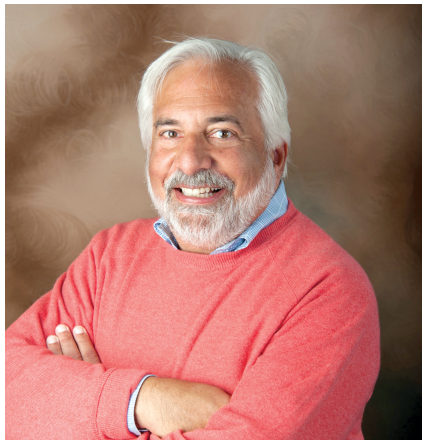
COLLEGE OF THE
Holy Cross

Twenty-Third Annual Symposium of the Dr. Charles S. Weiss Summer Research Program

September 9, 2016
Hogan Ballroom

With great joy, we proclaim that the summer research program at Holy Cross shall be known henceforth as the "Doctor Charles S. Weiss Summer Research Program."



Charles "Chick" Weiss joined the psychology faculty in 1975 with a Ph.D. in neurobiology and physiology from Ohio University. An esteemed professor, mentor and scholar, Professor Weiss served as the chair of the psychology department from 1984 to 1989. He continued to serve the College through significant administrative roles as the Coordinator of Grants and Research (1989-95), the Director of the Office of Grants and Corporate and Foundation Giving (1995-2003), and the Director of Strategic Initiatives and Corporate and Foundation Relations from 2003 until his retirement in 2016. Professor Weiss was integral to bringing major projects to life, most notably the College's $64 million integrated science complex, Brooks Concert Hall, and the Summer Research Program.

From its humble beginnings, the Summer Research Program has grown to accommodate more than 100 students across all disciplines at the College. Students are given the time, structure, and resources to fully immerse themselves in their projects in a way that fosters a close mentoring relationship with a faculty member, teamwork with other students involved in the project, and a sense of autonomy as many students continue their work during the academic year.

Over his remarkable 41 yearlong career at the College, Professor Weiss has supported and improved the College's education and infrastructure, leaving a lasting mark on Holy Cross.

Dear Members of the Holy Cross Community,

Welcome to the 2016 Summer Research Symposium. Now in its 23rd 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 2016. 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.

2016 Symposium Organizing Committee

Andre Isaacs, Department of Chemistry
Geoffrey Findlay, Department of Biology
Daniel Bitran, Science Coordinator

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

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University of Michigan MCubed program, the Institute for Research on Women and Gender, and the Population Studies Center

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. Victor Matheson, Director of the Summer Research Program in Economics.

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Poster 1

Investigation of Mixed Monolayer Systems on Au(111)

D. M. Fitzgerald, E. K. Krisanda, C. G. Szypko and L. G. Avila-Bront
Department of Chemistry, College of the Holy Cross

The self-assembly of octanethiol and biphenyl-4-thiol (BPT) on the surface of Au(111) is studied with scanning tunneling microscopy (STM) at the molecular level. The STM uses quantum mechanical tunneling as a means to probe the surface and characterize molecular layers. The molecules have been studied both independently and as a co-adsorbed system. From the images generated, topographic information such as spacings between molecules and their domain arrangements are observed. Independently, BPT molecules arrange in ordered rows with intermolecular spacings of 4-6 Å. Octanethiol monolayers possess high packing density and characteristic etch pits indicative of strong chemisorption of the thiol to the surface of gold. By manipulating variables such as concentration, anneal time, and temperature, optimization of monolayer structure can be achieved. Once consistent monolayer formation procedures have been developed, further investigation will focus on the patterns that form when both octanethiol and BPT form a co-adsorbed system on the surface of Au(111).

We thank Jeanne and James Moye, P15, 10; and Jacqueline H. and George A. Paletta, Jr., M. D. ’84, P15 for their generous contributions to the Alumni/Parents Summer Research Scholarship Fund as well as the Dean’s Office of the College of the Holy Cross for additional funding.

Poster 2

Defending the Iliadic Tradition: A Diplomatic Edition of *Iliad* 17

C. Hanley, M. Kelley, C. Scannell, M. Wauke, M. Ebbott, and N. Smith
Department of Classics, College of the Holy Cross

Over nearly a millennium, oral bards composed and recomposed the *Iliad* in individual performances. Our Homer Multitext team seeks to recover an understanding of the work’s multiform nature, which conventional scholarship obscures. To this end, we have created a digital edition of Book 17 from the tenth-century Venetus A, the oldest complete manuscript of the *Iliad*. Our diplomatic approach to editing requires recording every 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 mythological background, provide insight into the text’s multiformity. Our study of this multiformity relies on analysis of text reuse. As we edit, we label each occurrence of text reuse with TEI markup. We then extract these occurrences to independently analyze and categorize each one. This process offers insights into the history of the poem’s composition and transmission. For instance, we automatically extracted references to Alexandrian editors from scholia containing multiforms. We statistically analyzed a three-book sample to determine that there is a strong correlation between multiforms and three specific Alexandrian scholars. We believe this correlation suggests that these scholars strongly influenced the multiforms which the Venetus A transmitted.

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

Poster 3

Progress Toward the Total Synthesis of (+)-Cryptofolione and Development of Natural Product Analogues

K. A. Nicastri, C. N. Ndi, J. Torres, and P. R. Hanson
Department of Chemistry, The University of Kansas

Efforts toward the total synthesis of (+)-Cryptofolione employing a convergent synthetic strategy are presented. (+)-Cryptofolione was isolated from the crude extract of *Cryptocarya conncina*, a plant of the laurel family found in Brazil, and is known to be a G_2 checkpoint covalent inhibitor in human breast carcinoma MCF-7 cells. Structural features of Cryptofolione include a phenyl-substituted olefin, a 1,3-anti-diol subunit, and an α,β-unsaturated δ-lactone moiety. Highlights of the current synthetic method, include: two one-pot phosphate tethered-mediated sequential protocols, namely RCM/CM/H_2 and allylic transposition/tether removal, to generate the linear portion of the bioactive molecule. An RCM strategy was explored to generate the α,β-unsaturated δ-lactone piece. By employing a strategy amenable to modification of the electrophilic subunit, it is possible to produce natural product analogs to profile both their reactivity and biological response.

This work was supported by a Research Experience for Undergraduates grant made by the National Science Foundation.

Poster 4

University Responses to Sexual Violence on Campuses

H. Tulinski, E. A. Armstrong, and S. R. Levitsky
Department of Sociology, University of Michigan

Over the past couple of decades, colleges and universities have experienced increasing pressure from the federal government to prevent sexual violence. Several federal acts and amendments have put forth new standards of institutional responsibility to respond to sexual misconduct more effectively. Title IX of 1972, which prohibits sex discrimination in educational programs receiving federal financial support, was later followed by the Clery Act of 1990, requiring institutions to disseminate details about its crime statistics. The SaVE Act, a 2014 amendment to the 1990 Violence Against Women Amendment, further placed more responsibilities on academic institutions to prevent sexual misconduct. In response, universities and colleges across the country are reevaluating their policies and practices around campus sexual misconduct. One aim of this project is to evaluate what policy changes are occurring and how these schools are complying with their obligations. Our data set reflects the varied responses by documenting the Annual Security Reports of 380 colleges and universities, including language, content, and categories of misconduct. We investigate how universities respond to and navigate the legal environment. We ask, what does "compliance" with Title IX sexual misconduct policies look like? Because sexual misconduct creates educational environments that discriminate on the basis of sex, this investigation brings to question an academic institution's eligibility for federal funds. Currently data collection and analysis is ongoing, and the projected goals include classifying institutions according to levels of compliance, as well as making recommendations for universities to better uphold federal mandates and to foster safe academic environments.

This research was funded by the University of Michigan MCubed program, as well as the University's Institute for Research on Women and Gender, and the Population Studies Center.

Poster 5

Salt-Dependent Protein Splicing in Extreme Halophiles

D. A. Reidy, C. J. Janton, J. N. Reitter, and K. V. Mills
Department of Chemistry, College of the Holy Cross

Protein splicing is a post-translational process by which an intervening polypeptide, or intein, can excise itself and ligate the flanking polypeptides, or exteins. Inteins have been found in two extreme halophiles, *Halobacterium salinarum* (*Hsa*) and *Haloquadratum walsybi* (*Hwa*). Previous work in the lab demonstrated that splicing of the *Hsa* DNA Polymerase II (Polll) intein is salt-dependent. We compared the in vitro activity of the *Hsa* Polll intein to that of the only other *Hsa* intein, which interrupts the Cell Division Control protein (Cdc21a). The *Hsa* Cdc21a intein does not splice in E. coli, but can be induced to splice at very high salt concentrations under reducing conditions in vitro. We plan to compare the splicing of the *Hsa* Polll and Cdc21a inteins to the homologous inteins in *Hwa*. Additionally, we investigated the salt dependence of isolated C-terminal cleavage of the *Hsa* Polll splicing mechanism.

This work was supported by the National Science Foundation (grants MCB-1244089 and MCB-1517138 to KVM), the Dreyfus Foundation (KVM), and a generous gift by William F. McCall, Jr. to the Alumni / Parents Summer Research Scholarship Fund (DAR).

Poster 6

Spanning Tree Modulus and Homogeneity of Undirected Graphs

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The *p*-modulus of a family of objects on a discrete graph provides a method for quantifying the "richness" of the family. When applied to the family of spanning trees of a simple, undirected graph, modulus has a particularly interesting probabilistic interpretation. Among all possible probability mass functions (pmfs) on the set of spanning trees, modulus selects those that most evenly distribute the usage of graph edges. If a graph admits a pmf such that all edges are equally likely to appear in a random spanning tree, the graph is called homogeneous. If the uniform distribution on spanning trees is optimal, the graph is called uniform. We present a necessary and sufficient condition for a graph to be both uniform and homogeneous. Numerical experiments suggest large, well-connected, non-homogeneous graphs are rare. We present a sufficient condition for the homogeneity of *d*-regular, connected graphs. This condition suggests that as *d* gets large, *d*-regular graphs are almost surely homogeneous. Since any graph can be decomposed into homogeneous components using a process called deflation, understanding homogeneous graphs is the primary focus of this project.

This research was funded by NSF grant DMS-1262877 at the SUMaR REU at Kansas State University. Thanks to K-State, Dr. Albin and all who helped make this project possible.

Poster 7

Convergent Synthesis of *trans*-Alkene Peptide Isosteres

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Peptides are short chains of amino acids that are formed when the carboxyl group of one amino acid is linked to the amino group of another. The bond that is formed, known as an amide bond, can be broken when it meets the conditions that exist in the human stomach, rendering peptides poor candidates for widespread use as pharmaceuticals. The hydrogen atom bound to the nitrogen in the amide bond is able to interact with highly electronegative atoms via hydrogen bonding. These interactions are responsible for the recognition of peptides by other molecules and the three-dimensional shape of larger peptides. The aim of our research lab is to replace the amide bond with a carbon-carbon double bond, a *trans*-alkene bond, forming a peptide mimic known as a *trans*-alkene peptide isostere. This modified peptide is better able to withstand physiological conditions while maintaining the size and geometry of a peptide, but lacks the ability to form hydrogen bonds due to the loss of the amide functional group. The Sculimbrene lab is interested in finding efficient ways to synthesize these peptide isosteres from any of the 20 naturally occurring amino acids. We have previously published methods of synthesizing the D-Ala-D-Ala *trans*-alkene peptide isostere and used this biological mimic to study bacterial resistance to the antibiotic Vancomycin. Our current target, the Leu-D-Phe peptide isostere, mimics the naturally occurring antibiotic Gramicidin. Gramicidin is a cyclic peptide that demonstrates a high affinity for mitochondrial membranes, rendering it an important subject in the study and development of pharmaceuticals. Our convergent synthetic approach synthesizes the N- and C-terminal alkenes separately, then, in the key step, combines them via the Nobel Prize-winning reaction olefin cross-metathesis.

We thank Mr. and Mrs. Wendell P. Weeks (P15) for financial support.

