investigated using scanning tunneling microscopy (STM). Pure C_{60} forms a tight, hexagonally-packed structure on the Au(111) surface in agreement with the herringbone reconstruction of gold. Pure PPB self-assembles into discrete domains with adjacent molecules rotated to minimize steric effects. Preliminary data on the mixed monolayer indicate that sequentially-adsorbed C_{60} and PPB yields a structure of well-ordered PPB with very few islands of C_{60} clustering in the vicinity of monolayer defects, such as etch pits and domain boundaries. On the other hand, the co-adsorbed system produces a well-ordered PPB monolayer entirely segregated from any C_{60} islands or clusters. These results suggest that the structure and stability of the PPB monolayer inhibits the formation of large C_{60} domains. Ongoing and future experiments seek to investigate the effect of sequentially adsorbing PPB onto a preexisting C_{60} monolayer and varying the dosing concentrations of a C_{60}/PPB co-adsorbed system.

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Poster 41

Concentration Dependence of Alanine and Isoleucine Containing Peptides

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Diseases such as Alzheimer's and Parkinson's disease are directly associated with the deposition of protein aggregates in tissues.[1] These amyloid aggregates form as proteins misfold and adopt a β-sheet secondary structure. In order to determine whether peptides adopt β-sheets, IR spectroscopy is often used with a focus on the Amide I region, associated with the C=O stretching vibration. Since previous work in our group showed that peptides containing alanine and isoleucine show a peak not traditionally associated with peptide secondary structure at around 1675-1680 cm^{-1}, a series of alanine and isoleucine peptides were examined in order to determine if this peak should instead be attributed to residual TFA. Solid phase peptide synthesis was used to synthesize tripeptides with varying numbers and locations of isoleucine (AAI, AIA, IAA, AII, IIA, IAI and III). IR spectra were then collected from 25-65 °C and at 37 °C and were analyzed at concentrations from 0.05 M to 0.2 M. AAI, AII, IIA, and IAI all revealed a peak at around 1678 cm^{-1}. In order to probe the origin of this peak, IR spectra were also obtained for each peptides with added TFA. These spectra revealed that the TFA peak is found at exactly 1675 cm^{-1}, and is independent of peptide sequence, structure, and concentration. In the case of AAI, AII, IIA, and IAI an additional, structural peak is found at 1678 cm^{-1}.

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Poster 42

Custodians of Narrative: Catholics, Historians, and Catholic Historians

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Contemporary academic historical studies are often marked by multiple theories or perspectives, such as feminist, Marxist, or post-colonial. Yet historians also desire to maintain an emphasis on objectivity, detachment and a suspicion of narrative structures or meta-histories. This project counters the current assumptions of the historical discipline through a study of how Roman Catholic historians construct historical narratives within the technical standards of the modern academy. The project focuses on primary readings of the Catholic historical tradition, beginning with Augustine of Hippo's *City of God* and continuing through Christopher Dawson, G.K. Chesterton, Hans Urs von Balthasar, and Christopher Shannon. It is supplemented by essays on contemporary historical methodology and critiques of the Catholic perspective. Interviews were also conducted with Catholic historians at Holy Cross, Boston College, and The Catholic University of America. The project's engagement with practicing historians revealed a variety of approaches to the study of history through a Catholic perspective. This project demonstrates how the Catholic tradition of historical scholarship may contribute to the construction of narratives grounded in solid research and the philosophical standards of the common good and sound judgment.

I thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts for financial support.

Poster 43

Investigating the Behavior of an Extended-Cavity Diode Laser

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The extended-cavity diode laser (ECDL) has been widely used in research for over two decades. There are many published papers on ECDL design and on single-frequency performance. However, there is only a limited amount of published data showing in detail how the laser makes transitions between different optical modes; our work this summer provides such data. In a laser, light is amplified within an optical cavity, the length of which must be an integer number of half-wavelengths of the amplified light. Each integer solution is a *mode*, with a characteristic wavelength (or equivalently, frequency) of light. Our ECDL has two optical cavities, the laser diode chip cavity (~3mm) and an external cavity (~40mm), formed between the chip and a diffraction grating. The emitted frequency of light is controlled by both the chip cavity modes and the external cavity modes. For example, if we increase the drive current of the laser chip, it warms, causing the chip cavity to expand, gradually changing the light frequency. If the chip length changes enough, the frequency will suddenly "hop" from one chip mode to the next integer mode. We use a custom laser spectrometer to look at the frequencies of light from the ECDL, while a computer controls the chip and external cavities. Competition between the two sets of modes in some cases leads to unpredictable, even chaotic behavior; in other cases to stable, predictable changes. The information we capture will help to find stable operating parameters; it will also be used to test a mathematical model for light amplification inside the ECDL.

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

Poster 44

Improved Magnetic Reflector for Atom Diffraction

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In classic experiments, it has been observed that light acts as both a particle (photon) and as a wave (oscillating electro-magnetic field). This dual nature of light also applies to the fundamental particles that make everything up. If all particles are waves, then what kind of waves describe atomic particles? What would they look like? My project this summer is part of an investigation of this, by observing rubidium atoms as waves which are scattered from a patterned magnetic surface. Louis de Broglie showed that the wavelength of a particle is inversely proportional to its momentum. In our experiments, we require a small atom momentum, so that the de Broglie wavelength of the atoms will be large enough to cause an appreciable angle of diffraction (coherent scattering). We also require that the thermal energy of the atoms be extremely low, near absolute zero, so that the thermal spread of momenta does not muddle our data. To get the temperature of the atoms so low, we use a combination of lasers and magnetic fields to take away the momentum of the atoms and reduce their energy. The cooled atoms are then allowed to fall onto a magnetic surface below, from which they scatter upwards. In the spatial distribution of the diffracted atoms we should be able to see the wave-like pattern we expect. This summer, I created a new curved magnetic surface experimentally, using air pressure to stretch a thin magnetic recording disk into a uniform, naturally curved shape. This shape was then set using heat treatment in an oven. The curvature will serve to focus the diffracted atoms, so that we can more clearly observe the de Broglie waveform.

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

Poster 45

Negative Feedback Circuit for Laser Frequency Control

R. B. Daly, Jr. and T. Roach
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In the course of our experiments with rubidium atoms, we operate a laser tuned to a precise frequency close to that of an atomic absorption resonance. The laser light enters a chamber from six different directions, all converging to the center, in order to localize a gas of rubidium atoms. The collisions between photons and atoms cause the atoms to slow down greatly, so they reach a low speed corresponding to a temperature of about 10-6 K. At this low temperature, it becomes possible to study the de Broglie wave properties of the rubidium atoms. The laser we are using is very sensitive to vibrations and acoustic noise, which change the output frequency. To prevent this, we use negative feedback (a *lock loop*) to hold the laser at the correct frequency. The basic principle is that a detection system reads the deviation of the laser frequency from the desired operating point, and relays that information (the *error signal*), through a feedback circuit, to the laser frequency control. If the frequency of the laser is too high, the circuit sends a negative signal to the laser, forcing it to decrease in frequency; and vice versa. We implemented a new feedback circuit with higher gain to replace the old one, based on a mathematical model of the feedback loop. The old feedback circuit could hold the laser at the correct frequency for several minutes at best and would come unlocked if there was an outside acoustic or vibrational disturbance. The new circuit is able to hold the laser at the correct frequency for a couple of hours, even through a fire alarm.

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Poster 46

Analysis of Multi-year Cosmic Ray Flux Measurement to Determine Solar and Atmospheric Periodic Relationships

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Muon flux measurements collected over a long period of time provide information on mechanisms that modulate the flux of extragalactic cosmic rays on their way to Earth. Detecting periodicities in cosmic rays can aid in finding atmospheric and solar patterns, predicting and detecting storms, and determining the optimal times to commence space missions. Over a period of eight years, muon coincidence measurements were detected and recorded every minute at Smithtown HS East, NY. Data was averaged by hour before being corrected for barometric pressure. Correlation studies were then performed between the data and temperatures at different altitudes obtained from weather balloon data taken at the Brookhaven National Laboratory National Oceanic and Atmospheric Administration station. These studies allow us to locate approximately at what altitudes the detected muons were produced. To study the modulation of cosmic ray flux, we performed a Lomb-Scargle frequency analysis using the program R. The dominant frequencies of 93 days, 180 days, 323 days, and 4.24 years correspond with solar activity and solar cycles. The data also show reduction in flux due to immense coronal mass ejections. By gaining this knowledge, we will be able to assist in interpreting how these cosmic rays affect aviation electronics and are correlated with seasonal variations.

This project was supported by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists under the Science Undergraduate Laboratory Internships Program.

Poster 47

The Tale of Two Inteins and an Inhibitory Protein Splicing Mutation

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Protein splicing is a post-translational process facilitated by an intervening polypeptide called an internal protein or intein. The intein is centrally located between two flanking polypeptides called exteins. The intein catalyzes its excision from the extein contemporaneously with the ligation of the exteins. Protein splicing occurs in various organisms such as cyanobacteria. We used inteins that can be found in the DNA Polymerase II of the following cyanobacteria: Synechococcus sp. PCC 7002 (Ssp) and Trichodesmium erythraeum (Tery). Because they promote a post-translational modification, inteins are found in the translated sequence for DNA Polymerase II and might provide a regulatory mechanism to control enzymatic activity. The two inteins differ mostly in the residues that promote the third step of splicing, side chain cyclization coupled to peptide bond cleavage. While the Ssp intein has a native asparagine residue, the Tery intein has a native glutamine. Compared to glutamine, asparagine is kinetically favorable for the cyclization step. With this condition in mind, we introduced mutations at this position that would introduce a glutamine for Ssp and an asparagine for Tery. We hypothesized that, compared to the wild type inteins, the Ssp intein with the glutamine mutation would have a decreased splicing capability, and the Tery intein with the asparagine mutation would have unaffected splicing capability. In addition, the C-terminal cleavage and splicing capabilities were tested in inteins with Cysteine1 to alanine and/or penultimate glycine to histidine mutations.