Poster 8

Depression and Anxiety Impair Cognitive Control to Cocaine Cues in Veterans with Cocaine Use Disorder

M. Andre, P. Patnaik, and G. DiGirolamo
Department of Psychology, College of the Holy Cross

Cue-induced craving is an important clinical feature of cocaine use disorder (CUDs) influencing both use and relapse, and, recently added as a core DSM-V symptom in CUD. In the general population of CUDs, levels of cue-induced craving (changes in self-reported craving following cocaine cue exposure) modulate cognitive control to cocaine cues (DiGirolamo et al., 2015). The present study extends this research by examining the factors that influence breakdowns in cognitive control in veterans with CUD. Veterans suffer from higher rates of substance abuse but also higher rates of mood disorders. Here we determine what factors predict cognitive control deficits in a modified drug antisaccade task in veterans with CUD. 24 CUD veterans were asked to control their eye movements toward either a cocaine or neutral cue by looking away from the suddenly presented cue. The relationship between breakdowns in cognitive control (as measured by eye errors), and cue-induced craving and mood disorders was investigated. Veterans made significantly more errors to cocaine cues than neutral cues ($p < 0.0007$), demonstrating a breakdown in cognitive control. Regression analysis revealed cue-induced craving was not predictive of breakdowns in cognitive control, but mild depression and anxiety scores ($p < 0.0009$, in both cases) were significant predictors, showing that mood disorders modulate breakdowns in cognitive control in veterans. These results suggest that treating depression and anxiety rather than craving may better ameliorate substance use and abuse in the veteran population.

We thank Mr. and Mrs. John Kirby Bray '79 for their generous support of Michael Andre; the NIH and the VA for their financial support; and the veterans for their willingness to participate to further research in treatments for addiction.

Poster 9

Enantioselective Catalytic Phosphorylation

P. Endres and B. Sculimbrene
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Organic molecules that contain a phosphate are incorporated in many aspects of biochemistry such as DNA, RNA, proteins, and pharmaceutical drugs. Living organisms make these molecules by converting an alcohol into a phosphate, a reaction termed phosphorylation. Phosphorylation often "activates" molecules in the body and unlocks its functional potential. The Sculimbrene Research lab is interested in developing catalytic enantioselective phosphorylations in the laboratory. The reaction we are studying will be used for the selective synthesis of FTY720-phosphate, an immunosuppressant drug for the treatment of Multiple Sclerosis. FTY720-phosphate is synthesized in vivo from FTY720, a diol (a molecule containing two alcohols) that must be selectively monophosphorylated to obtain the active drug. Enantioselective phosphorylation of FTY720 in the laboratory would enhance the synthesis of this new immunosuppressant drug. Previously, the Sculimbrene lab has developed a Lewis acid catalyst that monophosphorylates diols in high yield. Our work now examines which alcohol of the diol is phosphorylated. We are using an array of binapthol ligands to optimize the enantioselectivity of our reaction; (i.e. which alcohol gets phosphorylated). Additionally, we are studying different conditions: solvents, temperatures, and catalyst preparations in order to increase the enantioselectivity.

I thank Kim and Wendell P. Weeks P15 for their generous financial support of the summer science research program.

Poster 10

Analyzing the Prospects of Renewable Energy Generation and Achieving Carbon Neutrality by 2040

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In 2007, the College of the Holy Cross pledged that the College would achieve total carbon neutrality - zero net emissions of carbon dioxide equivalents - by 2040. Holy Cross has made substantial progress towards this goal; as of 2014, the College's net emissions were down 44% from their 2007 levels. However, this progress has been achieved largely by harvesting "low-hanging fruit," i.e. transferring the boiler plant from running on highly pollutant oil to relatively clean (but still pollutant) natural gas. Pope Francis released the encyclical letter *Laudato Si'* on May 24, 2015. In *Laudato Si',* the Holy Father called on the "whole human family" to immediately step up to face the "urgent challenge to protect our common home." The challenge he referred to is climate change and the devastating consequences it has begun to wreak across the globe. We spent our research time considering how the College could respond to the Pope's call and overcome the remaining obstacles to carbon neutrality. We concluded: (1) the College should consider installing solar photovoltaic systems on the roughly 245,742 sq. ft. of solar-suitable rooftop space; (2) Holy Cross should begin raising money for a "Sustainability Fund" to retrofit all existing buildings with geothermal heating and cooling systems, which could eliminate 70% of remaining emissions; (3) that the College consider installing a wind turbine at the new retreat center; and (4) that the College should pledge to make all future buildings carbon neutral by including geothermal heat pump systems and solar panels in the designs.

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

Poster 11

Don't Be Salty: Protein Splicing of Salt Dependent Inteins from *Haloquadratum walsbyi.*

A. K. Lynch, S. Amunya, J. N. Reitter, and K. V. Mills
Department of Chemistry, College of the Holy Cross

Protein splicing is a self-catalyzed, post-translational process in which an intervening polypeptide (intein) catalyzes its own removal from the flanking polypeptides (exteins), as well as the ligation of the exteins. We are interested in the splicing of two inteins interrupting the cdc21 protein from *Haloquadratum walsbyi* (*Hwa*). *Hwa* is a halophilic archaeon. Because of this, we hypothesize that protein splicing may be salt dependent. The first intein, Cdc21a, does not splice on overexpression in *E. coli,* but can be induced to splice *in vitro* on incubation with 2.5 M sodium chloride at 28°C. The second intein, Cdc21d, splices *in vivo*, and further splicing can be induced *in vitro* with higher concentrations of salt. While the first intein requires 2.5 M salt to splice, Cdc21d requires only 500 mM salt to induce additional splicing. Given that both inteins interrupt the same protein, this differential activity could result in different protein products due to alternative splicing in the full precursor.

This work was supported by the National Science Foundation (grants MCB-1244089 and MCB-1517138 to KVM) and the Dreyfus Foundation (KVM).

Poster 12

Electrochemical Properties of Amines on Planar Platinum Surfaces

K. Wong, M. Ma, and E. C. Landis
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Platinum is a reactive metal that serves as a catalyst in direct methanol fuel cells that can be used to generate electricity. Our goal is to understand the fundamental catalytic activity of platinum towards methanol oxidation. We studied how self-assembled monolayers of amines on platinum affect catalytic reactivity. In order to have reproducible results, we used robust platinum electrodes with similar surface area. We varied the chain length of the molecules and functionalization time. Using cyclic voltammetry and infrared spectroscopy, we were able to analyze the catalytic properties quantitatively and understand the ordering of the molecular layer. We find that shorter functionalization time and smaller molecules both result in higher catalytic activity.

We thank the American Chemistry Society Petroleum Research Fund and the Dean's Office of the College of the Holy Cross for financial support.

Poster 13

Cocaine Dependent Patients Show both Breakdowns in Cognitive Control and Increased Arousal to Cocaine Cues

P. Patnaik, M. Andre, and G. DiGirolamo
Department of Psychology, College of the Holy Cross

Patients with cocaine use disorder (CUDs) exhibit deficits in cognitive control toward cocaine-related cues (DiGirolamo et al., 2015). But why these breakdowns in cognitive control arise is unknown. One potential mediator of increased breakdowns in cognitive control could be arousal. Arousal plays an important role in our cognitive capabilities from the extreme of lesions to the reticular activating system leaving people in coma to the daily modulations of cognitive systems by arousal…we've all had that afternoon crash! While arousal can be useful, increased arousal also leads to an increased difficulty in exerting cognitive control (DiGirolamo, Patel and Blaukopf, 2016). Since increased arousal leads to more cognitive control errors, we hypothesize that CUDs would exhibit increased arousal following presentation of a cocaine cue leading to more breakdowns in cognitive control to cocaine cues. We measured cognitive control in 69 CUDs during a modified drug antisaccade task (look away from this suddenly appearing cocaine picture). We also examined arousal (pupil diameter) following cue-presentation. In CUDs, pupil diameter was significantly greater for cocaine cues than neutral cues ($p < 0.001$). Moreover, CUDs made significantly more errors to cocaine cues than neutral cues ($p < 0.003$). CUDs experienced increased arousal following cocaine cues leading to increased breakdowns in cognitive control. Clinically, cocaine stimuli in the environment can lead to increased arousal in CUDs, leading to a failure to exert cognitive control and likely drug use.

We thank Mr. Jack D. Rehm, Jr. '88 P20, 18, 16 and Ms. Kathleen Millard Rehm '89 P20, 18, 16 for their generous support of Pooja Patnaik; as well as the NIH for its financial support.

Poster 14

Topological Modeling of Force Networks in Granular Materials

D. Damiano and E. Winn
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College of the Holy Cross

Granular materials, or collections of solid macroscopic particles in contact with each other, play an important role in chemistry, pharmaceutical sciences, and agriculture. Despite their importance, little is understood about the force networks formed from inter-particle contacts in these materials because of the difficulty of modeling large networks. The challenge lies in finding a model that is specific enough to characterize the local topology of a cell while still being robust enough to capture information of the entire network. A recently developed method that may answer this dilemma is the swatch and cloth, which uses adjacency graphs and statistics to model random cell networks. In this talk, we discuss how the swatch and cloth model can be applied to these force networks to facilitate comparisons of materials and their bulk properties. We also address applying swatch and cloth to communities, or partitioned sub regions, of a force network to examine different parts of one network.

We thank Dr. Dan Kennedy '68 for financing this research and the Holy Cross Summer Science Research Program for their support.

Poster 15

Understanding Social Synchrony in an Interview Setting

M. Strunk and R. Schmidt
Department of Psychology, College of the Holy Cross

Previous studies have shown that socially synchronous behavior can be found in nearly all aspects of social interactions and breaks down in social disorders such as autism and schizophrenia. Additionally, the bodily movements in social interactions have been found to display a fractal scaling of variability across timescales—a fact that indicates the metastability/flexibility of the underlying behavioral dynamics. The current project investigated the bodily activity in a natural interview setting and evaluated the importance of the interviewer and interviewee having visual information of each other. An interviewer (confederate) asked participants various questions pertaining to Holy Cross, and video recordings of the interviews were taken. Additionally, participants were asked to complete questionnaires evaluating their experience of the interview as well as their social skills. The bodily activity of the participants was measured by evaluating the degree of pixel change in the recorded video from frame to frame. We anticipate that the bodily activity of the interviewer and interviewee will be synchronized when they had visual information of each other but were not synchronized when they were not able to see each other. Moreover, we predict that bodily synchronization of the dyad as well as the fractality of the bodily movements of the interviewee will be related to the degree of social skills of the interviewee.

This research was made possible by a grant from the National Institutes of Health (R01GM105045 to RS).

Poster 16

A Bayesian Approach to Predicting the Outcome of Endovenous Laser Ablation

S. Chung, A. Pinkerton, H. Rehm, and M. Yu
Department of Mathematics, California State University, Fresno

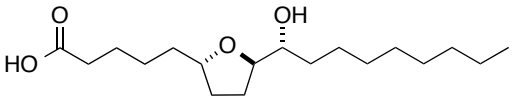
Varicose veins affect more than 40 million people in the United States. Endovenous Laser Ablation (EVLA) is a common and highly effective treatment method for varicose veins. The success of EVLA may depend on several key variables: laser power, time, length of vein, laser energy, and linear endovenous energy density (LEED), as well as combinations of these variables. In this study, we consider the Bayesian and parametric logistic regression models to predict the treatment outcome from these key variables. We use the Monte Carlo cross validation to assess the models. Our finding indicates that the Bayesian logistic regression is a better predictive model than the parametric logistic regression.

We thank the National Science Foundation (DMS-1460151) for financial support.

Poster 17

Efforts Toward Total Synthesis of (+)-Bovidic Acid

A. B. Millham and K. J. Quinn
Department of Chemistry, College of the Holy Cross



(+)-Bovidic acid is an 18-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 cyclic acetal. Functionalization via $TiCl_4$-catalyzed allylation allows for the establishment of the 2,5-*trans* stereochemical relationship of substituents on the target tetrahydrofuran (THF) ring. 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 College of the Holy Cross Office of the Dean is gratefully acknowledged.

Poster 18

Hydrogen Bonding Strength of Oxygen and Sulfur, and New Ways to Synthesize Amines

K. Marzotto and B. Linton
Department of Chemistry, College of the Holy Cross

Oxygen and Sulfur are in the same column in the periodic table and have similar properties. Although the hydrogen bonding strength of oxygen is fairly well known, that of sulfur still remains relatively unresolved. Our work compared the hydrogen bonding strength of the two by synthesizing molecules that either promote or prevent intramolecular hydrogen bonding to oxygen or sulfur. We used three different techniques to probe the hydrogen bonding strength. We also looked at new ways to create amines. Although there are existing methods to create amines such as the Gabriel Synthesis, we wanted to create a synthesis that would work on an array of molecules under easier, less forceful conditions.