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Poster 48

Development of Poly(ADP-ribose) Glycohydrolase Selective Inhibitors

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Poly(ADP-ribosyl)ation is a post-translational modification in which NAD^+ is consumed to produce ADP-ribose, which is then transferred to the desired proteins. Poly(ADP-ribose) (PAR) is catabolized by several enzymes, including PARG (poly(ADP-ribose) glycohydrolase) and ARH3 (ADP-ribosylarginine hydrolase-3). The PAR cycle is implicated in several diseases, such as acute cerebral ischemia and BRCA mutated cancer, where it is exploited therapeutically. Therefore, it is important to develop tools to probe and measure PAR metabolism. I have been working on the development of potential substrates and inhibitors of PARG and ARH3, particularly, substrates selective for PARG. Previous work has developed ADP-ribose mimics that contain 4-nitrophenol, which is cleaved off by the enzymes to act as a chromogenic reporter to measure enzyme activity. These substrates have been prepared with adenosine and inosine as the nucleoside incorporated in the ADP-ribose mimic with selectivity conferred by the base. I have been developing the synthetic pieces to create these mimics using guanosine and xanthosine as the starting nucleoside as well as C2-functionalized adenosine. In addition, previous work developed an inhibitor that was selective for PARG and not ARH3. As lack of a 3' hydroxyl is the key difference between this inhibitor and other inhibitors that are not selective of one enzymes over the other, I have also been working on developing a substrate that is PARG-selective as it also lacks a 3' hydroxyl, which we hypothesize confers the selectivity.

We thank the Harold Snyder Summer Scholarship Fund for financial support.

Poster 49

Analysis of Fractal Scaling in Child-Therapist Interactions

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Previous studies have shown that the dynamical patterns of complex systems, including behavioral systems, display fractal scaling of variability across various timescales, which indicates long-term correlations in the system's unfolding. While many systems exhibit monofractal scaling, past research indicates that multifractal scaling of variability (that is, multiple exponents are used to describe changing patterns across timescales, indicating a changing pattern of long term correlation) is often observed in many natural phenomena. The current study evaluates the fractal scaling of variability in the movements of socially interacting individuals. Activity time series of children with Autism Spectrum Disorder and their therapist during a conversation interaction task were acquired from video recordings and submitted to MATLAB analyses of fractal scaling. Significant mono and multifractal scaling exponents (indexing the degree of long-term correlation and its changing pattern, respectively) were found as well relationships between the scaling exponents and the severity of the child's disorder. Moreover, the scaling exponents of interacting individuals were correlated, exhibiting complexity matching. These findings suggest that fractal scaling of noise in the movements of social interactions is a bio-behavioral marker that may be able to be used in the diagnosis of Autism Spectrum Disorder at a very young age.

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Poster 50

Hidden in the Open: Afro-Argentines in Buenos Aires, Yesterday and Today

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In 1810, Argentina celebrated being a free nation for the first time. Since this time, however, competing versions of what "Argentine" meant resurfaced in border wars, political debates, and reconfiguration of the country's economy. Although Africans and their descendants were an intrinsic part of nation building, Argentina's high population of European immigrants dominated the debates and excluded Africans and their descendants in their definition of the nation. For instance, by the end of the 19th century, Afro-Argentines were kept out of the country's demographics because they were deemed unworthy of being counted as part of the nation. Today, even though Afro-Argentineans inhabit the city, no one seems to recognize their African heritage. It is as if Afro-Argentineans are hidden in the open because most Argentineans believe that there are no blacks in Argentina. We researched this phenomenon from the perspective of Afro-Argentineans. Do Afro-Argentines reject their African roots "like most Argentines?" How do these groups, the "minority," understand their ethnic identity in a city that openly rejects them? What models of minority identity are used by Afro-Argentineans? We found Afro-Argentineans are attempting to change the notions that reject Argentina's African culture by targeting these themes through writing and the arts. They find inspiration in the African Diaspora worldwide.

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

Poster 51

Subjective Experiences of Life in an American Nursing Home

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According to the CDC, there are currently 15,700 nursing homes, providing care for about 1.4 million residents in the United States (Centers for Disease Control and Prevention 2015). Given the strong negative stereotypes associated with aging, it is especially important to ensure that all residents receive the dignity and respect they deserve. An abundance of research has been conducted on nursing homes, but very little has examined it from the residents' perspectives. This presentation draws on 90 hours of participant observation at a private, 137- bed nursing home in Worcester, MA over a nine-week period. Observations included various aspects of residents' daily lives, as well as staff and overall environment at the facility. Informal conversations with nine residents also occurred. Grounded Theory analysis revealed three themes: subjective experiences of living in a nursing home, relationships between residents, and the activities that are important to residents. The findings from this study can inform nursing home practice and policy to improve the lives of residents and staff alike. Future studies on the topic should be conducted using in-depth interviews.

We thank the Greisch Family Summer Research Fellowship for Sociology Students for their support.

Poster 52

Sperm-Leucylaminopeptidases 3 and 5 Are Required for *Drosophila* Spermatogenesis

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Proteomic experiments have shown that eight sperm-leucyl aminopeptidases (S-Laps) are among the most abundant proteins in mature sperm from *Drosophila melanogaster*. These proteins are encoded by a recently evolved gene family found throughout the *Drosophila* genus, all of which arose from a non-reproductive leucyl-aminopeptidase through a series of gene duplication events. To begin to characterize the function(s) of these abundant sperm proteins, we used RNA interference to knock down expression of *S-Lap3* and *S-Lap5* in male testes. Males knocked down for either gene exhibit complete infertility. To investigate the nature of this fertility defect, we produced knockdown males that make sperm labeled with green fluorescent protein (GFP). These males transfer no sperm to females during mating, and dissections of testes revealed that knockdown males are unable to produce mature sperm. These results suggest that the S-Lap3 and S-Lap5 proteins, in addition to being major components of mature sperm, are also essential for spermatogenesis. We also examined the molecular evolution of these proteins. We found strong purifying selection acting on both S-Lap3 and S-Lap5. Furthermore, we observed significant covariation in the evolutionary rates of seven of the eight S-Laps across the *Drosophila* phylogeny, with the strongest signal of coevolution observed between S-Lap3 and S-Lap5. Taken together with the functional data above, this result suggests that S-Lap3 and S-Lap5 may act together in a common spermatogenesis pathway. Future experiments will analyze the functions of the other six S-Laps.

We thank The William F. McCall, Jr. '55 Summer Research Fellowship Fund for Students in the Sciences for financial support.

Poster 53

Female Sex Peptide Network Proteins Impact D. *melanogaster* Fertility

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After mating, *Drosophila* females display a stereotypical post mating response (PMR): increased egg production, reduced receptivity to courtship, and initiation of sperm storage. The PMR is induced by the transfer of sperm and seminal fluid from males to females, but it requires female-expressed proteins as well. Most studies of the PMR have focused on the male-contributed proteins, but a recent screen identified three female proteins that are essential for post-mating fertility: fra mauro (CG3239), hadley (CG 5630), and Esp. We have used RNAi knockdown in *Drosophila melanogaster* to investigate the nature of the fertility defect when each of these proteins is depleted. We conducted single pair mattings between knockdown females, control females, and wild-type males that produce sperm tagged with protamine green florescent protein (GFP). We then measured fertility daily and used confocal microscopy to count sperm present in each female's primary sperm storage organ, the seminal receptacle. We found that females knocked down for each gene produced fewer eggs and progeny than controls. In hadley and Esp knockdown females, we also observed significantly more sperm remaining in the seminal receptacle. Because sperm release is likely coordinated with ovulation, we hypothesize that the fertility defect is due to a reduced rate of egg production and/or ovulation in hadley and Esp knockdown females. Future experiments will use tissue-specific knockdown to better understand the localization and function of these female-specific proteins.

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

Poster 54

Characterizing the Evolution of the *Drosophila* Sex Peptide Network

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The sex peptide (SP) network in *Drosophila* consists of at least 13 proteins from males and females that interact to control female behavior and physiology after mating. Function of this network is necessary for reproductive success in *D. melanogaster*. However, a literature review revealed that several SP network-related phenotypes, including remating behaviors, sperm storage and sperm size, have been affected by major evolutionary changes within the *Drosophila* genus. These macroevolutionary changes imply the possibility of changes at the sequence level in the SP network proteins. Thus, we have investigated the mechanisms of molecular evolution of each protein in the network. Using PAML, we tested for and identified adaptive evolution on specific protein sites and phylogenetic lineages. It is also established that gene duplication is an important force in shaping reproductive protein diversity. In the second part of this study, we investigated the consequences of two gene duplication events that gave rise to an essential SP network gene, *seminase*. An ancestral species had only one copy, while species in the melanogaster group have three copies: *seminase*, *CG11037* and *CG10587*. We have studied the evolutionary history of this gene family to understand how *seminase* became essential to the SP network. Further, we have tested expression of *seminase* and its paralogs in several of the melanogaster group species, as well as outgroup species. Preliminary results indicate male-specific expression of each gene. Future work will focus on characterizing tissue-specific expression of these proteins in several species, which will give insight into the possible functions of these genes.

We thank Nancy and William F. Crowley, Jr., MD '65 for their generous financial support of the Holy Cross Summer Science Research Program and this project.

Poster 55

Rethinking the Parkinson's Paradigm: Induced Excitotoxicity Resistance

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The traditional schema of Parkinson's Disease (PD) assigns the cause of advanced movement neurodegeneration to alpha-synuclein phosphorylation, proteasome dysfunction, subsequent Lewy Body formation and dopaminergic neuron death. Although these facets of PD are accepted, prolonged Parkinson's-derived pathologies may have another cause. Excitotoxicity, the detrimental overexposure to neurotransmitters, is widely thought of as dependent on the release of glutamate across the synaptic cleft. After dopaminergic neuron death and an eventual dearth of dopamine, glutamate receptors operate unmediated. Linked trans-membrane ion channels remain open for antagonistic ion ingression and begin a cascade resulting in cell necrosis. After an observed resistance to a Parkinson's model in *drosophila melanogaster* learning mutants (*rutabaga* and *dunc*e) the hypothesis was formed that a chemically induced learning mutation may show similar rescue effects against our Parkinson's model. We used simple chemical agents (Glutamate and KCl) whose introduction into the body will result in neuronal depolarization and a prolonged refractory period without causing death.

We are indebted to The Miami Project to Cure Paralysis and the Summer Trainees in Academic Research program for their support.