We thank Richard A. Marfuggi, M.D. '72 for financial support.

Poster 19

Copper-Catalyzed Approach to β,γ-Unsaturated Amides

A. Bosse and A. 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 a terminal alkyne with tosyl azide. In a one-pot copper-catalyzed process, the 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. To date, few nucleophiles are known to react with the electrophilic carbon of the ketenimine. In the Isaacs lab we are interested in expanding the substrate scope of nucleophiles that can engage with the ketenimine. By reacting propargyl alcohols under the 'click chemistry' conditions, we form ketenimines *in situ* which then are attacked in an intramolecular fashion to afford various β,γ-unsaturated amides. β,γ-unsaturated amides are an important functional group that can be seen in various natural products and pharmaceuticals. In the past β,γ-unsaturated amides have been challenging to synthesize due to the difficulty of implementing the pi-bond in the beta gamma position. This method allows for facile and selective formation of β,γ-unsaturated amides in a one pot, one step reaction, adding to the growing repertoire of chemical reactions.

We thank the Research Corporation for financial support.

Poster 20

The Cinderella Agency: A Critique of Feminist Reworkings of the Tale

P. Corey and A. Adams
Department of Modern Languages and Literatures,
College of the Holy Cross

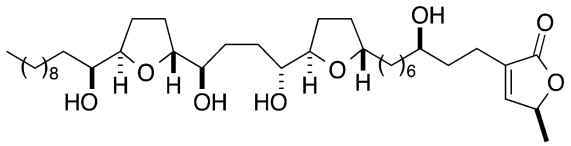
Specifically, from the start of the 1960's Feminist Liberation Movement to modern times in 2016, there has been a marked increase in feminist rewritings of the Cinderella tale in film and various narrative forms. The majority of such rewriters approach the heroine of the traditional Cinderella tale as too "passive" and "anti-feminist," misunderstanding Cinderella's passivity. It was revealed that Cinderella's perceived passivity is located within the "shoe test," – that Cinderella represents the object of desire, which does put Cinderella in a passive position in a "way". However, Cinderella's passivity represents much strength, such as honing intuition and introspection through the Eastern tradition of hesychasm. Hesychasm reveals a specific way of praying, turning inward and denying desires to fully achieve visceral knowledge of God, which may be interpreted – especially in western culture – as undesirable "passivity" and equating to no personal or sexual agency. By negatively assigning Cinderella's passivity, readers misunderstand that this characteristic is used as a saving power, which is the vehicle to her own self transformation and actualization. My interpretation turns the feminist retellings on their ear by assigning a positive value to what scholars regard as negative passivity, which reconfigures perceptions of what seems to represent authentic heroic attributes – transforming essentialist ideas of womanhood in relation to heroism.

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

Poster 21

Synthetic Studies on Squamostanin C

P. J. Miller, Y. Hu, and K. J. Quinn
Department of Chemistry, College of the Holy Cross



Squamostanin C is a cytotoxic member of the Annonaceous acetogenin family of natural products that are isolated from the seeds of the sugar-apple fruit 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.

We thank Mr. and Mrs Domenic J. Dinardo ’75 P17, 06 and Mr. and Mrs. Stephen R. Winslow P14, 16 for their generous financial support of the Summer Research Program in the Sciences.

Poster 22

Preliminary GIS-based Analysis of the Presence and Distribution of Ice-filled Cirques

X. Zeng and S. G. Mitchell
Environmental Studies, College of the Holy Cross

In previous studies, the distribution of cirques, a type of erosional glacial landform, is correlated with local Quaternary average equilibrium line altitudes (QA-ELAs). This correlation suggest that cirques contribute to the “glacial buzzsaw,” a process whereby glacial erosion is hypothesized to limit the height of mountains. However, this correlation might simply be an artifact of the study sites, which included only ice-free mountains. In this study, we investigate the location and distribution of cirque-like overdeepenings beneath the Aletsch Glacier in Swiss Alps and compare the results with those in the nearby, ice-free Maggia Valley, and the local QA-ELA. We use ArcGIS to extract ice-surface profiles, apply Haeberli and Hoelzle’s (1995) parameterization scheme to estimate glacial ice depth, and locate “potential” cirque floors based on the resulting sub-ice bedrock profiles. Our preliminary data show an average potential cirque floor elevation at the Aletsch Glacier is 3369±190 m, higher than the QA-ELA (2400 m) and the average in the Maggia Valley (2212±342 m). Cirque relief is 505±204 m at the Aletsch Glacier, comparable to 523±290 m in the Maggia Valley. The average distance from headwall to cirque is 581±367 m at the Aletsch Glacier, compared to 744±528 m in the Maggia Valley. It appears that cirques in this area form at a set distance below peaks rather than at the QA-ELA. Further work is necessary to determine whether cirque formation has an important role in limiting peak heights.

We thank Michele K. and David M. Joy '74 P11 for their support of the Summer Research Program in the Sciences.

Poster 23

Responses to Rachel Carson: Gender, Business, and Religion

J. Cormier and J. Poché
Department of History, College of the Holy Cross

Scientist and writer Rachel Carson caused an uproar in the 1960's when she published *Silent Spring,* her cautionary study on the dangers of unchecked pesticide use. While existing research and publications focus on a more biographical approach to Carson, this project specifically explores her role in transforming both the gender politics of environmental science as well as causing many to reconsider the moral relationship between humans and the natural world. Through the use of archival and periodical sources, it investigates public and private reactions to Carson's work. After chemical companies published propaganda painting Carson as nothing more than an uninformed female with a typewriter, average American women supported Carson with letters to local newspapers corroborating the reality of pesticide poisonings and calling attention to her scientific credentials. Carson's work also caused some to question the religious role of humans on earth—what exactly does it mean to hold dominion over all of nature, as described in the Bible's Book of Genesis? Analysis of these varied responses through the 1960's reveals the significant ties between gender, industrial politics and the nature of moral leadership in this critical period of American history.

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

Poster 24

Copper-Catalyzed Reactivity of Ketenimines

M. Beauchamp, G. Farley, 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 make up the core structure 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 both intramolecular and intermolecular pathways. This methodology enables the synthesis of previously unattainable complex compounds that include non-carbon elements.

This research was made possible by a grant from the Research Corporation and from the financial support of the Summer Research Program in the Sciences.

Poster 25

Isolating Multivalent Peptide-DNA Interactions Using Nanomaterial Scaffolds

C. Brown, A. Hartmann, and J. Rouge
Department of Chemistry, University of Connecticut

Nanomaterials have persisted amid biotech innovation with aspiring potential. Oligonucletotide-modified nanoparticles have displayed revolutionary drug delivery capabilities due to their small size and enhanced chemical stability within the human body. The ultimate objective of nanoparticle assisted drug delivery research and development is to effectively and efficiently deliver therapeutics while avoiding the harmful and debilitating side effects associated with classic drug delivery, particularly off target effects. The following research employed nucleotide-modified gold nanoparticles and is aimed at studying both specific and nonspecific interactions between a peptide and an enzyme assembled nanomaterial. The target peptide chosen for this project is involved in a variety of inflammation pathways, and is of particular relevance to asthmatic inflammatory responses. An in-vitro selection was performed to isolate randomized DNA biopolymers that bound specifically to Ovalbumin (OVA) peptide, an epitope of the peptide involved in the activation of helper T-cells and generation of asthmatic immune response. The hope of this research is to find a new, functional DNA molecule that selectively binds to OVA peptide and therefore inhibits asthmatic inflammation response.

I thank the National Science Foundation and University of Connecticut for financial funding and facilities. I am also thankful for the guidance provided to me by Dr. Jessica Rouge and Alyssa Hartmann throughout my summer research. This research was supported by the NSF grant: REU site Chemistry at the University of Connecticut (CHE-1359081).

Poster 26

The Answer Isn't Crystal Clear: Crystallography of Inteins from *Halobacterium salinarum*

O. Conroy, W. Zhang, J. N. Reitter, and K. V. Mills
Department of Chemistry, College of the Holy Cross

Protein splicing is a post-translational modification by which a segment of protein, known as intein, self-catalyzes its excision from the flanking protein while simultaneously ligating the two flanking exteins. Inteins can be found in many types of archaebacteria, such as halophiles, which specifically thrive in environments with high salt concentrations. The lab previously reported that the *Halobacterium salinarum* (Hsa) DNA polymerase II (Pol II) intein promotes conditional protein splicing at high concentrations of sodium chloride. To study the structure of the intein, we attempted to find conditions for the formation of protein crystals of the unspliced Hsa fusion protein under conditions of different salt concentrations and non-salt precipitating reagents. Furthermore, we also attempted to learn if splicing of two inteins from *Haloquadratum walsbyi* is also salt dependent (the inteins interrupting Replication Factor C (RFC) and DNA Gyrase B (GryB)).

This work was supported by the National Science Foundation (grants MCB-1244089 and MCB-1517138) and the Dreyfus Foundation. We also thank the Robert J. Stransky Foundation for its support of the Summer Science Research Program.

Poster 27

Motifs and Meanings in Iban Ritual Textiles

M. MacMullin and S. Rodgers
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Southeast Asian textiles are often overlooked by Western art historians. When they are remembered, these complex cloths tend to be misunderstood. As a classics major, I initially fell into the same trap as many scholars before me: if the motifs of Iban *pua kumbu* (large blankets or covers) and *kain kebat* (ceremonial skirts) could be categorized into a glossary of symbols, researchers could decode the cryptic visual language. However, further reading, textile lessons in Indonesia, interviews with weavers in Malaysia, and museum visits and observations with my peers in summer 2016 led me to a different conclusion: only the weaver can read her textile and understand fully her intentions. As unsatisfying as this answer may be, it seems the only one appropriate. Though scholars such as Alfred Haddon and Michael Heppell suggest otherwise, Traude Gavin, Datin Amar Margaret Linggi, and the weavers with whom I spoke concur: the textiles are powerful metaphors that cannot be so easily decoded, unlike many of the Western artworks I have studied in other courses.

We thank the Summer Research Program in the Social Sciences, Humanities, and Fine Arts for financial support, and Michael ’93 and Jennifer Figge for their gift to the Cantor Art Gallery enabling the “Woven Power” exhibition.

Poster 28

Iban Textiles and Colonial Power Relations

M. Umunna and S. Rodgers
Department of Sociology and Anthropology, College of the Holy Cross

Ikat textiles are hand-manufactured by wrapping small portions of the threads to resist dyes and build up complex patterns of motifs and hues. Ritual ikats were made by Iban and Dayak women in Malaysian and Indonesian Borneo to communicate with the gods, to protect shamans, and (before pacification) to receive trophy heads from warfare. Older women were held in high regard for possessing secret knowledge and powers connected dyeing, weaving, fertility, and rice field generativity. Yet, the introduction of colonial control in Sarawak by Sir James Brooke, a British adventurer and founder of the “White Rajahs” dynasty (1841-1946), greatly affected Iban weaving culture. Changes included Christian missions, immigration of Chinese merchants to Sarawak, introduction of Western schooling, and the end of head hunting. This study focuses on the historical settings for ikat textile *pua kumbu* (weaving large blankets or covers) of the Iban of Sarawak. I ask how the *pua kumbu* transitioned from ritual object to heritage art during the Brooke era and also today. This project is based on 5 weeks of intensive readings on textiles of Southeast Asia and textiles of Iban and Dayak people, a week of weaving lessons in Saori Weaving Studio in Worcester, and 2 weeks of fieldwork in Sarawak, Malaysia studying textiles and interviewing Iban weavers. This project works in conjunction with the Fall 2016 Cantor Art Gallery exhibition curated by Susan Rodgers, professor of anthropology: “Woven Power: Ritual Textiles of Sarawak, Malaysia and West Kalimantan, Indonesia,” which will run from August 31-December 14, 2016.

We thank the Holy Cross Summer Research Program for financial support, and Michael ’93 and Jennifer Figge for their gift to the Cantor Art Gallery enabling the “Woven Power” exhibition.