Poster 56

Harlot, Wife, Entertainer: Depictions of Women in 18th-19th Century Japanese Art

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By the mid-18th century, new printmaking technology made the mass production of colored prints possible in Japan. These prints were known as *ukiyo-e*, or images of the floating world. *Ukiyo-e* prints depict a vast range of subject matter, including kabuki actors, scenes from plays, and famous courtesans from the licensed pleasure quarters. Depictions of courtesans were particularly popular in *ukiyo-e* and many artists specialized in *bijin-ga,* or images of beautiful women. Courtesans were an idealized symbol of femininity in 18th century Japan. They were seen as highly fashionable trendsetters, intelligent, and refined women. In contrast, women outside of the pleasure quarters were expected to be dutiful wives, good mothers, and careful spenders. By the end of the 18th century, however, interest in courtesans as the main subjects of *bijin-ga* began to change. Artists such as Kitagawa Utamaro (1753-1806) depicted different classes of women in his *bijin-ga* prints. Tea-house waitresses, merchant's wives, and even low-class prostitutes became increasingly popular subjects in *bijin-ga.* We have analyzed 18th and 19th century *ukiyo-e* prints depicting women from various social class backgrounds. We propose that depictions of women from each social class represent very different feminine ideals, challenging the uniform representation of Japanese women in the West. A consideration of depictions of different social classes within the same print serves to emphasize these ideals.

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

Poster 57

Determining a Twisted Torus Link's Number of Components

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Sam Houston State University

A link is a smooth embedding of a finite number of disjoint copies of S^1 into S^3. Links of one component are known as knots. Links that can be embedded on the surface of a torus are called torus links. Further, a twisted torus link is the concatenation of two or more torus links. While torus links have been studied extensively, no complete classification of twisted torus links currently exists. We examine finding easy ways to determine the number of components that a twisted torus link has and look for special cases when it has one component and is therefore a knot. We find that there exist various patterns in the parameters of a twisted torus link that reveal general information about the number of components.

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Poster 58

Confucianism and Human Rights

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The Universal Declaration of Human Rights (UDHR) lists what have come to be called "first" and "second" generation rights. First generation rights are civil and political (for instance, the right to vote, freedom of speech, freedom to assemble); second generation are social, economic, and cultural (protection against unemployment, universal healthcare, equal pay). However, Western and Asian nations are in disagreement about whether or not all of these generations of rights should be universal. While Western nations strongly believe that first generation rights should be universal, Asian nations insist that their unique "Asian values" require second generation rights to precede first generation rights. It turns out that many of these "Asian values" are derived from the Confucian tradition. However, scholars debate whether Confucianism supports first-generation rights, second generation rights, or both. We have concluded that Confucianism supports both generations of rights. After analyzing the Confucian values in detail, it is clear that Confucians need access to the first and second generation of rights in order to best follow the tradition.

We thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and the Arts for funding this work.

Poster 59

Constraints on Bodily Synchronization Underlying Joke Telling

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Previous research has exhibited spontaneous synchronization of bodily movements when people interact. This dynamic interactional synchrony occurs in all kinds of everyday movements and has been demonstrated empirically in varying social contexts. The objective of this project is to advance understanding of the dynamical synchronization processes that enable the spontaneous entrainment of movements in naturalistic social interactions. Over the course of four semesters, 42 pairs of participants are asked to read knock-knock joke scripts to one another. Using a video methodology we measured the degree of interactional while manipulating the amount of perceptual information available using an auditory occlusion and manipulating individuals' motor signatures weighting their limbs. We predicted that when people are weighted or cannot hear one another that a dyad's movements would be less synchronous. Our results however indicate that the effect of weighting depends on the whether audition is occluded or not. By learning more about this dynamical process of human interaction's "dance-like" synchronization we hope to gain insight to how humans socially connect and cooperate.

We thank the National Institutes of Health for their financial support.

Poster 60

Multi-Spectral Imaging for Counterfeit Packaging Analysis and Differentiation

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Pfizer Global Security is responsible for protecting Pfizer's colleagues, property, reputation, and integrity of its medicine. Due to the danger that counterfeit medicines pose to safety, Global Security has implemented an aggressive anti-counterfeiting program to detect and disrupt major manufactures of counterfeit Pfizer medicine. A joint initiative between GS and IPFL brought Neutec's Videometer "on loan" to the Groton, CT labs for a trial period to evaluate its quantitative abilities. The IPFL knew the Videometer could identify counterfeit tablets. The project's focus was to identify and quantify commonalities between different counterfeit Viagra packaging. 11 unique counterfeit Viagra IFCs, 8 unique counterfeit Viagra blisters, and 9 unique counterfeit Viagra bottle label designs were identified. This data allows Global Security to be proactive in its anti-counterfeiting efforts and builds a more comprehensive case for law enforcement. Dependent on the purchase of the Videometer, an algorithm will be developed to automate data analysis.

I thank Pfizer for financial support.

Poster 61

Atomic Beam Density Measurement Using Wavelength Modulation Spectroscopy

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In preparation for experiments which collide lithium atoms and protons, a systematic measurement of the density of a lithium atomic beam has been made. The density of the beam is an essential quantity for interpreting collision probability, the key parameter in collision experiments. The technique used to determine the beam density is a type of laser absorption spectroscopy, called wavelength modulation spectroscopy (WMS), and measurements made with this technique are compared to those using traditional laser absorption spectroscopy. In the WMS technique a laser beam passes at right angles through the lithium atomic beam as its frequency scanned over an atomic transition in the lithium atom. As the laser is scanned, its frequency is also sinusoidally modulated at a much faster rate than the scan rate, by modulating the laser current. Using a photodiode the absorption of laser light by the lithium beam is measured, from which the lithium beam density is inferred. Modulating the laser current also gives rise to an undesirable modulation of the laser intensity, which complicates the analysis of the experiment. The effect of this intensity modulation is significantly reduced by using a balanced pair of photodiodes, which also reduces laser intensity noise. The balanced photodiode technique thus simplifies the analysis, while improving dynamic range and signal to noise. In our experiments, careful attention is also paid to calibrating the frequency scan of the laser, which is necessary for accurate results. With these developments we find that the WMS method results agree with those from traditional laser spectroscopy to better than 10%.

We thank the Richard B. Fisher '47 Summer Research Fellowship Program for funding, Prof. Roach for advice and equipment loans, and Dick Miller for machining expertise.

Poster 62

The Digital Transgender Archive: Accessibility Best Practices

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The Digital Transgender Archive (DTA) strives to connect archives from around the world by creating an online database for transgender materials. Although there exists thorough research on general website accessibility and human disability, there lacks in-depth protocol for constructing accessible digital archival databases. I traveled to the University of Victoria (UVic) in British Columbia, Canada and conducted one week of intensive research on Fantasia Fair, one of the first popular transgender events on the East Coast. I digitized Fantasia Fair materials that were unique to the university's archives. I also spent time at Harvard University, searching through their Fantasia Fair materials and filling in materials that were absent from the UVic collection. We created an Accessibility Best Practices Guide for the DTA by synthesizing technical guidelines for general website accessibility. These guidelines will provide philosophical and moral standards for which the DTA will strive during its future development. I have found that there exists a need for accessibility research when it comes to creating accessible metadata for database systems.

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

Poster 63

Standardizing the Preparation of Cigarette Smoke Extract for use in Mouse Fibroblast Viability Assays

A. Garewal, J. Jacob, R. Ndahayo, and J. Paxson
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According to the American Lung Association, smoking-related diseases claim an estimated 443,000 American lives each year. Chronic Obstructive Pulmonary Disease (COPD) and Emphysema are common smoking-related diseases seen in older patients that progressively destroy lung tissue, and are currently incurable. In order to better treat patients with smoking-related diseases, it is important to better understand how cells are damaged by cigarette smoke, and how they are repaired. Previous studies have used a variety of methods to generate soluble cigarette smoke extract (CSE) that can be used to damage cells. However, there is a large degree of variability in how the CSE is made, and how it is standardized for use. The goal of our research was to investigate the consistency of preparing CSE on a batch-to-batch basis and study how this CSE affects the viability of mouse fibroblast (3T3) cells. We developed a standard protocol for generating CSE using a simple suction apparatus. Each CSE batch was standardized using a standardization curve based on spectrophotometer readings made at an absorbance of 390 nm. Using this the standardized CSE, the 3T3 mouse fibroblasts were damaged at concentrations between 1-8%, which resulted in observable morphological evidence of cellular damage. This damage was further quantified using a cell viability assay, the MTT assay. Our results showed large amounts of variability in CSE potency and ability to damage 3T3 cells on a batch-to-batch basis. However, using the standardization curves we developed, we have been able to show potential ways to reduce the amount of inconsistency in 3T3 cell damage between batches of CSE.

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Poster 64

Investigation of the Zenith Angle Dependence of Cosmic-ray Muons at Different Elevations.

S. Habein, J. Harrison, and T. Narita
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Cosmic rays (high energy particles originating from dying stars, primarily protons, accelerated through space) strike the atmosphere at a rate of 1000 collisions per square meter per second (N. Ramesh). These cosmic rays crash into particles in the atmosphere and burst into showers of muons. We built a two-paddle scintillator detector to record these highly penetrating muons reaching Earth. Throughout the summer we collected data from different angles to study the life of these cosmic ray muons. The cosmic rays depend on the zenith angle (with vertical representing 0 degrees) by a factor of $\cos^n$, where n is between one and two depending on the altitude. While our results at sea level fit data offered by other physicists, our work at higher elevations is novel and will take more time to formulate a trend. This correlation between *n* and altitude will require further investigation including consideration of solar activity, position of the detector in Earth's magnetic fields, and weather conditions.

This work was made possible by a generous contribution by Dr. Daniel J. Wasser and Dr. Karen Randall P15 to the Alumni / Parent Summer Research Scholarship Fund.