Poster 29

Orientalism and Iban Headhunting Legacies

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The Fall 2016 Cantor Gallery exhibit "Woven Power" displays 32 antique *pua kumbu* cloths and 11 *kain kebat* ceremonial skirts woven by the Iban and Dayak peoples of Borneo (c. 1830s-1930s) from John Kreifeldt's collection. These ritual cloths are admired for their beauty yet serve as a difficult point of cultural contact because of their associations with headhunting practices and, by extension, orientalist, sensationalist views of Asia. Through extensive reading on Iban textile traditions and the scholarship on headhunting, and through travels to Indonesia and Malaysia, my fellow "Woven Power" docents and I learned about the continuation of the textile arts in these nations. We studied the rhetoric of modern tourism promotion and perspectives of current scholars on Southeast Asian textiles. This project considers in historical and anthropological context the ritual practices and beliefs of the earlier Iban and Dayak cultures in relation to ritual violence. My work helps gallery visitors to see both the larger context of customary law (*adat*) and indigenous religion surrounding *pua* and headhunting. My project also aims to aid museumgoers in processing the convoluted, politicized accounts of headhunting. This research is directed toward balancing perspectives on the *pua* as a vehicle of spiritual violence in the past and as an art object and symbol of ethnic identity and cultural heritage within modernizing Asian nations in the present.

We thank the Holy Cross Summer Research Program in the Social Sciences, Humanities, and Fine Arts for financial support, and Michael '93 and Jennifer Figge for their gift to the Cantor Art Gallery thereby enabling the "Woven Power" exhibition.

Poster 30

Making Iban Ritual Textiles: Past and Present

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Ritual textiles of Sarawak and West Kalimantan once held significant spiritual and social meaning in Iban and Dayak societies. My fieldwork-based project asked: how have these systems of meaning changed over time in both indigenous societies? I spent three weeks in Southeast Asia learning about textile making through dye lessons with the Indonesian NGO Threads of Life in Ubud, Bali and through interviewing Iban weavers at the Tun Jugah Foundation in Kuching, Malaysia. Textile making is still very much alive today in these regions, but has changed significantly over time. Cloths woven for ritual purposes are now considered heritage art objects and are woven for commercial markets. Ritual cloths are still used as spiritual objects in *gawai* festivals, but their designs are also being appropriated for fashion wear by entrepreneurs such as Edric Ong, of Kuching, Sarawak. The influence of NGOs, conversion to Christianity, market demands, nationalist discourses about ethnic minority cultures, and mechanization of traditional weaving techniques have all contributed to changes in Iban weaving culture. Conversion to Christianity from the 1860s—1930s had a major impact, diluting and secularizing Iban rituals. For example, the chemically and ritually significant process known as *ngar* was a ceremony led only by an Iban woman well versed in the sacred process—knowledge that came to her in a dream. Though the chemical process of oiling threads still exists, the ritual components constituting *ngar* have collapsed.

We thank the Summer Research Program in the Humanities, Social Sciences, and Arts and Michael '93 and Jennifer Figge and their gift to Cantor Art Gallery for the "Woven Power" exhibition and for financial support of our summer research.

Poster 31

Phosphorylation Of Glycerol

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Phosphates play a significant role in a variety of naturally occurring compounds, including DNA, RNA, ATP and phosphoglycerols. Phosphates are typically made by reaction of an alcohol with a phosphorylating agent in a reaction called phosphorylation. Our lab has developed a lewis-catalyzed phosphorylation using titanium alkoxides and tetrabenzyl-pyrophosphate. Using this reaction, we are now interested in the desymmetrization of diols using chiral titanium catalysts. We have chosen protected glycerol as a model diol due to their prevalence in important molecules constituting the lipid bilayer. In order to effect a desymmetrization of glycerol we examined different reaction conditions and studied their effect on the selective phosphorylation. This included varying the solvent, temperature, chiral titanium catalyst and additives. Currently our most selective conditions are using bromobinol as the chiral catalyst in methylene chloride at zero degrees. Under these conditions we saw a 45:55 enantiomeric ratio. Our research will continue to optimize this reaction.

We thank the Dean's Office of the College of the Holy Cross for financial support.

Poster 32

Probabilistic Change Point Analysis on Bond Liquidity

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The role of primary dealers in the bond market has changed with the passage of the Volker Rule (the Rule) in 2010. An unintended consequence of the Rule may be that primary dealers no longer provide an adequate level of market liquidity through large intermediate bond holdings in their own accounts, and instead are more active in matching buyers and sellers. Bid-ask spread data can be used to measure bond market liquidity, since in times of high market liquidity the bid-ask spread has historically been narrow with the inverse also true. In order to determine whether passage of the Rule has materially affected bond market liquidity, a Probabilistic Change Point algorithm was developed in R to analyze historical bid-ask spreads relative to primary dealer net bond positions from 2001 to the present. Change point models allow a piecewise function to be fit to a data set that is expected to require more than one linear regression model and Bayes' Rule is invoked to create a probability distribution on the unknown number of change points and their best-fit locations. Due to the size of the data set, a solution cannot be obtained through brute force methods and a recursive solution to the multiple change point problem was used instead. From our analysis, we found that implementation of the Rule and the subsequent change in dealer inventory had very little effect on bond liquidity.

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

Poster 33

Nonlinear Vertical Oscillations of a Particle in a Sheath of a Radiofrequency Discharge

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Dusty (complex) plasmas are composed of weakly ionized gas and charged micro particles that represent the plasma state of soft matter. They provide experimental versatility via dynamical time and distance scales, yet the micro particles are easily individually visualized. A growing field for physics research, measuring the spatial distribution of the electric field in the plasma sheath has been the goal of much research. A method based on the experimental investigation of vertical oscillations of a single particle in the sheath of a low-pressure radio-frequency discharge is proposed. The oscillations become strongly nonlinear as the rf amplitude increases. The theory of anharmonic oscillations gives estimates for the first two anharmonic terms in an expansion of the sheath potential around the particle equilibrium.

We thank the National Science Foundation for financial support.

Poster 34

Techniques for Identifying and Classifying Counterfeit Drug Packaging

C. Zanini
Pfizer Analytical Sciences, Intellectual Property Forensics Lab, Groton Laboratories

Counterfeit drugs pose a serious health risk to patients. Therefore, Pfizer Global Security (GS) has implemented an aggressive anti-counterfeiting program to detect and disrupt manufacturing facilities and distributors of counterfeit Pfizer drugs. The Intellectual Property Forensic Laboratory (IPFL) analyzes suspected counterfeit drugs seized by GS and external law enforcement agencies. Analytical Instruments, such as the VideometerLab 4, and authentication techniques, such as Systech's UniScan iPhone App, can help analysts identify and verify counterfeits quickly using the surface chemistry of drug packaging (blisters, individual folding cartons, and bottles). After assimilating cases with similar ink colors, determined by the VideometerLab 4, Systech's UniSecure software can decipher whether all the samples are printed using the same printing press configuration. In all, the marriage of these two technologies could enable GS to identify counterfeits in the field, while ensuring the safety of patients and eliminating counterfeits from the global market.

I thank the support of the Pfizer Summer Student Worker Program and Jeffrey DeBartolo, Martin Mikelson, Kathy Ford, Amy Callanan, Brian Donnelly, Jack Leary, and Victoria Masterson for their support.

Poster 35

Analysis of FAME and Sterol Profiles in Biodiesel Using Gas Chromatography

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Due to environmental concerns, the use and study of biodiesel has gained interest as a form of clean, renewable energy in the field of green energy. Biodiesel can be synthesized from a variety of plant oils and animal fats, making it domestically sourced. Biodiesels produced with methanol can be characterized by their unique fatty acid methyl ester (FAME) profiles. Our group has previously characterized and identified feedstock type based on the FAME peaks using gas chromatography and chemometric techniques. While FAMEs are abundant in biodiesel and therefore effective in characterizing feedstock type, previous research shows that FAMEs degrade quickly in the environment making them less effective in determining feedstock type after a spill. Though less abundant than FAMEs, a group of chemicals called sterols are also found in biodiesel and are known to persist longer in the environment. In an effort to better understand sterol content, we evaluated sterol profiles in various biodiesel feedstocks using gas chromatography. Two reactions were utilized to remove the FAME components (saponification) and to make the sterols elute at a lower temperature (derivitization). Chromatograms of biodiesel samples were compared against that of sterol standards in order to identify the specific sterols present in each feedstock. Plant-based biodiesels are characterized by the presence of β-sitosterol while animal fat-based biodiesels show the presence of cholesterol. Other sterols are observed but cannot be generalized to one type of feedstock.

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

Poster 36

Topological Data Analysis of Ballistic Deposition Models

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College of the Holy Cross

In this project we adapt a method developed by MacPherson-Schweinhart that utilize persistent homology (PH), and apply them to analyze the void structure of ballistic depositions. Their method uses PH to calculate a topological analogue of fractal dimension for one-dimensional complexes generated by probabilistic processes. The ballistic depositions model porous granular media. We consider depositions that depend on a probability p in a novel matter. We compute their PH and fractal dimensions for varying sizes and probabilities, and obtain a relation between them. The PH is computed using a filtration of the void space by maximum radii permitted within the closed voids.

We thank Dan Kennedy, Ph.D. '68 for financial support.

Poster 37

Investigating the Functional Consequences of Sequence Divergence in a *De Novo* Evolved Gene

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De novo genes arise from non-coding sequences. Many are expressed in the male reproductive system, suggesting their importance for male fitness. Our lab has identified one such gene in *Drosophila melanogaster*: *saturn.* Prior work in the lab found that *saturn* knockdown resulted in reduced sperm production in males and reduced sperm storage in females, causing a 90 percent reduction in male fertility. We confirmed these phenotypes using CRISPR-Cas9 to knock out the *saturn* gene. A fertility assay showed a similar reduction in knockout male fertility. Confocal imaging of GFP and DAPI labeled sperm in the knockout male seminal vesicles, and in the seminal receptacles of their mates, showed similar results as the knockdown. In the future, we will use a YFP-tagged *saturn* to determine *saturn'*s cellular localization. Since the *saturn* gene has evolved rapidly, we have begun to test for the conservation its function across related species of *Drosophila*. We are inserting *saturn* orthologs from these species into our *saturn* knockout line of *D. melanogaster.* We will then express these orthologs in the testes and measure their ability to rescue the knockout fertility defect. We hypothesize that as the phylogenetic distance of species with the *saturn* ortholog increases from *D. melanogaster*, the degree of fertility rescue will decrease due to *saturn*'s rapid evolution.

We thank Dr. and Mrs. William F. Crowley, Jr. '65 and a Holy Cross student travel grant for generous funding.

Poster 38

Functional Characterization of Sperm-Leucylaminopeptidase, a Gene Family Essential for *Drosophila* Spermatogenesis

B. T. Nicholson, M. M. Kearns, and G. D. Findlay
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Eight of the most abundant proteins found in the mature sperm proteome in *Drosophila melanogaster* are encoded by the Sperm-Leucylaminopeptidase gene family. To examine the functional consequences of the gene duplication events that gave rise to this family and to test whether these genes act redundantly, we used RNA interference to knock down expression of each gene in male testes. For most of the genes, knockdown males exhibit complete or near complete infertility. To investigate the nature of these fertility defects, we produced knockdown males that make sperm labeled with green fluorescent protein (GFP). These males transfer no (or very few) sperm to females during mating, and dissections of testes revealed that knockdown males are unable to produce mature sperm. These results suggest that this family of proteins, in addition to being a major component of mature sperm, is also essential for spermatogenesis. Recent cytological experiments have yielded preliminary results suggesting different members of this gene family act on at least two different stages of spermatogenesis. Continued cytology and molecular work may allow us to determine the pattern(s) of neofunctionalization or subfunctionalization that occurred after the gene duplication events.

This work was supported by Holy Cross Summer Research Fellowships funded by Dr. and Mrs. Anthony M. Marlon '63.

Poster 39

Thiol Azide Functionalization with Click Chemistry on Nanoporous Gold

N. Chevalier and E. Landis
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Porous surfaces increase the surface area of a sample. This allows for more molecules to be bonded on to the surface for applications. We have created nanoporous gold by dealloying a silver gold alloy in nitric acid. We attached azide to the porous surface using a thiol to gold bond. We show this reaction took roughly one week to complete. We confirmed the presence of azide through an infrared spectroscopy peak at around 2100cm^{-1}. We then performed a copper catalyzed [3+2]-cycloaddition with ethynyl ferrocene. This reaction is also known as a click reaction and was used to bond a ferrocene molecule to the azide group. We detected the attached ferrocene molecules using cyclic voltammetry and X-ray photoelectron spectroscopy.

We thank Drs. Daniel J. Wasser and Karen Randall P15 and the Research Corporation for Science Advancement for financial support.

Poster 40

Utilization of Thermostability Data in Early Development: Improving the High-Energy Functional Group (HEFG) Screen and Understanding the Thermostability of Common Peptide Coupling Reagents

C. Minteer and J. Sperry
Chemical Research and Development, Pfizer

Process safety in pharmaceutical chemical research and development is pivotal for safe and efficient scale-up and manufacturing of compounds. Thermal risk assessments must be routinely preformed and understood to determine the potential severity and probability of runaway reactions. In general, this process includes all compounds undergoing process safety screening, which are, or may be, characterized as containing a high-energy functional group (HEFG), but more specifically may refer to groups of compounds like peptide coupling reagents. Differential Screening Calorimetry (DSC) utilizes isoparabolic testing to model compound thermal stability so heats of reactions and thermal onsets may be used in accordance with the Yoshida industry correlation to predict shock sensitivity and explosive propagation to identify suspect compounds. Results indicate uronium based peptide coupling reagents, as well as compounds containing oxetanes, 1,3,5-triazines, azetidines, aziridines, isothiazoles, azetidinones, pyridazines 1,2,3-triazoles, 1,2,4-triazoles, isoxazoles, oxazoles, pyrazoles, tetrazoles and epoxides were routinely the most exothermic and severe of the more than one thousand tests screened and analyzed. Although DSC assessments are an industry standard, further thermal analysis using instrumentation like Thermal Screening Units (TSU) and software like Advanced Kinetic and Technology Solutions (AKTS) should be used to improve risk assessment knowledge for the severity and probability of runaway reactions.

This research was supported by the Groton Laboratories, Pfizer Global Research and Development, Groton, CT.

Poster 41

Diversifying the Digital Transgender Archive

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Archives serve the noble purpose of collecting and preserving various historical artifacts that are then accessible for exploration by academics, researchers, and the greater public. However, typically archives tend to privilege certain social locations over others, leaving some demographics within certain communities absent or subsumed in their holdings. At the Digital Transgender Archive, an online hub for digitized historical materials, born-digital materials, and information on archival holdings throughout the world, we observed that certain segments of the trans community were underrepresented: trans people of color, trans men, trans narratives outside of the North American context, non-Western conceptions of gender variance, trans people of faith, etc. Thus, we sought to assemble an even more comprehensive archive of trans history by actively seeking out records documenting these marginalized trans experiences. We accomplished this through initial archival research in London at the Lesbian and Gay Newsmedia Archive (LAGNA) which has a number of female-to-male transgender themed articles awaiting digitization. While attending the ALMS Conference 2016 in London, we forged connections with archives across Europe. Upon returning to Holy Cross we set out to assess the trans-related holdings of the Sexual Minorities Archives in Holyoke, MA, digitize their rare materials, and create a discovery resource for potential researchers. We also updated our online global terms list to be more historically and geographically inclusive with the addition of more gender-related terminology. Additionally, we received permission from two art galleries to link to two transgender-themed art pieces concerning the Native American Two-Spirit and Neopolitan Femminiello dating back to the 18th and 19th centuries. This project is ongoing and will foster more intersectional approaches in the field of trans studies.

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

Poster 42

Developing a Quasi-single Cell Acoustic Harvesting Strategy for *Chlamydomonas reinhardtii*

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Chlamydomonas reinhardtii is a widely used model system in molecular biology, utilized to investigate a diverse range of pressing issues in medicine, agriculture and renewable energy. Their unique metabolism and motility are probed using biophysical, biochemical, and genetic cell assays. Recently, the granularity of these assays was increased with automated cell harvesting technologies compatible with 384 well plates. Here, we report a unique acoustic cell harvesting technique that enables a further four-fold increase in efficiency using an acoustic harvesting strategy employing no tips or other mechanical harvesting tools. Using gaseous exchange and light as life sources, chlamydomonas can be successfully transferred using acoustic droplet ejection to a 1536- well plates. Acoustic droplet ejection uses sound energy to transfer droplets of cells through an air column to a data collection media using the Echo 550 located at the National Synchrotron Light Source II at Brookhaven National Laboratory. The droplet size ejected is based on the wavelength of sound emitted, yielding precise ejected volumes. This harvesting strategy allows the user to establish an arbitrary quantum of harvested matter. By reducing the volume of material to as little as 2.5 nL, the user may employ a quasi-single cell harvesting strategy that uses a handful of cells from each colony. Acoustic methods preferentially harvest vigorous alive cells, so that healthy daughter colonies can be established from just a handful of progenitor cells.

This project was supported in part by the Brookhaven National Laboratory (BNL), Photon Sciences under the Supplemental Undergraduate Research Program (SURP).

Poster 43

Predictors of Long-Term School-Based Behavioral Outcomes in the Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder

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Children with attention-deficit/hyperactivity disorder (ADHD) often experience significant school-based challenges. Previous studies reviewing school-based outcome findings of the Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder (MTA) demonstrated that improvements in negative/ineffective parental discipline were associated with decreased disruptive behavior at school. Behavioral intervention was also found to greatly reduce homework problems during the initial 12 months of treatment. We examined potential baseline predictors of school-based behavioral outcomes in children who completed the 8-year follow-up in the MTA. Stepwise logistic regression and Receiver Operating Characteristic (ROC) analysis identified baseline predictors associated with higher risk of truancy, school discipline and in-school fights. Stepwise regression analysis explained between 8.1% (in-school fights) to 12.0% (school discipline) of the total variance in school-based behavioral outcomes. Logistic regression identified several baseline characteristics associated with school-based behavioral difficulties eight years later including sex, race, increased Conduct Disorder symptoms, decreased parental affection, ADHD severity and study site. ROC analyses identified the most discriminative predictors of truancy, school discipline and in-school fights, to be Aggression and Conduct Problem Scale Total score, family income and race, respectively. Future research might target higher paternal involvement and parental knowledge of behavioral principles and reducing use of physical punishment in order to improve school-based behavioral outcomes in children with ADHD.

We thank the National Institute of Health 1K23MH091240, NARSAD and the Patterson Foundation for financial support.

Poster 44

High-content Screen Reveals Rab7A Modulates Trafficking of LRRK2-Rab29 Complexes to the Trans-Golgi Network in Parkinson's Disease

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Parkinson's disease is a neurodegenerative disease that leads to the loss of dopaminergic neurons in the substantia nigra pars compacta. It can be characterized by tremors, postural instability, problems with gait and bradykinesia. LRRK2 (leucine-rich repeat kinase 2) is a large multidomain protein in which mutations associated with Parkinson's disease appear to alter its normal function; LRRK2 is involved with vesicular trafficking and the lysosome autophagy pathway. It also interacts with Rab29 and translocates to the trans-Golgi network (TGN), but the mechanism by which Rab29 influences LRRK2 to affect vesicle dynamics is not understood. We have however, identified Rab7A as a negative regulator of Rab29 mediated shuttling of LRRK2 to the TGN. In order to further explore the capacity of Rab7A to mediate LRRK2 relocalization to the TGN in the presence of Rab29 we performed several experiments and found that the absence of Rab7A leads to an accumulation of TGN protein and increased colocalization in cells.

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

Poster 45

How Decentralization in the Southeast of Turkey Could Diffuse Tension Between the Kurds and the Turkish Government

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Since 1984, violence between the secessionist Kurdistan Workers' Party (PKK) and the Turkish state has claimed more than 40,000 lives. In 2016 this violence has significantly worsened, causing the number of Kurdish youth who seek retribution for the destruction of their homes via violent retaliation to skyrocket. Because ceasefires between the PKK and the government continue to fail, it becomes clear that this conflict will not end without a restructuring of the very core of the Kurdish-majority southeast. Political scientist Dawn Brancati shows that decentralization and expanded local governance have facilitated peace and dampened calls for secession in many democracies throughout the world with regionally concentrated ethnic minorities; the historic 12% of votes (fourth overall) won by the pro-decentralization Kurdish People's Democratic Party (HDP) in the 2015 parliamentary elections demonstrates the increasing support for this solution among Kurdish and non-Kurdish Turks. My project examines what federal powers could be decentralized to increase local Kurdish autonomy, and what patterns of service provision or infrastructure building would be needed to facilitate this decentralization. To accomplish this I examine case studies of political decentralization in countries with regionally concentrated minorities and secessionist movements like Turkey, including Northern Ireland, India, Indonesia, and Spain. As a way to investigate further mechanisms to facilitate peace, I also explore reforms to Turkey's education system, focusing on a dual-language Kurdish-Turkish educational program. To do this, I evaluate case studies of countries with similar education systems to Turkey, including Spain, France, Northern Ireland, Scotland, and Sri Lanka.

We thank the George I. Alden Trust for the financial support.

Poster 46

Worcester's St. Patrick's Day Parade of 1890

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March 17, 1890, St. Patrick's Day, was a Worcester event that has been referenced in historical works, but never truly explored. Its significance lies with a conflict between two great Irish crusades. Worcester saw the steady emergence of the temperance movement among their Irish citizens in the late 1800s. The goals of these men were utterly incompatible with those of the traditional Irish, who did not view sobriety as the answer to the Irish American question. Temperance men wanted to end brawls and alcoholism in their community, while traditionalists dismissed these concerns, and wanted the community to be based around unity and a strong connection to their ancestral home in Ireland. This single event allowed the conflicting societies to all work together for the first time in Worcester history, and to honor their Irish heritage with minimal conflict. By looking through the College of the Holy Cross Archives and the American Antiquarian Society, a variety of 1890 newspapers and diaries revealed the story of the parade, and the conflict brewing beneath the surface.

We thank the Alexander F. Carson Fellowship in American History for funding this research.

Poster 47

Laser Control Using Feedback Loops

A. Cavanagh and T. Roach
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The laser we use for atomic experimentation demands precise control and stability of its optical frequency, which is obtained using a feedback control loop. The feedback loop involves several pieces of the laser system, each with its own set of response characteristics, such as voltage gain, corner frequencies and resonances. Response measurements were taken, compiled with previously collected data, and from this we created a mathematical model of how the entire laser system responds to control signals. Based on this, we designed and built a sophisticated feedback circuit to amplify and filter an error signal, derived from the absorption spectrum of a reference rubidium gas cell. The new circuit response was mathematically modeled to complement the laser system response, so as to effectively suppress disturbances by providing negative feedback and to ensure the stability of the feedback loop by avoiding unwanted oscillations. An important new feature is that we can now separately control the laser current (fast response) and the laser diffraction grating (slow response). The new circuit box also combines some previously separate components, which significantly improves the ease of use. Now that assembly is complete, we continue to make measurements to quantify the effectiveness of the circuit at suppressing disturbances in accordance with the entirety of the feedback loop.

We thank Eileen Whyte O'Holleran '91 for financial support of this research.

Poster 48

Modeling Atomic Diffraction

P. K. Connolly and T. Roach
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For some time, the wave-particle duality of matter has been known. However, it is only within the last two decades that this duality in particles as massive as atoms has been explored in detail, using laser light to slow (or cool) atoms. When cooled to tens of micro-kelvin, atoms begin to exhibit their wave nature and with this comes the potential for atomic diffraction. To study this, we drop a cloud of laser-cooled rubidium atoms 100 mm onto a magnetic diffraction grating and observe the patterns the scattered atoms create as they are reflected upward. In order to counteract thermal expansion of the atomic cloud and cleanly observe diffraction, a grating with a curved surface is used. We have previously created such atomic diffraction gratings but have lacked the tools to measure and predict the effects of and tolerances of factors such as the surface roughness and curvature of the grating. In response to this, we have created two new tools. We developed a surface profiling apparatus to measure both the curvature and roughness of existing gratings. We also created a computer simulation of atomic trajectories to measure and observe the effects of curvature, surface roughness, temperature of the cloud, and other parameters on the quality and visibility of atomic diffraction patterns. Using these tools, we have found that the roughness of a previously used grating likely caused random scattering that was observed, even though the average curvature was within an acceptable range, and we have now begun work on new methods to produce a more smoothly curved magnetic grating.

We thank the College of the Holy Cross for generous financial support of our work.

Poster 49

Mega-events and Tourism: The Case of Brazil

M. Zakrzewski, V. Matheson, and R. Baumann
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Mega-sporting events such as soccer's World Cup are expensive affairs. Host countries often justify the spending required to put on these events by predicting that mega-events will draw large numbers of tourists. This research analyzes monthly tourist arrivals into Brazil between 2000 and 2015, a period that includes the country hosting the Confederations Cup and the FIFA World Cup. We find that the 2014 World Cup had a large impact on tourist arrivals in Brazil, far exceeding tourism estimates from previous mega-events, but that these additional arrivals resulted at least in part from the luck of the draw.