Poster 65

Swapping Elements in a Implicitly Learned List

A. Eckert, D. McMaster, M. Morrow, and C. Locurto
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The ability to master sequences of elements is a key component of language acquisition — an ability that was once assumed to be uniquely human. Extensive research has studied list-learning abilities in both humans and non-humans, and has led to the conclusion that non-humans are capable of rather sophisticated sequence learning. Our study investigated pigeons' abilities to learn a five item list implicitly, that is, under conditions in which reinforcement is delivered randomly, not for correct responses. In a prior study of this problem, subjects were given a high information list in which each element was different both spatially and visually, and all elements were presented in an order that went from left to right on a touch screen. That experiment demonstrated that pigeons did indeed learn this information list. In present research we isolated spatial proximity from ordinal proximity determine which was more important. The elements in the chain were in order alphabetically from A to E, however the list was controlled for spatial location (B.D.E.C.A). Swapping of elements in the list, during test trials, was used to determine whether or not the pigeons had learned the list. Overall the latencies during the swap trials were significantly higher than during the baseline trials, indicating the pigeons also learned the list under these new conditions. Importantly, we discovered that the symbolic distance between elements caused higher latencies than the spatial distance during the swap tests.

We thank the Office of the Dean for providing the funds that made this research possible.

Poster 66

Learning of a Temporally Isolated List

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A key element of human language is sequential learning, the ability to master sequences of elements. Past studies have shown that humans are not the only species that are capable of learning sequences. Our study investigated pigeons' abilities to learn a five item list implicitly without direct reinforcement. Unlike previous work which delivered reinforcement randomly during the list, we used a two-part chain schedule to isolate primary and conditioned reinforcement from the list. Generally a chain schedule has two components; in one component primary reinforcement is delivered on a schedule for responding. In the second component responding is not reinforced, but completion of this part of the chain brings forth the first component of the chain in which primary reinforcement is delivered. In the present study, the order was reversed so a reinforcement schedule preceded the chain schedule. We compared two different temporal delay intervals that were inserted between the two components of the chain schedule. The two conditions examined were a short 1 second interval and a much longer 10 second interval. Despite the lack of direct reinforcement during the sequence the pigeons were able to learn the list. The results demonstrated a tendency for the pigeons to take a higher proportion of extended breaks during the ten second delay condition, particularly during the start cue that preceded the sequence itself. Overall, however, latencies did not change when switching from the one second interval to the ten second interval.

We thank the Office of the Dean for providing the funds that made this research possible.

Poster 67

Genocide in the Jungle: A Regional Analysis of Ethnic Violence in the African Great Lakes Region

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Throughout the African Great Lakes Region (GLR), a cyclical pattern of genocidal violence persists: Rwanda (1962-1963), Uganda (1971-1979), Burundi (1972), Rwanda (1994), Democratic Republic of Congo (1994-1995). The nature and frequency of these revolving-door conflicts indicate regional trends that are best examined and addressed by means of a regional perspective. Attempting to move away from the typical, single-state interpretation of the United Nations' definition of genocide, I set out to declare regional genocide across the GLR. The GLR, historically and today, possesses an ethnically dichotomous demographic. With a regional landscape consisting of primarily Hutus and Tutsis and their associated sects, this distinctly divided region existed in harmony until Belgian and German colonizers shuffled the ethnic landscape of the GLR, and established bureaucratic political systems dependent on violent subjugation. Post-colonialism, the GLR took its first step into modernity, simultaneously initiating a cycle of regional violence by which ethnic scores were settled in eruptive bouts of genocide. Today, these bureaucracies perpetuate oppressive political and social systems that still function by means of widespread violence instead of productive economies and progressive political discourse. At this time no magnitude of genocidal violence occurs across the GLR to justify declaring regional genocide. Yet, pockets of genocidal violence exist, and with widespread regional violence and insecurity, potential future genocides loom as a stark reality. However, a regional approach on behalf of the UN and African Union can curtail these future genocides.

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

Poster 68

17β-Estradiol (E2) in Cell Membranes: Orientation and Dynamic Properties

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To progress the understanding of estrogens and their interactions with the cellular membrane, we have looked at the preferred orientation and dynamic properties of 17β-estradiol (E2) in the phospholipid bilayer membrane environment. Previously performed experiments demonstrated E2 to have a counter-intuitive horizontal orientation. In order to confirm this conclusion, we reanalyzed the data from these experiments and worked to develop a more efficient approach for any possible future reanalysis. H2 NMR spectra of E2, using H2 labels at specific locations in E2, produced experimental quadropolar splitting values. These values were compared to the calculated, theoretical H2 label quadropolar splitting values from the manipulation of H1 NMR spectra data points. Calculations required the eclectic study and application of mathematical, chemical, and computational methods. Parallel-performed calculations using Microsoft Excel and C++ computer programming led to the pursuit to develop a flexible program designed to more quickly calculate and test for similar experiments in the future. Our results were consistent with the original results supporting E2 to prefer a horizontal orientation within the cell membrane. Development of the program is still in progress.

This research was supported by a grant from the Excellence in Career Related Undergraduate Education Award from the George I. Alden Trust.

Poster 69

Suitcase and Guitar in Hand: An American Musical Pilgrimage

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The road has long symbolized progress towards untapped opportunity and has inspired countless "rambling" musicians, from Woody Guthrie to the Allman Brothers. Suitcase and Guitar in Hand is a songwriting project that captures the experience of traveling across the United States to the epicenters of American music. During the research phase of the project, my travel partner and I drove 10,000 miles crossing 30 different states. We spent the bulk of our time in places that have innovated distinctive styles of American popular music, including Nashville, New Orleans, Memphis, Chicago and San Francisco. We chose to forgo the luxury of hotels by lodging in hostels and campgrounds; this allowed us to interact with countless fellow travelers, document their stories, and participate more authentically in the "rambling" experience. We visited legendary musical landmarks, witnessed live performances of indigenous genres, and spoke with local musicians. The journey evoked existential questions about life after college and constantly challenged us to confront the unfamiliar. To share our experience while on the road, I operated a travel blog at suitcaseandguitar.com that enabled audience members from all over the world to journey with us through photos and prose entries. After returning from this journey, I began composing a collection of original songs based on our remarkable journey. Each captures a different aspect of life on the road. Thanks to the tireless efforts of my advisors, bandmates, and several Holy Cross musicians, the project has now grown into a deeply personal, full-scale EP album. This work will be available in physical CD and digital formats in September.

We thank the Holy Cross Summer Research Program in the Humanities, Social Sciences and Arts for their generous financial support.

Poster 70

In-111 Uptake in SPECT Images of Murine Tumors with Varying Antigen Expression: A Topological Approach

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College of the Holy Cross

Using computational topology and methods previously developed by Melissa McGuirl ’15, we analyzed the antibody uptake of single-photon emission computed tomography (SPECT) images of murine tumors. Study data consisted of images of three groups of mice, each injected with a different xenograft cancer cell line. The cell lines were distinguished by different levels of antigen expression. Images utilized an indium-111 labeled targeting antibody. Using Morse Theory and dimension zero persistence homology, we analyzed the points of maximum uptake in an attempt to distinguish between uptake behaviors of the different groups to find heterogeneity of uptake within the groups. Statistical analyses indicate that through focusing on areas of high and low uptake, we could efficiently distinguish uptake behavior of the antibody in the three different tumor cell lines.

We thank Dan Kennedy, Ph.D. ‘68 and an anonymous donor for their generous contributions to the Alumni / Parent Summer Research Scholarship Program. We also thank inviCRO for providing us with data and software, and Melissa McGuirl ’15 for her work developing the methods that we utilized.

Poster 71

Identifying the Role of Spinal Muscular Atrophy Genes in the Regulation of Insulin Signaling

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Spinal muscular atrophy (SMA) is a neurodegenerative disease that is caused by a mutation in the *SMN1* gene. The nematode worm *Caenorhabditis elegans* is an excellent model to study SMA, as the *smn-1* gene is nearly 80% identical in worms and humans. My project seeks to establish and characterize a new, promising link between SMA and glucose intake in *C. elegans*. *C. elegans* can be used to explore the response to a high-glucose diet due to its conserved, yet simplified, insulin-signaling pathway. Worms with a mutated *daf-2* insulin receptor have decreased insulin signaling, which increases entry into an alternate life stage, called dauer. Previous studies have shown that a high-glucose diet decreases dauer formation in *daf-2* mutants, through the upregulation of insulin signaling. A series of RNA interference (RNAi) screens identified approximately 44 candidate genes that may be specifically required for this insulin-signaling response to high glucose. Interestingly, two of the most promising candidates are *smn-1* and *nekl-3*, the latter of which is a modifier of *smn-1*. This identifies a potential link between SMA, high-glucose diet, and insulin signaling. We are currently investigating the role of 30 other genes, which have been identified as *smn-1* genetic interactors, in the insulin-signaling response to high glucose, by performing dauer assays using RNAi for the interactors on a high-glucose diet. Preliminary data suggests that at least 3 genes, *mog-4*, *dlc-1*, and *T02G5.3*, are very strong suppressors of this phenotype, perhaps even stronger than *nekl-3*.

This research was made possible by the generous contributions of Kim and Wendell P. Weeks P15 (ESS & MAM) and the Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowships (KD).

Poster 72

Evaluating Elevation on Muon Flux

J. Harrison, Sam Habein, and T. Narita
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While cosmic rays have been researched extensively, there have been few studies which focused on the variation of muon flux in regards to elevation change. In an attempt to do so, we tested our Cosmic Ray muon telescope at five different elevations. Cosmic rays — high energy sub-atomic particles that collide with the Earth's atmosphere — produce secondary particles upon crashing into atmospheric nuclei. Muons are secondary particles created in pion decay. The distance muons travel through the atmosphere is proportional to their energy. Consequently, muons found at sea-level generally require larger amounts of energy than those found higher up in the atmosphere. Therefore, more muons should exist at higher elevations than at sea level. After traveling through four states, including three summits (one of which is the highest peak in the North East), we were able to record a different muon flux at varying altitudes. Greatest count rates were observed at higher elevations. For instance, our data showed that the average count rate was 1.50 muons per second at Providence, RI (sea-level) and 2.51 muons per second at Mt. Washington (6,288 ft).

We thank Dr. Daniel J. Wasser and Dr. Karen Randall P15 for the generous contributions made to the Alumni / Parent Summer Research Scholarship fund.

Poster 73

Forest Fragmentation and Bird Decline in Massachusetts

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Habitat fragmentation is the process by which large contiguous areas of habitat are broken up into smaller pieces. This can be detrimental to many species, as individuals of some species avoid habitat close to edges or perform poorly in such locations. Fragmentation of forest habitat in eastern North America has accompanied human population increases over recent decades, especially as housing spreads into forested areas. Populations of certain bird species, especially neotropical migrant warblers and thrushes, have declined in New England in the past several decades. Fragmentation of breeding habitat is one possible cause of such declines, but detailed studies linking population declines to such fragmentation are lacking. In this study, we compared forest interior (FI) bird abundance from the North American Breeding Bird Survey (BBS) and land use trends from digitized aerial photographs. Using ArcMap GIS software, we determined the extent of interior forest along BBS survey routes in MA. We identified 17 FI bird species based on significant positive correlations of abundance with extent of FI habitat across the bird routes, and habitat descriptions in field guides. We calculated regression coefficients representing the change in bird abundance and extent of interior forest over time on each route. Correlations between change in bird abundance and change in extent of interior forest were positive for 14 of 17 bird species, a trend that is statistically significant. This supports the view that habitat fragmentation has a significant impact on FI bird populations. We propose that changing patterns of development to minimize habitat fragmentation could mitigate the potentially severe decline in forest bird populations.

We thank the Excellence in Career Related Undergraduate Education Award from the George I. Alden Trust for financial support.

Poster 74

Stress and the Transition to College: Examining the Effect of Living with a Concealable Stigmatized Identity

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Concealable stigmatized identities (CSIs) are socially devalued identities and attributes that can be hidden from others (e.g., mental illness, HIV/AIDS). Previous research has found that the possession of a CSI has a negative effect on psychological and health well being. However, no research has focused on CSI individuals as they adjust to major life transitions such as the transition to college. Major life transitions are stressful for everyone, but it is possible that people living with CSIs will experience significantly more stress because of heightened social belonging concerns but fewer available coping resources. Using retrospective hair cortisol assays and self-reported stress, we will examine whether students living with CSIs experience greater stress during the transition to college than their non-CSI peers. Greater hair cortisol levels and self-reported stress would suggest that students with CSI may also experience a greater susceptibility to the negative health effects of elevated stress (e.g., metabolic syndrome, cardiovascular disease). The results of this study will help us understand how social identities can affect the college transition and to suggest possible routes of intervention to reduce this stress during the first year of college.

We thank Mora M. and Timothy J. Babineau, M.D. '82 for their generous donation to the Summer Research Scholarship Fund.

Poster 75

Exploring the Glassmaking Community and Techniques

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The process of glassmaking is a field that has barely been explored and made available to the general public. Given the lack of public knowledge on the subject, I chose to research glassmaking from the perspective of both a novice glass artist and documentarian. Throughout the project I observed, interviewed, assisted and collaborated with other glass artists to increase my own technical understanding of the medium while at the same time getting to know the individuals behind the work and learning about their relationship with the medium. Documenting the various processes of glass art occurred in a variety of settings including the hot shop, flame shop, cold shop, flat shop, home studios, and at live demonstrations. Another important facet of my research was attending galleries and shops where glass was displayed to learn about the curation, display, and marketing of both commercial and artistic glass objects. In addition to documentation, I also learned the techniques of flameworking and glass casting at Newstreet Glassworks. Preliminary research of glass art peaked my interest in developing a conceptual series of work focused on putting human figures in different types of vessels. After I learned how to flamework more commercial glass object such as beads and pendants, I focused on developing my ability to sculpt anatomical forms from solid rods of glass. I also learned the process of kiln casting to create more detailed figures by pouring molten glass into molds. Collaboration with more experienced artists was a key component in putting my anatomical forms into vessels. Cantor Art Gallery Director Roger Hankins and I have organized a gallery to take place during the fall semester showcasing my work and the work of other regional artists I engaged with this summer.

I thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts for financial support.

Poster 76

Relative Equilibria of Four Vortices with Three Equal Circulations

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Using equations derived from fluid mechanics, the vortex problem tracks the motion of a point vortex in space. Since these equations account for the circulations of other vortices in the system, the problem's complexity depends on the number of vortices. We consider the relative equilibria (rigid rotations) of the four-vortex problem with three equal circulations and one arbitrary circulation, m. Using a set-up similar to that of the sister four-body case, we investigate both collinear and symmetric kite solutions. Applying methods from computational algebraic geometry enables us to reduce and factor the defining equations in order to simplify the problem. For example, in the collinear case, a 12th degree polynomial with complicated coefficients in terms of m is factored into the product of four cubics; for the kite configurations, level curves are obtained that classify the different types of possible shapes (convex or concave). Letting the mutual distances vary numerically gives rise to different sets of m-values as well as important bifurcations. Our numerical work leads to the discovery of theorems describing the number and types of possible solutions in terms of the parameter m.

We thank Dr. Dan Kennedy, Ph.D. ‘68 for his generous support of the Alumni/Parents Summer Research Scholarship. This research was also supported by grant DMS-1211675 from the National Science Foundation.

Poster 77

Optimization and Characterization of HPLC/MS Method for Use in Extractable/Leachable Testing

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Plastic containers, delivery systems, and medical devices contain a wide variety of additives used to enhance their processing and functional capabilities. These additives, designed to aid in processing and drug delivery, can also be a source of contamination should the compounds leach into the drug product itself. Pfizer's Analytical Science team uses extractable/leachable (E/L) testing to investigate the possible risks of this contamination. This project aims to optimize and characterize a LC/MS method for use in analysis of semi-volatile E/L compounds which dramatically reduces analysis time over the current standard. The results are primarily achieved by transitioning from a totally porous to a partially porous column. The project then uses this method to generate a database of E/L compounds including peak shape and retention time which will aid in future analysis.

This project was funded by the Scientific and Laboratory Services group at Pfizer Inc.

Poster 78

When I'm Not Trying As Hard As I Can…My Crazy Comes Out! Impulsivity Modulates Cognitive Control in the Antisaccade Task

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Impulsivity is often operationally defined as a deficit in inhibitory motor control (Logan, Schachar, & Tannock, 1997) based on impairments in psychiatric populations who show high impulsivity and deficits at inhibiting a prepotent response (e.g., antisaccades). Whether impulsivity in the non-clinical but highly impulsive person stems from similar deficits of control remains unclear. Here we examined the correlations between trait impulsivity (measured with the Barratt Impulsiveness Scale-Version 11) and antisaccade performance. Impulsivity did not correlate with deficits in cognitive control in the initial stages of the experiment when participants were most actively exerting maximum cognitive control. In subsequent blocks, where cognitive control was less than maximal, higher impulsive participants made significantly more errors than lower impulsive participants and impulsivity significantly correlated with cognitive control deficits. At least in non-clinical populations, highly impulsive individuals appear to be able to overcome rash responding when they are maximally exerting control. However, when control lessens, impulsive behavior is revealed, and even non-clinical subjects are less able to compensate. So try your hardest or your crazy will come out…

We thank the National Institute of Health and the College of the Holy Cross for financial support.

Poster 79

Spinal Muscular Atrophy (SMA) Genes Regulate Insulin Signaling in Response to High-Glucose Diet

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Spinal muscular atrophy (SMA) is a neurodegenerative disease that results in the loss of motor neurons, muscle atrophy, paralysis, and often infant mortality. SMA affects up to 25,000 people in the United States alone and a previous screen identified the SMA causative gene's (*smn-1*) effects on the insulin-signaling pathway in *Caenorhabditis elegans*. Coupled with the increased prevalence of type 2 diabetes, it is important for future studies to characterize this link and provide insight into both disease pathways. Our project seeks to establish this promising link between SMA and glucose intake in *C. elegans*. The worm model has been used to explore the effects of high-glucose diets due to the high homology between the worm (DAF-2) and human insulin receptors. The *smn-1* gene is also nearly 80% identical in worms and humans, making it a useful model to study SMA. Previously, a screen used RNA interference (RNAi) to suppress expression of ~11,000 different genes in the *C. elegans* genome. This screen identified approximately 44 candidate genes, including *smn-1*, which may be required for this insulin signaling response to high-glucose diet and was shown to decrease *daf-2* worm lifespan. Our studies this summer focused on identifying other glucose-specific insulin signaling phenotypes, such as heat-shock stress resistance. Due to the fact that decreased insulin-signaling has previously shown to increase heat-shock resistance, we hypothesized that high-glucose would decrease the *daf-2* worm stress-response to heat-shock. Unexpectedly, our initial findings show that glucose exposure actually increased the *daf-2* worm stress-response to heat-shock in both a *smn-1* and control background.

This research was supported by a gift to the Alumni / Parents Summer Research Scholarship fund by Kim and Wendell P. Weeks P15.

Poster 80

The American Context and NGO Standards

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As nongovernmental organizations (NGOs) become increasingly powerful and active within civil society, questions have arisen concerning their legitimacy. These questions of legitimacy come from state actors, individual donors as well as from those who benefit from the endeavors of these organizations. To address these concerns, organizations have methods of sectoral accountability. Whereas research to date has focused on transnational initiatives, like the Sphere Project or HAP International, it is increasingly apparent that national context impacts organizational struggle and strategies. It is the national political and social structures that are coming to be seen as influential in determining what is considered appropriate or effective work. This research seeks to apply these insights to nonprofit governance. It asks: What role does the American context play in the design of NGO standards? It explores this question through an analysis of the InterAction PVO Standards, the most widely signed international nonprofit guidelines in the United States. InterAction comprises over 180 members working internationally on issues related to poverty and vulnerability. This research seeks to better understand the interplay between national context and international norms in the design of NGO standards through interviews with InterAction members as well as comparative analysis of nonprofit standards. In the case of the PVO Standards, international norms of independence, transparency, and voluntariness are presented through a domestic framework that emphasizes efficiency and pragmatism.

I thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts for financial support.