We thank the Office of the Dean for financial support.

Poster 50

The Impact of the Michigan Promise Zones on Local Elementary and Secondary Schools

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The state of Michigan has been proactive in creating place-based scholarships, or Promise programs, which aim to provide free, universal access to community colleges or public universities. The first Promise program, the Kalamazoo Promise, awards college scholarships to all resident high school graduates in the district, and in doing so, it inspired Michigan legislature to design more Promise programs. In 2009, the state of Michigan announced the creation of 10 new Promise Zones in poverty-stricken areas to award college scholarships to students who both reside in and receive a high school diploma from the included district(s). While the most obvious goal in the creation of these Promise Zones is to provide universal access to a higher education, another goal is to improve the struggling local economies. These scholarships could potentially improve the economies of each area by increasing enrollment in the districts, which could raise local property values. Also, by sending more students to college, the Promise Zones would provide more educated workers for local employers. In order to assess the effects of these 10 Michigan Promise Zones, we analyzed the changes in enrollment, student demographics, and academic achievement both at the high school and intermediate school district levels. Thus far, we have found no significant effects on these outcomes, as our preliminary results have been inconclusive.

We thank the Office of the Dean for financial support.

Poster 51

The Economic Impact of the Olympics: Evidence from the Leakage of Host City Announcements

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Prior studies have indicated that in the days following the International Olympic Committee announcement that a particular city will be hosting the Olympic Games, the stock market of the host country experiences a temporary boom. After about two weeks of trading, however, this initial euphoria pewters out as markets stabilize. We are taking a look at how host country markets, as well as markets of countries that have lost the bid, behave in the days leading up to the IOC announcement. By means of searching for and collecting a comprehensive dataset including daily returns of all countries bidding to host the Olympic Games, we have conducted several event studies to determine the abnormal returns of markets in a few different timeframes surrounding the announcements. Our dataset dates back to the early 1980s, when countries were bidding to host the 1988 Olympic Games. Our findings indicate statistically significant positive returns in Winter Games host countries one to two days before the IOC announcement. While this stock market confidence may be attributed to leaked information to large investors, it may also be a consequence of investors' speculatory bets on host cities. If this were the case, however, we would expect to see an uptick in the markets of losing countries leading up the announcement, which we do not.

We thank the Dean's Office for financial support of our studies.

Poster 52

Exploring and Classifying Modifications to the Collateral Source Rule

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The collateral source rule is of common law origin limiting what evidence may be presented before a jury in tort cases. Collateral source evidence varies depending on the jurisdiction, but typically includes insurance payments, payments from a government entity (e.g. Social Security), or payments from family, friends or charitable organizations. This paper examines how legislation has amended the rule, starting with modifications to prevent double recovery or a windfall to the plaintiff. We classify the amendments as exceptions to (erosions of) the rule and exceptions to the exceptions (partial returns) to the rule. Our focus is in statutory law only, so we do not address how the Affordable Care Act may affect the collateral source rule. We examine the statutes of all 50 states as well as D.C., the Virgin Islands, and Puerto Rico, and find that as of July 2016, 38 states have modified the rule and 3 jurisdictions have eliminated the rule. This material was examined previously in 2005, and since then 35 jurisdictions have introduced at least one change in the collateral source rule.

We thank the Office of the Dean for financial support.

Poster 53

Shock Value: On the Precursors and Consequences of Changes in Contributions in Repeated Public Good Games

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Can one person make a difference? This study examines the precursors and consequences of "shocks" in the standard repeated public good game. We define a "shock" to be a change in a player's contribution between periods greater than 25% of total endowment. Our analysis pools data from eight well-known public good papers and finds that positive and negative shocks are reactive and consistent with forward-looking/strategic behavior. We also find a significant impact of both positive and negative shocks on the contributions of others in the following period.

We thank the Dean's Office of the College of the Holy Cross for financial support.

Poster 54

Lithium and Violent Crime

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Lithium has often been used as a psychiatric medication to treat major depressive disorder and bipolar disorder. Lithium is also found dissolved in lakes and reservoirs. The level of lithium varies widely across place and time. This research examines whether the level of lithium present in a county's water supply impacts the amount of violent crime that occurs in that county. We collect data on lithium concentration in 38169 monitoring stations of water sources in 1846 counties across the United States and data on the number of violent crimes (including murder, aggravated assault, rape, and robbery) for each county. Both datasets span from 1977 to 2012. Using ordinary least squares and county fixed effects, we find that an increase in lithium concentration does reduce the incidence of violent crime: A 1% increase in lithium concentration reduces violent crimes by 7%.

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

Poster 55

Creep Much? An Examination of How College Graduates Affect Their Employer's Stock

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The goal of this research is to create a novel measure of college quality. Instead of ranking colleges based on their inputs like tuition and acceptance rate, for example, we will judge college quality based on an output: the stock-market performance of the companies employing the college's graduates. This measure has the benefit that equity is constantly traded and arguably exploits all known information about the company and its prospects. Consequently, if a particular college's graduates consistently lead to significant changes in a company's stock price, then that college is providing value to the students. This value should then be taken into account both when students choose their colleges and when companies choose which graduates to hire. To accomplish this goal, we need to obtain data on the numbers of graduates from each college that are employed by each public company. This has led us to create a computer program that can routinely acquire where graduates of particular colleges are working. The program we have created scrapes publicly available data from LinkedIn and forms the underlying dataset necessary to generate our novel college rankings.

We thank the Office of the Dean for financial support.

Poster 56

"Econphiles:" YouTube Videos dedicated to Economics

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With the national elections nearing, the old adage is proving true: a well-functioning democracy requires well-informed citizens. To this end, we have created a new YouTube channel called "Econphiles" devoted to explaining in simple terms the economics research on current events. As part of this channel, we have released two episodes, one describing the causes of the Great Recession of 2008 and one analyzing whether it is worth it for countries to host the Olympics. In the future, episodes will be released approximately once a month.

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

Poster 57

Language Deprivation: The Neglected Factor in Learning Disability Diagnosis in Deaf Children

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Previous research suggests that children who experience language difficulties are at an increased risk for a learning disability diagnosis. Deaf children are particularly at risk for language difficulties. However, the factors that contribute to a learning disability diagnosis in deaf children have not received enough attention. Therefore, the current study aimed to address this gap. The American Sign Language Assessment Instrument (ASLAI) was used to evaluate the sign language abilities of participants. We also received background information on participants from their schools. Our study revealed that grade (Elementary school v.s. Middle school v.s. High school), signing status (native v.s. nonnative), and gender (female v.s. male) were significant predictors of learning disability diagnosis in deaf children. An unexpected finding was that sign language vocabulary knowledge was not a significant predictor of learning disability diagnosis. This suggested that learning disabilities are diagnosed before children improve their vocabulary skills. Our results suggest that the home language environment and implicit teacher bias have important roles in diagnosing learning disabilities in deaf children. Future examination is necessary in order to provide more accurate diagnoses and interventions for learning disabilities within the deaf community.

We thank the Summer Research Program at the College of the Holy Cross for financial support. Data for this project were provided by the Center for the Study of Communication and the Deaf, a collaborative project between the Learning Center for the Deaf in Framingham, MA and Boston University.

Poster 58

Twilight of the Gods

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"Twilight of the Gods" has been a digitally art based video game project in which I attempted to recreate a piece of mythology in an interactive format. This project has been an exploration into the designing and development of a visual novel styled video game inspired by the sagas of Norse mythology. "Twilight of the Gods" is a text based visual heavy adventure in which the player takes an active role within the story of the Norse apocalypse myth. The primary source used in this project was the "Voluspa" by Snorri Sturlson from the epic of the *Poetic Edda.* This project involved writing a full script, designing the characters and environments, and programming the game. The game itself pushes the player to take an active role in dictating the outcome of the story through dialogue options with the characters that inhabit the game. The aim of this project has been to better understand the process behind video game development and to create a piece of media that brings an ancient piece of literature into a modern setting.

Special thanks to Summer Research Program in the Humanities, Social Sciences and Fine Arts for financial support.

Poster 59

Diazonium Grafting on Nanoporous Gold

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Nanoporous gold has a wide range of potential applications due to its large surface area and high conductivity. However, surface functionalization to add reactive groups is necessary for many of the proposed applications. We have functionalized nanoporous gold with an azide group in order to facilitate click chemistry on the gold surface. Click chemistry creates a stable and conductive bond between the gold's surface and whatever is being "clicked" to it. We functionalized the nanoporous gold surface using diazonium based grafting to generate a radical intermediate. This radical intermediate goes on to form a very stable and conductive gold-carbon bond. We have been able to characterize the grafting process using a combination of IR and XPS, which has confirmed that we have been successful in attaching the azide group to the nanoporous gold surface. We show that the IR peak for the azide is both stable and reproducible. We have also found that a larger pore size has little to no effect on the resulting IR peak.

We thank the Research Corporation for Science Advancement for financial support.

Poster 60

The Search for *Order*: A Catholic Response to a Europe in Crisis

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This project is an intellectual history of the historian Christopher Dawson's (1889-1970) Catholic intellectual movement *Order*, active in the interwar period. Directed primarily by English Catholic converts, *Order* sought to examine the possibilities of cooperation and conflict between the traditional Catholic spiritual order and modernity. To achieve this end, the *Order* movement published an eponymous journal and book series *Essays in Order* through the publishing house Sheed & Ward. Primary source research was conducted with the Christopher Dawson Papers at the University of St. Thomas (MN). A careful reading of each book in the *Essays in Order* series—which boasted such luminaries as Jacques Maritain, Theodor Hecker, Ida Coudenhove Görres and the Russian Orthodox philosopher Nicholas Berdyaev—provided a portrait of the intellectual and spiritual ambitions of the movement. This was supplemented by additional readings supplying historical and cultural context for the *Order* movement, such as reviews of the individual *Essays in Order* books. This project demonstrates the importance of Dawson's *Order* in the twentieth century Catholic intellectual revival, therefore in the wider social, political, and philosophical scenes of the early part of the twentieth century.

I thank the George I. Alden Trust for financial support, and the Special Collections and Archives at the University of St. Thomas (MN) for their generous archival research support.

Poster 61

Maternal Provisioning of Eggs of the Starlet Sea Anemone, *Nematostella vectensis:* Selection Pressures Favoring the Evolution of Coloniality

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Coloniality has evolved in only a few lineages, suggesting that specific selection pressures favor this life history mode. When compared with solitary individuals, coloniality may confer specific reproductive advantages to individuals. Offspring of better quality may be produced when mothers provision eggs with biochemical constituents with greater organic content and/or per unit energy, such as lipid and protein. We measured per egg levels of maternal provisioning using standard colorimetric assays of total lipid, protein, and carbohydrate content for eggs produced by solitary and two-headed (colonial) morphotypes of the starlet sea anemone, *N. vectensis*. Our results from the lipid and protein assays reveal significant differences between morphotypes in per-egg organic and energetic contents and densities. Based on these results, one-headed individuals produced eggs that were significantly more energy-rich. Alternatively, two-headed individuals produced significantly larger eggs, each containing significantly less lipid and protein. Our results for carbohydrate were inconclusive and were not included in our analysis. We will discuss these results in light of their effects on offspring quality, development, and growth, as well as their implications for the selection pressures favoring the evolution of coloniality.

We thank Richard B. Fisher ’47, P79 for financial support.

Poster 62

Exploring Causal Relationships Between American Sign Language and English: Evidence of Cross-modal Transfer

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The extent to which American Sign Language (ASL) abilities transfer cross-modally to English reading proficiency has long been debated. While there is substantial evidence regarding the relationship of ASL to English, no causal evidence between the two has been presented. This study examined whether a causal relationship between ASL knowledge and English abilities exists. We tested a diverse group of deaf students using a sampling of tests from the American Sign Language Assessment Instrument (ASLAI), a computer based receptive skills test of ASL. The tests included four different ASL vocabulary tests, and one ASL syntax test. English proficiency was measured using the Rhode Island Test of Language Structures (RITLS). We found causal relationships between some ASL skills and English abilities. The kinds of ASL knowledge that transferred to English suggested that overall metalinguistic skills, rather than language-specific networks, matter more for cross modal language transfer. Our findings highlight the importance ASL knowledge has on developing English literacy proficiency.

We thank the Summer Research Program at the College of the Holy Cross for financial support. Data for this project were provided by the Center for the Study of Communication and the Deaf, a collaborative project between the Learning Center for the Deaf in Framingham, MA and Boston University.

Poster 63

Everybody Is Doing It: The Off-Label Use of ADHD Medications on College Campuses

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Estimates project that 11% of people ages 4-17 and 5% of adults live with attention-deficit hyperactivity disorder (ADHD) in the United States. The exponential increase in ADHD since the 1970s is considered the original example of "medicalization." The process of redefining social and familial "issues" into medical and individual "problems" has been widely critiqued by sociologists for its threat to communal bonds and collective consciousness. Given that a disproportionate number of those diagnosed are under 21, the social construction of ADHD on college campuses is largely de-stigmatized. While beneficial for diagnosed individuals, one consequence has been the escalating rates of "off-label" use of the medications prescribed to treat the condition as a so-called study drug for students. Our study examined 17 students' views and experiences of the off-label use of ADHD "study drugs," including the perspectives of those diagnosed and undiagnosed. Core findings from the full dataset suggest widespread misconceptions about the prevalence rate and reported efficacy of use on college campuses. Those who opt to use study-aid drugs reveal beliefs that they increase the efficiency but not the quality of academic performance. While they report short-term problems such as sleeplessness, headaches, moodiness and appetite loss, they perceive no long-term effects of usage. Holy Cross students who use the drugs overwhelmingly attribute environmental factors such as a high stress climate to their usage. The findings from this small cross-sectional study reveal persistent misunderstandings about the use and abuse of study-aid drugs. These results can inform educational interventions as well as health services on college campuses. Future studies should follow student usage over time and in subsections identified as more likely to use study-aid drugs, including males, caucasians, athletes, members of the Greek-life community, and at competitive New England schools.

We thank Richard J. Greisch '72 P99 for financial support.

Poster 64

QUARE: Irish LGBT+ Lives and Literature An Exhibit

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To foster interest in the study of LGBT+ literature and draw attention to Ireland's unique LGBT+ history, we have curated an exhibit currently on display in Dinand Library: *QUARE: Irish LGBT+ Lives and Literature.* On display are historically important LGBT+ Irish books as well as newer selections from the Dinand collection. Through informative labels and quotes, the exhibit showcases the ways Irish LGBT+ literature challenges facets of Irish identity. The exhibit was also designed to bring traffic into Dinand Library and remind visitors that libraries are inexhaustible resources for learning. We created an engaging brochure to accompany the exhibit and provide visitors with a tailored list of LBGT+ Irish literature. We organized two events, a student reading and a scholarly lecture, to be staged in tandem with the exhibit in September 2016. Additionally, we crafted a webpage to host the exhibit material after QUARE is taken down in November so that it can be used as a reference. We hope to have created a model for exhibits in Dinand that other students and faculty can follow in the future. The exhibit runs through November 2016.

QUARE: Irish LGBT+ Lives and Literature was funded by the Summer Research Program in the Humanities, Social Sciences, and Arts, with event funding from the Callahan Irish Studies Support Fund and PRIDE. Thanks to Dinand Library staff for assistance and support.

Poster 65

The Torah's Excellence: *Aretē* in Josephus' *Against Apion*

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In his two-book work *Against Apion*, written in ancient Greek in the first century CE, the Jewish priest and historian Josephus defends the Jewish people and religion against contemporary critics. In my research on this work, I performed a word study of *aretē*, a word with a rich history in Greek literature, often translated as "bravery" or "moral virtue." I found that Josephus uses the word only in the second book of *Against Apion* and only in reference to the Jewish people and the Torah. Where he does mention the two famed city-states of Greek history, Athens and Sparta, Josephus explicitly withholds *aretē* from them. I observe that the way Josephus employs *aretē* mirrors the larger argument of *Against Apion*, that the Jewish people have had an admirable law and history dating to time immemorial, whereas the Greeks are a recent people, whose thinkers are intellectually dependent on the Jews. I argue that Josephus appropriates the Greek virtue of *aretē* to make Jewish religion and culture understandable and attractive to his Greek-speaking Roman audience.

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

Poster 66

Analysis of Procalcitonin Immunoassay Capability for the Manufacture of Master Curve Materials

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Siemens Diagnostics Global Assay Development

Procalcitonin is a 116 amino acid protein typically present in low levels in the human body. Increased levels of PCT in serum indicate a failure to process the protein and have been shown to correlate heavily with severe bacterial infection and sepsis. An immunoassay is a biochemical procedure used to evaluate the presence of an analyte in solution. It relies on high specificity and affinity of immunoglobulins (antibodies) for identification and quantification of biological molecules. Analyte concentration is determined when antibodies "capture" their target molecule, combine with detection reagents, and produce a signal measured in relative light units. Master Curve Materials (MCMs) are a product supplied to the customers to support the immunoassay. They are used to verify the instrument's calibration and are required by diagnostic laboratories to establish the assay measuring range. Our study takes into account the manufacturing and precision capabilities of the procalcitonin assay to establish a feasible set of master curve materials and an efficient manufacturing procedure. By analyzing within, total, and lot-to-lot precision of the procalcitonin assay, we established appropriate acceptance criteria suited for both manufacturing and customer uses. These selected Master Curve levels were verified in testing before and after lyophilization. The final 5 level procalcitonin MCM panel spans the analytical measuring range of the PCT immunoassay, and according to our development data, will meet the customer usage requirements.

I thank Siemens Healthcare Diagnostics for financial support.

Poster 67

Modeling Metabolic Outcomes and Symptom Severity Based on Genetic Risk Factors in Patients with Schizophrenia: An Exploratory Use of Tree-Based Algorithms

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Schizophrenia is a psychiatric illness characterized by psychotic symptoms, cognitive impairment, and social dysfunction. Unfortunately, antipsychotic medications used to treat schizophrenia have severe metabolic side effects. It is unclear whether metabolic risk genes established in the general population are also associated with poor metabolic outcomes among antipsychotic-treated patients. Furthermore, this established comorbidity raises the possibility of shared genetic vulnerability pathway(s). To explore these questions we used tree-based data mining algorithms to model both metabolic outcomes and schizophrenia symptom scores based on metabolic risk genes. Genetic risk factors emerged as important variables in both analyses, suggesting that genetic screening may prove useful for personalized decision making in treatment that manages both metabolic risk and symptom severity.

We thank Samuel E. Krug, Ph.D. '65 for financial support.

Poster 68

Chelation of Copper II by Calprotectin and Reengineering Crystals of the RAGE Ligand Binding Domain

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Pathogenic bacteria pose a significant threat to global public health due to emerging antibiotic-resistant strains. Eukaryotic organisms have evolved a response known as “nutritional immunity” which slows the growth of the bacteria by limiting access to key metal nutrients. Understanding this response could lead to better therapeutic strategies to combat these pathogens. Calprotectin (CP) has been identified as a key member of nutritional immunity by utilizing high affinity transition metal-binding sites. Previous studies have illustrated its ability to sequester manganese and zinc to deprive bacteria of these key nutrients. Observations of CP protection against copper-dependent bacteria and the Irving-Williams series suggest that CP should not only bind copper, but have a higher affinity than the other transition metals. Using assays such as isothermal-titration calorimetry, X-ray crystallography, and fluorescence spectroscopy, we aim to establish the affinity of the CP-Copper interaction and its structural characterization. Beyond its metal sequestration activity, CP interacts with the cell surface receptor RAGE (the receptor for advanced glycation end products). This interaction activates a pro-inflammatory signaling cascade when large amounts of RAGE ligands are present. Here a positive feedback cycle is established, which can cause chronic inflammation and several adverse effects of diabetes. The Chazin lab has begun fragment-based discovery for inhibitors of RAGE as a promising therapeutic target in diabetes. We are focusing on identifying a RAGE mutant that is conducive for structural studies needed to develop a multivalent RAGE inhibitor. This could lead to drugs that specifically target RAGE and its adverse signaling during diabetes.

This work was supported by NSF Award 1460706.

Poster 69

Investigating the Association Between Anemia and Postpartum Depression

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Women have an increased risk of developing anemia in pregnancy (AIP) due to the body's increased demand for iron and the quantity of blood lost during childbirth. The effects of AIP are critical and supplemental iron is typically prescribed. In addition to anemia, new mothers can develop Postpartum Depression (PPD), a psychological disorder that can also have detrimental effects on maternal health and infant development. PPD is diagnosed using the Edinburgh Postnatal Depression Scale (EPDS). Several studies have investigated a possible association between anemia and depression in the general population as iron plays an imperative role in the synthesis of monoamine neurotransmitters. This investigation explored whether maternal anemia is associated with PPD. The presence of anemia in any trimester of pregnancy or immediately postpartum and a diagnosis of PPD was found to be associated. However, the effect of iron supplementation on alleviating PPD symptoms was found to be unrelated. It was observed that a large number of patients faced a language barrier, lacked writing/reading skills to accurately complete the EPDS questionnaire, or experienced known cultural differences in reporting depressive symptoms. Additionally, many patients lacked complete prenatal records so AIP may have never been diagnosed or treated. Future studies should continue to investigate the association between anemia and PPD in addition to the effects of supplemental iron and socioeconomic factors that may impact anemia and PPD.

We thank Hartford Hospital for financial support.

Poster 70

Synthesizing Novel Artificial Siderophores for Use in PET Imaging Probes

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Siderophores are bacterial molecules that bind metals. They are a crucial component of PET imaging probes, which consist of a radioactive metal complex and antibody conjugate. The goal of the project was to synthesize novel artificial siderophores that are compatible with Ga and Zr, two metals commonly used in PET imaging, and compare their binding abilities to DFO, the gold standard siderophore. Four artificial siderophores were synthesized by converting the amine groups of various ornithine oligomers to hydroxamate groups through a series of reactions. A linear trimer and tetramer were synthesized, as well a cyclic trimer and tetramer that both had a hexapeptide ring consisting of ornithine and glycine monomers. These ligands were then coordinated to both Ga and Zr and the complexes were characterized by NMR and LCMS. LCMS showed that all siderophore ligands coordinated to both Ga and Zr while NMR showed shifts and splitting between the ligands and the complexes in regions that were expected. In vivo studies of the linear trimer and tetramer in mice showed promise for the linear trimer as compared to DFO. Future studies will involve further characterization of all four siderophores as well as conjugation with antibodies and subsequent in vivo studies.

This work was made possible by the Bulfinch Temporary Services program at the Massachusetts General Hospital and Athinoula A. Martinos Center for Biomedical Imaging.

Poster 71

When Fiber Arts Joins Mathematics

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The structures of geometry and topology concepts can be depicted through physical models. The geometric objects that we studied included Möbius strips, Klein bottles, tori, and hyperbolic surfaces. For our project, I knitted models of these surfaces, using straight and circular needles, acrylic yarn, and zippers. Knitted models are advantageous for their flexibility, as knitted material can be manipulated in ways that would cause material such as paper to crinkle or tear. So, these models allowed us to illustrate the curvature and flatness of the surfaces and shapes. Each model was created entirely from knit and purl stitches. Suitable checkerboard patterns helped to conceal the seams of non-orientable models, while a stockinet pattern highlighted mathematically-interesting curves as textures. The pattern that I used for the torus with Hopf links model was a stockinet pattern, with "purls" evenly spaced out to create diagonal parallel lines. For that same model, I used a zipper closure on one torus model, allowing the torus to be opened, twisted, and reattached, illustrating the mapping class group and its effect on linking of circles on the torus. I also incorporated a zipper closure on a model of the Klein bottle to show how it can be constructed from two Möbius strips attached along their boundaries. I also utilized different colors of yarn to address surfaces going through themselves to show that the apparent self-intersection in my abstract models is not an essential feature for these surfaces in four-dimensional space. We also used this technique of using different colors to show how a torus can be subdivided into seven mutually-touching regions.

We thank an anonymous donor for financial support.

Poster 72

Copper-Catalyzed Reactivity of Ketenimines and Synthesis of Indolizines

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Ketenimines are reactive synthetic intermediates that can engage with nucleophiles, electrophiles and radicals. We applied the recently discovered 'click chemistry' that utilizes copper as a catalyst to generate desired ketenimines from the reaction of an alkyne with tosyl azide. In a one-pot copper-catalyzed process, the acyclic substrate is transformed into a 1,4-disubstituted 1,2,3-triazole that spontaneously decomposes to the ketenimine intermediate, which can then be engaged by a nucleophile at the electrophilic carbon. Only a limited number of nucleophiles are known to react with the electrophilic carbon of the ketenimine. Recently, however, we expanded the list of nucleophiles to include pyridines. Consequently, we created a library of pyridine substrates to react in an intramolecular fashion in order to synthesize a series of substituted indolizines. Indolizines are a common core of many natural products including alkaloids. In the Isaacs lab, we performed experiments that optimized the reaction conditions for the synthesis of indolizines and expanded the substrate scope of possible nucleophiles. This new methodology enables the synthesis of previously unattainable complex compounds in a fast and high yielding fashion.