Poster 81

Limb Demand Ischemia Modulates Revascularization and Adipocyte Differentiation in Obese Mice

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Claudication, a form of demand ischemia (DI), has been associated with altered skeletal muscle fiber morphology and fatty degeneration in patients with peripheral arterial disease (PAD). Metabolic syndrome in patients with PAD exacerbates exercise intolerance due to impaired circulation and metabolism. The diet-induced obese (DIO) mouse provides a robust model of humans at risk for metabolic syndrome and PAD. We tested the hypothesis that exercise would enhance the angiogenic profile and modulate adipocyte differentiation in the setting of ischemia by assessing hindlimb skeletal muscle tissues from exercised and sedentary ischemic limbs of DIO mice for capillary density (CD31 immunohistochemistry), myofiber cross-sectional area (CSA), pro-angiogenic cytokines (VEGF and G-CSF), signal transduction molecules (pSTAT3 and pERK1/2), and markers of adipocyte differentiation (UCP-1 and PGC-1α). The data suggest that DI enhances capillary density, but lowers myofiber CSA. Since VEGF and ERK1/2 levels were not different between exercised and sedentary ischemic muscles, the enhanced capillary density may be primarily dependent on G-CSF and STAT3 signaling pathway after 4 weeks of DI. Exercise also appears to modulate adipogenic differentiation and muscle energy metabolism, evident by the decrease in UCP-1 protein and increase in PGC1-α gene expression in the DI muscle. The clinical implications of our study suggest that an exercise regimen in patients with PAD may augment microvascular perfusion and decrease fatty degeneration, thereby enhancing muscle adaptation to ameliorate claudication and improve limb function.

I thank Dr. Richard P. Cambria, Chief of Vascular and Endovascular Surgery at Massachusetts General Hospital for financial support.

Poster 82

Contemporary Outcomes of Fenestrated Endovascular Aneurysm Repair (FEVAR) of Abdominal Aortic Aneurysms: A 5-Year MGH Experience

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Endovascular aortic aneurysm repair (EVAR) has become the standard of care for patients with infrarenal abdominal aortic aneurysms (AAA). Until recently, patients with complex AAA, meaning supra, para, or juxtarenal AAA, have been limited to open surgical repair (OSR) due to fear of occluding the visceral vessels located in the proximal seal zone required for EVAR. However, the 2012 FDA approval of fenestrated aortic stent graft devices has made the entirely endovascular treatment of complex AAA possible using fenestrated EVAR (FEVAR). This study focuses on the intermediate term outcomes, reinterventions, and complications of contemporary FEVAR as compared to OSR in MGH patients with complex AAA. We examined demographic details, intraoperative details, and complications, mortality and outcomes, focusing specifically on renal, pulmonary, cardiac, graft, wound, and infection complications. The FEVAR cohort of n = 27 patients ranged from 2011-2014 and the open cohort of n = 128 patients ranged from 2010-2015. Our cohorts differed slightly in both demographics and intraoperative details. Of interest, we also found that the groups did not differ statistically in any rates of complications except for graft complications, with FEVAR having a higher rate of graft complications than OSR (15% vs. 3%). Additionally, KM analysis showed that FEVAR patients had a significantly increased 3-yr survival. The absence of differences in other rates of complications as well as increased survival probability suggests that FEVAR could be a safe and effective alternative to OSR for patients with complex AAA.

I thank Richard P. Cambria, MD, Chief of Vascular and Endovascular Surgery at Massachusetts General Hospital for financial support.

Poster 83

Predictors of Success After EVAR: A 13 Year Massachusetts General Hospital Retrospective Study

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For the repair of abdominal aortic aneurysms, EVAR (Endovascular Aneurysm Repair) is a non-invasive technique that has been preferred over open repair because of its lower postoperative mortality and morbidity rates. However, statistical analyses have shown that EVAR is associated with higher frequencies of aneurysmal sac endoleak and secondary interventions. In hopes of being able to investigate certain predictors of success after EVAR (which include patients who do not have any sort of endoleak or secondary intervention), we utilized MGH databases to analyze the outcomes of past patients. 900 patients who had undergone EVAR at MGH from 2003-2015 were investigated. The variables that were evaluated included demographic data, anatomical measures, intraoperative details and postoperative complications and reinterventions. Patients who had a history of cerebrovascular disease (which included those who had a stroke and/or TIA) were shown to have a statistically higher chance of having some sort of complication after EVAR. Other variables such as the length of the proximal seal zone of the endograft, the presence of endoleak 6 weeks postoperatively and aneurysmal sac shrinkage seemed to be associated with success postoperatively and will be further analyzed in the future.

I thank Richard P. Cambria, MD, Chief of Vascular and Endovascular Surgery at Massachusetts General Hospital for financial support.

Poster 84

The Effect of Autophagy on Wound Healing in the Murine Model

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Delayed wound healing is a prevalent problem in medicine, including vascular medicine where it is seen associated with peripheral vascular disease. Autophagy, an important cellular process in homeostasis and cellular repair, is known to be hampered in various cardiovascular disease risk factors, including diabetes. However, autophagy's role in the wound healing process has not yet been investigated. We hypothesized that autophagy plays a role in cutaneous wound healing. To test this hypothesis, we used a well-established autophagy inhibitor, chloroquine, in wounded mice to determine if there was a delay in the wound healing process. Serial imaging was taken for 14 days and using modular image analysis we determined that there was a significant delay in wound healing with chloroquine treatment, as compared to the saline-treated control group. This delay in wound healing was then confirmed to be due, in part, to autophagy using western blot analysis of key markers of autophagy (LC3-II, p62 and Beclin-1) and apoptosis (uncleaved and cleaved Caspase-3). The clinical significance of our finding of delayed wound healing associated with autophagic inhibition can be expanded upon through future experimentation. Diabetic patients are more susceptible to delayed wound healing and therefore conducting this experiment on diabetic mice would be more clinically pertinent. In addition, we will explore the effects of autophagic enhancement on cutaneous wound healing.

I thank Richard P. Cambria, MD, Chief of Vascular and Endovascular Surgery at Massachusetts General Hospital for financial support.

Poster 85

Peripherally Inserted Central Catheters (PICCs) and the Risk of Phlebitis in Infants Admitted to the Newborn Intensive Care Unit (NICU)

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PICCs, used in the NICU to provide prolonged intravenous nutrition and medication to newborns, can result in complications including inflammation of the vein (phlebitis), prompting early PICC removal. Anecdotally, the Baystate NICU PICC team suspected that the incidence of phlebitis was increasing. Factors correlating PICCs with the development of phlebitis were contradicting in the newborn literature. We hypothesized that the newborn's PICC (1) insertion site in the leg and/or (2) non-central anatomic tip location outside of the Superior or Inferior Vena Cava were associated with phlebitis. Using a case-control design, we analyzed the existing PICC database for all newborns admitted to Baystate's NICU between the years 2008 and 2014 whom had a PICC inserted. The incidence of phlebitis tended ($p=0.057$) to be higher if the PICC was inserted in the leg vs. the arm/scalp, but the incidence of phlebitis was not different ($p=0.52$) if the anatomic tip location was central vs. non-central. The duration of PICC placement was shorter for phlebitis cases vs. controls ($p=0.005$). The data suggests that PICC insertion site in the leg, but not anatomic tip location, tended to be associated with an increased risk of phlebitis. Our study was limited by its retrospective design and small number of phlebitis cases. We speculate that decreasing PICC insertion in the newborn's leg will lower our incidence of phlebitis & prolong the duration of PICC insertion.

We thank Baystate Medical Center and Baystate's Summer Scholar Program for financial support.

Poster 86

Effects of Chronic Corticosterone Administration on Amphetamine-seeking Behavior

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High stress levels are correlated with increased drug use and the establishment of drug acquisition associations. Using conditioned place preference (CPP), a widely-used model for drug-seeking behavior, many studies have observed that stressful experiences, including corticosterone (CORT) injections, potentiate drug-induced reinstatement of CPP in mice. However, not many studies have observed the effects of stress on acquisition of drug-seeking behavior. This study uses a noninvasive administration of CORT to mimic HPA axis activation, and seeks to determine to what extent CORT, independent of life stressors, affects acquisition of amphetamine-seeking behavior. Experimental mice received 14 days of CORT administration in their drinking water, during which all mice underwent the Acoustic Startle Response test twice, and after which all mice underwent a 4-day CPP protocol. Experimental mice displayed higher startle amplitude than control mice on Day 14, but not Day 9 of CORT administration. Therefore, the effect of elevated CORT on startle amplitude seems to appear between nine and fourteen days. All mice could be conditioned to place using amphetamine. However, there was no difference in the level of acquisition of CPP between groups. Future studies will investigate the biological processes by which CORT affects startle amplitude, an indicator of affective state.

We thank Michele K. and David M. Joy '74, P11 for financial support of the Alumni / Parents Summer Research Scholarship Fund.

Poster 87

Circadian Phase and Water Maze Performance in Mice

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Water maze tasks, in which the subject must learn the location of a hidden escape platform, are commonly used to test spatial learning and memory in rodents. Members of our laboratory have developed a novel water maze task to assess working memory in mice. The advantages of this task are that it tests working memory without the use of food deprivation and in a manner that imposes few constraints on the animal's behavior compared to classical tasks. As previous research has demonstrated that mice, which are nocturnal, use different spatial strategies when tested during their active phase, as compared to their inactive phase, we sought to compare the spatial learning of mice in different circadian phases using the novel water maze task. Unexpectedly, our preliminary data show that the mice tested in their inactive phase performed as well as the mice tested in their active phase during the portion of the task in which a cue was present to mark the platform location. Furthermore, in the hidden platform portion of the task, the mice tested in their active phase demonstrated more errors, longer swimming distances, and greater latencies to reach the platform. Further testing is required to achieve the statistical power necessary to interpret the results of this study.

We thank Mary R. and Herman R. Charbonneau '56, P97 for financial support of the Alumni / Parents Summer Research Scholarship Fund.

Poster 88

A Parametric Study of Trace Fear Conditioning in Mice

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When using laboratory measures of associative learning in animals, care must be taken to distinguish the learned association from the general effects of handling. We choose to explore associative learning in mice using Pavlovian (classical) conditioning of the fear response. Different published fear conditioning protocols vary in the degree to which they yield conditioned fear, generalized fear, and pseudo-conditioning. Recently, concerns have been raised about high levels of pseudo-conditioning in trace conditioned rodents. Trace conditioning, in which the unconditioned stimulus (US) follows the conditioned stimulus (CS) after an interval of several seconds, is of particular interest because of its dependence on the hippocampus and cortex. To assess the level of generalized fear in trace conditioning, we created an unpaired control, in which the CS and US were both present during conditioning but separated by more than a minute in time. To assess levels of pseudo-conditioning with long trace intervals we conducted a parametric study varying the length of the trace interval (Delay, 20s, 45s, 70s, 100s). For intervals longer than 60s, high levels of freezing to the CS alone would indicate pseudo-conditioning. Our preliminary results indicate that even when the CS and US were separated by 100s, pseudo-conditioning did not occur. In addition, during a fear extinction protocol where the CS was repeatedly presented alone, we found that regardless of the trace interval duration, the freezing response could not be completely extinguished. We hope this research will contribute to a greater understanding of the complexity of fear conditioning and fear memories.

We thank Mary R. and Herman R. Charbonneau '56, P97 for financial support of the Alumni / Parents Summer Research Scholarship Fund.

Poster 89

Validation of Copy Number Assay for DiGeorge Syndrome

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Wisconsin Law requires screening of every newborn's blood to detect diseases not readily apparent at birth. One particular disease not currently being tested, but that could be detected through screening is 22q11.2 Deletion Syndrome. Also called DiGeorge Syndrome, it results from a loss of ~30-40 genes on the long arm of the 22nd chromosome. The most prevalent phenotype occurring in ~80% of patients with the deletion is Complex Congenital Heart Disease. We propose a collaborative validation study using dried blood spots from each patient for the detection of the deletion associated with this syndrome. We have previously employed TAQMAN Copy Number Assays to detect the number of copies of a particular gene of interest localized to specific regions on a patients' chromosome. During initial screening, genomic DNA is isolated from a child's blood and screened for one gene, *TBX1*. For example, seventeen subjects (3.94%) were found to contain the deletion from a survey of 432 patients from the Congenital Heart Disease Tissue Bank (CHDTB, CHW). These results are consistent with previous publications. Currently, a *TBX1* and *CRKL* assay is offered clinically as a genetic test that doctors can order in-house for their patients at Children's Hospital of Wisconsin (CHW). Through a collaborative effort with the University of Ottawa Children's Hospital of Eastern Ontario newborn screening program, dried blood spot cards from the CHDTB create a comprehensive cohort to study the detection of 22q11.2 Deletion Syndrome using TAQMAN chemistry. An international collaboration brings awareness and attention to the importance of this assay being adopted by newborn screening programs in the United States particularly Wisconsin.

Financial support: BBC, Hohenwalter Grant, and CHEO.

Poster 90

The Impact of a Colorectal Screening Program to Reach Underserved Populations in Hartford, CT

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Hartford Hospital

The goal of this retrospective study was to code colonoscopy scans from 2013 in the primary care ambulatory database for patients at the Brownstone Clinic at Hartford Hospital. The clinic serves a large Hispanic population of a lower socioeconomic status. It is important to study this population's access to healthcare in order to eliminate health disparities in medicine. This study was conducted by querying colonoscopy scans from 2013 in the database according to national eligibility criteria and then coding these scans using a standardized legend. Results showed that the majority of patients had good bowel preparation with only 8% reporting as poor prep which is lower than the national average of 21.7%. The findings of the colonoscopies showed that 51% of the scans had benign tumors or polyps which is a larger percentage than the national standard of 30%. The standardization of colonoscopy data will be incorporated into the electronic medical records database at Hartford Hospital. Further research aims to use analytical statistics to find any predictive variables for polyp detection, such as gender or ethnicity. Comparisons of screening rates between Hartford Hospital and national/regional averages will help to recognize disparities and prompt reform so that more patients receive optimal care and disease prevention.

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

Poster 91

Universal Cervical Length Screening for Prevention of Preterm Birth: Comparison of Maternal Characteristics and Neonatal Outcomes of Women Who Accepted Versus Declined Screening.

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Premature infants, those born at less than 37 weeks' gestation, are at an increased risk for morbidity and mortality. In the United States, 11.6% of infants are born prematurely. In women without a history of preterm birth and a cervical length < 20mm at < 24 weeks' gestation, the use of vaginal progesterone has decreased the rate of preterm birth. Transvaginal cervical length screening is not a current universal standard of care, but is considered as a reasonable and useful intervention per the Society for Maternal Fetal Medicine. We compared the maternal characteristics and neonatal outcomes of women who accepted versus declined cervical length screening for preterm birth prevention. The research questions we addressed were: the proportion of eligible women that were screened, the demographics of those who accepted screening versus those who declined, the impact of refusal on the effectiveness of universal cervical length screening, and what barriers are present to prevent women from accepting the screening. Results from this study will yield answers to provide understanding on the best approach to implement transvaginal cervical length screening as a universal standard of care to prevent preterm birth.

We thank the BestCare for a Lifetime Grant for funding this study.

Poster 92

Outcome of a Diabetics Shared Care Program in a Primary Care Clinic: 3 Years Follow-up

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Diabetic patients with or without metabolic syndrome were increasing around the world every year. The disease has complications such as cardiovascular disease or chronic renal disease and affected a large number of people. In Taiwan, the prevalence of diabetes and cost of medical care for diabetes increased annually. Diabetic shared care programs (DSCP), for instance, were promoted in Taiwan 15 years ago. At present, numerous primary care clinics were enrolled in DSCP. The data were collected from 132 patients who were treated and followed for at least three years under DSCP guidelines. We found that HbA1c level, waist circumference (<=80, female; <=90, male), cholesterol, triglyceride, cholesterol/ high density lipoprotein ratio, and plasma glucose level decreased when adjusted for age and gender. The analysis on the severity of HbA1c (HbA1c<7, 7-9, >9) revealed decrement of patients (HbA1c>9) from 22.0% to 8.3%. We further noticed that high density lipoprotein, lower density lipoprotein, body mass index, and urine albumin/ creatinine ratio did not improve in those patients after our three years follow-up. Previous studies have shown the benefit of integrated care and diabetes education on glycemic control. If participants adhered to the program, they not only would improve their HbA1c level but also their dyslipidemia.

We thank the Shi-Ren Clinic and Changhua Christian Hospital for financial support.

Poster 93

Developing High Dielectric Constant Nanoparticles From Group 4 Metal Alkoxide Precursors

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Advanced Materials Laboratory, Sandia National Laboratories

High dielectric nanomaterials are capable of holding charge well and are used in a variety of electronic applications. Some of the highest dielectric constant materials are the oxides of the group 4 metals hafnium and zirconium. The goal of the project was to synthesize uniformly shaped, monodispersed nanoparticles from hafnium and zirconium alkoxide precursors. Since the ligand set of the precursor strongly affects the end morphology of the nanoparticles, we explored novel alkoxide precursors that were synthesized through reaction of commercially available hafnium and zirconium alkoxides with the H_3-AM-DBP_2 alkoxide ligand. The novel precursors were characterized using FTIR, NMR, elemental analysis, and single crystal XRD. Once the novel precursors were synthesized and characterized, we synthesized hafnia nanoparticles through solution precipitation in 1-methylimidazole and water then characterized them through PXRD and TEM. PXRD revealed initial nanoparticles were amorphous and thus needed post-processing by heating at high temperatures. TEM revealed a wide variety of sizes and shapes depending on which novel precursor was used. Particles synthesized from the precursor [H][Hf(η^4-AM-DBP)(η^2-AM-DBP)] were both nano and spherical, which suggests we can use these novel precursors to obtain desirable nanoparticle morphologies.

This work was supported by the Department of Energy at Sandia National Laboratories. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Poster 94

Wisdom and Stress and Faith and Doubt in Later Life

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This qualitative study examines two basic themes and the tension between faith and doubt in later life using a sizable and still growing sample of interviews of older adults (over 250, aged 50 and older). The first theme examined was age related, specifically cognitive developments, such as wisdom (shades of grey" thinking rather only "black and white). The second was stress related in terms of traumatic life events, such as bereavement and illness. The interviews showed that despite significant life stressors, which are more common in later life, those with established faith remained faithful and were more likely to use their faith as a source of comfort and strength through hard times. Doubt was not consciously increased due to a traumatic life event. Instead, cognitive development (wisdom) showed to be the most prominent reason for the tension between faith and doubt in the interviews. If wise, an older adult may consider their faith in relative terms – as one among many possible beliefs – consider the context and usefulness of belief and religious activity, and willingly entertain doubts about their faith. This follows Baltes and colleagues theories of epistemic wisdom or post formal reasoning, which if it occurs allows the older adult to understand the nature of relations between the individual and full context in other words to "see the big picture." It is what may allow older adults to have doubts about religious beliefs and may also permit them to ask fundamental questions about purpose and meaning in life. For example, these questions would be their to attempt to understand themselves in the context of "God's plan" or the universe.

We thank the Holy Cross Summer Research Program in the Humanities, Social Sciences, and Arts for their support.

Poster 95

Searching Data Provenance From R Script Executions

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Ensuring that data analysis leads to accurate and reproducible results is critical to scientific progress. As scientists explore increasingly sophisticated issues, they often utilize large data sets and complex models for handling the data. The data provenance, the processes performed to achieve reported results, has become increasingly complex, presenting a challenge to establish the authenticity behind scientific results. Scientists can use RDataTracker, an R library to collect provenance from executing R scripts, to create a Data Derivation Graph (DDG), a structured record of the provenance. DDG Explorer, a program that improves accessibility to DDG, assists with assessing the data provenance. Although the DDG displays this information in an organized fashion, it can be difficult to find specific information within the DDG efficiently – especially within DDG containing hundreds or thousands of nodes. To ensure a quick and intuitive experience with finding data, I focused on creating search capabilities for the DDG. The current search extracts information from the DDG and structures it so that information can be queried by the type of data and associated text information. The interface allows users to enter a search which returns a list of search results. Once the user selects a result the node is displayed. Future updates will incorporate searching within the DDG Explorer's database (implemented with APACHE JENA) by incorporating the SPARQL querying language in addition to an advanced search design to assist with discovering relationships between nodes. Search will assist scientists with debugging programs in addition to quick traversal of the DDG.

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Poster 96

Predictors of Permanent Pacemaker Implantation in Patients Who Underwent TAVR: A Single Center Experience

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The purpose of this study was to determine predictive variables for permanent pacemaker (PPM) insertion after transcatheter aortic valve replacement (TAVR). A total of 160 commercial patients not enrolled in Core valve trial studies that were diagnosed with severe aortic stenosis (AS) that underwent TAVR at Hartford Hospital between February 2012 and July 2015 were reviewed. Patients with a preexisting PPM were excluded. The mean age of the patient population was 82 years old. Variables collected included: name, MRN, gender, ethnicity, TAVR date, PPM implant date, Post-op complications, valve type and size, STS/Euroscore risk score, pre and post TAVR PR and QRS intervals, pre and post TAVR LBBB and RBBB, pre and post LAFB, depth of valve implant, and percent ventricular pacing using 30 day pacemaker dependency checks. The aims of this study are to: identify potential risk factors in TAVR patients that led to the development and progression of advanced conduction disease; and characterize patients who developed a post-procedural LBBB and evaluate their future need for pacing.

We thank the medical staff at Hartford Hospital for both their guidance and financial support.

Poster 97

Comparative Analysis of Assay Protocols on the ADVIA Centaur Immunoassay System

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The immunoassay is a biochemical procedure used to quantify or detect the presence of a protein or antibody (commonly called analyte) in a solution. Several antibody-based reagents are added to the reaction mix at various times during the assay, and both reagent formulation and order-based reagent addition sequence need to be characterized during assay development to achieve optimal results. ADVIA Centaur BRAHMS PCT assay measures the concentration of procalcitonin (PCT) in solution using a chemiluminescence reaction that relies on acridinium esters (AE), acid, and base. This study evaluated responses in the assay's Relative Light Unit (RLU) output measured by the ADVIA Centaur platform across different assay protocols. Eight assay protocols were studied along with a set of 7 standard samples measured in triplicate. Each protocol differed in the timing and the reagent addition sequence. The purpose of the study was to identify the major factors contributing to reaction sensitivity and immunoassay signal strength. It was observed that early introduction of the ancillary reagent (housing capture antibodies) enhanced the assay's signal strength and sensitivity.

We thank Siemens Healthcare Diagnostics for financial support.

Poster 98

Analyzing Cardiovascular Treatment Based on the Number of Significant Lesions

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The Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) trial focused on addressing the effectiveness of different treatments for diabetic patients with coronary artery disease. In this population, the association between the number of lesions and the effectiveness of treatment is unknown. The goal of this analysis was to examine the association between the number of lesions with the outcome of death, myocardial infarction (MI), or stroke and explore whether there is a more effective form of treatment depending on the number of lesions through numerous statistical analysis methods. The Cox regression model showed that the hazard for death, mi, or stroke was significantly greater for patients with 3 or more significant lesions (Hazard Ratio = 1.495, p-value <0.0001). After stratifying by the number of lesions and comparing the revascularization procedures with medical therapy, among patients who had 3 or more significant lesions and were selected to receive CABG, those who received CABG had higher survival rates of death, MI, or stroke compared to medical therapy (p-value = 0.0280). Further analysis shows patients with a greater number of lesions benefitted from receiving CABG compared to medical treatment in terms of a subsequent event of an MI, but not for death or stroke.

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Poster 99

Nanotechnology-Based Fluorescent Probes as Novel Tools for CLL Research

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In Chronic Lymphocytic Leukemia (CLL), signals from the cellular microenvironment play a crucial role in the survival and proliferation of leukemic cells. However, many of the mechanisms involved in the interplay between CLL cell signaling and altered gene expression remain poorly understood. To optimize this research, it is crucial to analyze the expression of genes of interest in CLL cells while also conserving their natural, living state. The use of spherical nucleic acid (SNA) probes shows promise with its ability to sort and quantify RNA expression within live cells, without disturbing the metabolic and transcriptional processes responsible for the cellular response. To test the viability of these probes, we placed them in culture with both cell lines and cryopreserved PBMCs (Peripheral Blood Mononuclear Cells) from healthy and CLL patients. Our results indicated that these probes were effective for CLL patient samples, enabling future experiments that can facilitate a more detailed analysis of the mechanisms linking gene expression, CLL cells and their microenvironment biology.

We thank the Feinstein Institute for Medical Research for financial support.

Poster 100

D.F.W., the Self, and Intentionality: The Figure of the Clerk in *The Pale King*

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In 2008, David Foster Wallace died and left a work he often referred to as "The Long Thing," an unorganized collection of manuscripts, chapters, and vignettes about I.R.S. workers in Peoria, Illinois. These fragments were arranged by his long-time editor Michael Pietsch into *The Pale King* (2012), a surprisingly coherent novel that sheds light on the last ten years of Wallace's career. The title of the work refers to a particular class of persons in the novel whose importance is understated but indicative of the author's contentions about boredom, alienation, and the self. This class of persons, which includes Shane Drinion, Edward Rand, 'Irrelevant' Chris Fogle's father, and Fogle's Advanced Tax professor, represents Wallace's re-telling of the clerk figure. The novel argues that the most insidious consequence of boredom is forced confrontation with the self. The pale clerk figure leads others to confront the self, but does so in a way that allows for spiritual growth and awareness rather than the self-consciousness and fear associated with boredom. In addition, the presence of the pale clerk figure proves essential to Wallace's literary aesthetic of eschewing the self-conscious, nihilistic irony characteristic of his postmodern predecessors, namely John Barth and Don Delillo. To conduct this analysis, I read selected earlier novels, essays, and short story collections by Wallace, the seminal novels of the postmodernists who influenced him, and various critical essays on *The Pale King*. Additionally, I studied Wallace's original materials and notebooks, located in the archives at the Harry Ransom Center at the University of Texas at Austin, to understand his process and intentions for the unfinished novel.

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Poster 101

Deorphanization of GPR151

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G-protein coupled receptors (GPCRs) are widely studied as one of the largest and most diverse groups of transmembrane receptors. When a signaling molecule binds, they are responsible for interacting with a heterotrimeric G-protein to induce a specific signaling transduction pathway in the cell. For this reason, GPCRs make great drug targets, and over 40% of pharmaceutical drugs on the market today are responsible for targeting GPCRs. However, more than 200 GPCRs are still orphan receptors, meaning that they have no known endogenous ligand. One of these is GPR151. Microarray and RNAseq genomic screen data of injured peripheral neurons in mouse dorsal root ganglia (DRGs), has shown GPR151 to be upregulated after peripheral nerve injury. While the central nervous system fails to regenerate significantly after injury, peripheral nerves usually regain function with time. Our goal was to further investigate the role of GPR151 in peripheral regeneration and neuropathic pain. To this end, we engineered a chimeric optogenetic receptor "Opto-GPR151" and cloned it to look at the physiological effect of GPR151 activation by light. We also cloned GPR151 into a lentiviral plasmid. We hope to both overexpress this gene and knock it down with an shRNA to look at its effect in both injured and uninjured mice DRGs. Ultimately, our goal is to be able to generate a knockout mouse to look for regeneration and/or pain behavioral endpoints of GPR151

Poster 102

Identifying the Effects of High-Glucose Diet and the Causative SMA Gene on Lifespan in *Caenorhabditis elegans*

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Spinal muscular atrophy (SMA) is a severe genetic disorder characterized by neurodegeneration, leading to paralysis and often infant mortality. Our project seeks to establish and characterize a new, promising link between SMA and glucose intake in *Caenorhabditis elegans*. The nematode worm model *C. elegans* has been used to explore the effects of high-glucose diets 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. *C. elegans* is also an excellent model to study SMA, as the causative gene is nearly 80% identical in worms (*smn-1*) and humans (SMN1). An RNA interference (RNAi) screen identified 45 candidates as being involved in the insulin signaling response to a high-glucose diet, including *nekl-3*. *smn-1* is a modifier of *nekl-3*. I sought to analyze the effect of *smn-1* and high-glucose diet on other insulin-signaling phenotypes, such as lifespan. Lifespan is a well studied phenotype of insulin signaling, and *daf-2* insulin receptor mutants have been shown to live twice as long as wild type. Knowing that *nekl-3* RNAi slightly increases dauer formation and that adding glucose exacerbates this effect, I anticipated an *smn-1* knockdown would decrease lifespan and glucose would further reduce the worms' longevity. Preliminary results from the summer indicated glucose shortened lifespan in the empty vector control, and *smn-1* RNAi assays this fall will further investigate the effect of the SMA causative gene.

We thank Renee and Anthony M. Marlon, M.D., '63, for their contributions to the Summer Science Program.

Poster 103

Genomic Instability in the Absence of Heterochromatin

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Proteins involved in epigenetic regulation of cells have become an integral part of cancer research. Specifically, proteins involved in regulation of heterochromatin have emerged as one of the key proteins whose aberrant regulation is implicated in nearly all cancers. One hypothesis suggests that these proteins are required for maintenance of genomic stability. The Motamedi Lab is focused on the how heterochromatin domains are established, maintained and propagated using the fission yeast as a model. In *S. Pombe* the proteins Sir2, Clr4 and Ago1 are involved in heterochromatin formation via histone deacetylation, histone methylation, and RNAi-dependent targeting of heterochromatin factors, respectively. All of these proteins are involved in the functionality of heterochromatin. By growing cells lacking these proteins, we plan to ask how the stability of the individual genomes changes over many generations. If heterochromatin factors are required for maintenance of genome stability, then we predict that cells lacking these proteins will display a higher rate of mutation compared to wild-type strains. Through deep sequencing we will learn about the type and frequency of mutations the genome has undergone, and gain knowledge on how heterochromatin modifications contribute to genome stability.

Poster 104

Effect of Admission in Latent Labor on the Rate of Cesarean Delivery

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This study explores whether being admitted in early labor predisposes a woman to cesarean delivery (CD). The national average CD rate is 33%, having risen steadily from 1996 to 2011 and then having plateaued from 2011 on. At Hartford Hospital in Hartford, CT, the CD rate is somewhat higher at 36.2% as of 2014. Despite the previous increased CD rate, fetal and maternal outcomes have not improved. By exploring factors that may be increasing the CD rate, such as admission in latent labor, the hope of the study is to be able to identify patients with potential risk factors so as to avoid unnecessary CD. In order to identify factors that could contribute to a risk of CD, this study looks at nulliparous term singleton vertex patients (NTSV), a group of patients who should ordinarily be at a low risk for CD. This is a retrospective cohort study that hopes to evaluate 1) the baseline prevalence of NTSV patients to labor and delivery in latent versus active labor and 2) if admission in latent labor is a contributing factor to increased risk for CD. The hypothesis is that admission of NTSV patients in latent labor results in increased risk of cesarean delivery compared with admission in active labor. Research is ongoing.

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