We thank Richard B. Fisher '47 P79 for his generous financial support of our research.

Poster 73

Developing a *Caenorhabditis elegans* Assay in Liquid Media to Investigate Aging Mechanisms Following Exposure to Cigarette Smoke Extract

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We sought to develop an assay to measure how lifespan in *Caenorhabditis elegans* is altered after chronic exposure to varying percentages of cigarette smoke extract (CSE). We hypothesize that exposure to CSE will result in a dose-dependent reduction in lifespan, involving similar molecular mechanisms of cytotoxicity as seen in mammalian cells. In part, this hypothesis is based on recent research demonstrating that *C. elegans'* innate immune response to xenobiotic factors such as cigarette smoke has proven translational to mammalian culture. Even though most toxicology assays in *C. elegans* rely on exposing the worms to the xenobiotic incorporated into agar plates, CSE is a liquid and must be used immediately after making or thawing. Ideally, the exposure media would also be free from the bacteria that *C. elegans* eat, since these bacteria can presumably metabolize the CSE. We first explored liquid media in which to expose the worms to CSE. However all the abiotic liquid media resulted in death of the worms within 48 hours (without addition of CSE) as a result of hypoosmolarity, presumably related to lack of bacterial proteins and metabolites in the solutions. This led us to pursue live and killed bacterial media which proved successful. In particular, UV-killed bacteria in S-complete exhibited the most promising results in that many more worms were alive and healthy following 48 hours in liquid media. Next we determined whether exposure to CSE can reduce lifespan in *C. elegans*. In mammalian cells 6-7% CSE is sufficient to reduce cell viability by 80-100%; however, worms are well-adapted to environmental toxin exposure and we hypothesized that greater concentrations of CSE would be required to induce cytotoxicity. We exposed worms to 0%, 40%, and 80% CSE for 48 hours in live bacteria and autoclaved bacteria. Results showed a dosage response with worms exposed to autoclaved bacteria and CSE, confirming that CSE can indeed reduce lifespan.

We thank Richard B. Fisher '47 P79 for financial support.

Poster 74

Children's Representation of Space Science Concepts Across Different Modalities

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Many educated children and adults do not understand basic ideas in Space Science. Acquiring space science concepts may be elusive, because a student must reconcile Earth-based observations of the sky with explanations involving unperceived events in outer space, such as Earth's rotation (e.g., Plummer, Bower, & Liben, 2016). The present study tests the theory that relational scaffolding—guided comparisons between Earth- and space-based perspectives—will help children understand scientific explanations of the day-night cycle. Another goal was to examine space science conceptions through two modalities—verbal responses and actions. Third-grade children from Worcester Public Schools (N = 56, mean age = 8.6) were randomly assigned to one of two conditions: (1) the Spatial Thinking and Relational Scaffolding (STARS) condition, in which they received scientific explanations of the day-night cycle and guided comparisons between Earth- and space-based perspectives, or a (2) no-instruction Control. Results showed that (a) children often invoked Sun motion—the Sun moving up, down, or rotating—to explain the day-night cycle, and (b) this intuitive conception was expressed twice as frequently through modeling than through verbal responses. At posttest, intuitive conceptions were less common in the STARS condition than the Control, both verbally and through modeling. These results showed that relational scaffolding helps children integrate Earth-based and space-based perspectives, reducing the frequency of common intuitive explanations. The findings also revealed that modeling tasks provide important insight into children's space science conceptions. Verbal assessments alone may underestimate the prevalence of intuitive beliefs.

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Poster 75

Choice Between Pattern and Random Sequences

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Humans are capable of implicitly learning sequences, meaning that they learn a sequence without the knowledge that they are doing so. In previous experiments in our lab, it has been shown that nonhumans are also capable of implicit learning. In the present experiment, we examined whether pigeons show a preference for either patterned sequences or random sequences, each of which was learned implicitly. Each pigeon received baseline training of trials consisting of only pattern sequences and trials consisting of only random sequences. The pigeons were then given the choice between pattern and random sequences. This test allowed us to test whether pigeons have an evolutionary preference for patterns. Based on the results of a previous experiment, we hypothesized that the pigeons would show a preference for a pattern sequences. This could be an extremely important find because it would suggest that the ability to implicitly learn a pattern has evolved evolutionarily for more than 300 million years from the Last Common Ancestor (LCA) between mammals and birds.

We thank Dr. and Mrs. Timothy J. Babineau '82 for funding our research.

Poster 76

The Plant-pollinator Interaction Revisited: Do Honeybees Prefer Plants that Offer Antimicrobial, Antiviral and Fungicidal Compounds in Nectar?

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Seasoned beekeepers report that honeybees are attracted to herbaceous plants and especially members of the *Lamiaceae* (mint) family, which includes oregano, thyme, lavender, basil, mint and lemon balm. These plants contain the compounds citral, 4-allylanisole, thymol, carvacrol, menthol and linalool; these compounds were reported to have antiviral, antibacterial and fungicidal properties. It was hypothesized that honeybee foragers self-medicate at herbaceous plants because the nectar contains immune-boosting compounds. It was additionally hypothesized that the compounds might maintain their bioactivity in honey, producing a medicated food source for the queen, larvae and worker bees. Six hives were established on the campus to ensure genetic diversity. Forager bees were collected at the hive entrance and while foraging in the field. The preferred concentration of compounds was established with captive foragers using the proboscis extension reflex test (PEFT). In a laboratory study, foragers were collected and infected with *E. coli* to test preference in immunocompromised foragers. Forager fidelity to medicated versus non-medicated solutions was tested in the field and in the laboratory. No preference was observed for the medicated feeding solutions, indicating that honeybees do not self-medicate.

We thank Jean M. Vining, M.D. '83 for financial support.

Poster 77

Headspace Analysis of Stabbed Honeybee Larvae: Stimuli that Trigger Larvae to Release Odorants Resulting in Ejection from the Colony

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Hygienic honeybees are able to detect and remove diseased and dead larvae from the colony. Three volatile compounds were detected in the headspace of larvae infected with *Ascosphaera apis,* that are not emitted by healthy larvae. It is hypothesized that the larvae themselves emit these volatiles and that multiple stimuli such as fungal infection or puncturing of the cuticle can trigger larvae to secrete these compounds, resulting in removal from the colony. Larval volatiles were collected from headspace using solid phase micro extraction (SPME) and analyzed using gas chromatography-mass spectroscopy (GC/MS). Volatiles were collected from fifth instar larvae reared in lab or their native colony. Results showed little difference between lab and colony reared larvae. Puncturing the larvae cuticle did not cause a significant difference in volatile output, despite the time elapsed post puncture. Unexpected compounds were detected in the headspace of colony-reared larvae. The source of these compounds is undetermined.

We thank Dr. and Mrs. William C. Goggins '88 for financial support.

Poster 78

Development of a Multi-sided Polydimethylsiloxane Cell Growth Surface Using 3-D Printing Technology

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**Alpert Medical School, Brown University*

The physical surface on which cells are cultured can affect their morphology, behavior, and interactions with the extracellular matrix. Our research group has shown texturized polydimethylsiloxane (PDMS) surfaces mimic a natural environment for cells similar to an *in vivo* system. To further explore the applications of PDMS in the field of tissue engineering, the growth of cells on a two-sided texturized PDMS surface was investigated. Using computer-aided design and three-dimensional printing technology, plastic troughs and inserts were created in which to cast PDMS. Various methodologies were used to generate a diverse collection of two-sided textured surfaces. Treatment with oxygen plasma and the addition of an amine terminated self-assembled monolayer to the PDMS surface introduced hydrophilic properties and promoted cell adhesion in culture. By using actin staining as a reporter of cell structure, we have shown the morphology of various cell lines are dependent upon their texturized microenvironment. These cell lines include MDA-MB-231, NMuMG, NIH-3T3, and Cos-7. The ability to generate multi-sided, texturized PDMS that supports *in vivo*-like cell growth has exciting applications in the development of implantable devices. This scaffold may ultimately allow for the control of cellular interactions and behaviors as a way of mimicking *in vivo* environments.

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

Poster 79

REE-cycle Efforts for Nationally Critical Elements using Alkoxy Ligands for Extraction

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Rare-earth containing materials have been declared nationally critical because their sources have become unreliable in the US. For the past few decades, China has been the largest supplier of lanthanide oxides with 95% of the world's supply, while the US doesn't have mines to obtain these materials. Currently only 1% of rare-earth containing consumables are recycled every year, therefore, recycling of the rare earth elements (RE-cycle) or "urban recycling" from existing products will become a necessity. Recently, Bogart and co-workers demonstrated that certain ligands selectively coordinate to lanthanide precursors allowing specific targets to be extracted from mixtures. They synthesized their ligand called H_3-TriNox and accomplished a separation between Nd/Dy through leaching. This ligand resembles a number of alkoxy ligands that we have been developing, therefore, this project focused on preparing, implementing, and testing the coordination behavior of our novel ligand H_3-AM- DBP_2. I developed a novel family of Ln(AM- DBP_2) compounds, and explored its utility to extract certain lanthanide precursors. We observed variations in structural nuclearity with Single Crystal XRD structures (Y and La), and will be using the differences in molecular weight to isolate one complex from the other either by Thin-Layer Chromatography or Column Chromatography.

We thank the National Science Foundation for financial support

Poster 80

Identité et Laïcité: Representations of French National Identity and Secularism in Baudelaire's *Les Fleurs du Mal*

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After the multiple attacks committed by terrorist organizations on French soil in 2015, many have questioned why France has become the new target for Daesh. Through an examination of both French political and clerical history, I have shown how secularism, or *laïcité*, has contributed to a cleavage of religious identity and Republican identity. Born from the *loi du 9 décembre 1905*, French secularism is now confronted with the accommodation of an unprecedented number of Muslim citizens whose religious practice often interferes with a traditional conception of *laïcité*: for example, in 2004 Muslim headscarves (as well as all other religious insignia) were banned from public schools. Later, in 2011, a law was passed banning the burka from being worn in public. These laws raise important questions about what it means to be a practicing Muslim and a French citizen. In an attempt to look for answers to these societal questions of identity, I turned towards one of the most influential and popular French poets–Charles Baudelaire. In his *Fleurs du Mal*, he defines the stifling feeling of 'spleen' that plagues modern society and he exalts the exotic as remedy to this malady. Close readings of certain poems have lead to illuminating commentaries on our relationship with the unknown and our conception of personal identity that may well serve as answers to these difficult questions.

I thank the summer research program in the humanities, social sciences, and arts for financial support.

Poster 81

Ameliorating Hind Limb Ischemia-Reperfusion Injury with a Mitochondrial Targeting Peptide in Mice

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Skeletal muscle necrosis following an acute ischemic event may lead to a limb threatening complication in the lower extremities of patients with peripheral artery disease. Ischemic muscle necrosis is a direct consequence of mitochondrial dysfunction, which leads to metabolic deficit and subsequent inflammatory response during reperfusion. Recent studies have reported that targeting mitochondria with d-Arg-2′, 6′-dimethyltyrosine-Lys-Phe-NH2 peptide (SS-31) resets mitochondrial function, reduces apoptosis and protects against tissue injury in models of acute renal, cardiac and cerebral ischemia. Experiments were undertaken to assess whether SS-31 treatment can ameliorate myofiber injury and reduce metabolic deficit in a mouse model of acute hind limb ischemia-reperfusion injury (IR). At 72 hours following IR, SS-31 treated mice had a greater recovery of limb function when compared to saline treated mice, as well as reduced myofiber injury and enhanced steady state levels of ATP. Furthermore, SS-31 treatment correlated with diminished inflammatory cell infiltration (as measured by Ly6B+ leukocytes), lower KC protein content (a chemokine) and decreased caspase-3 activation (an apoptotic marker) in skeletal muscle tissues. Our results demonstrated that SS-31 treatment is protective against myofiber necrosis following acute IR. This effect may be attributed to the preservation of mitochondrial function and the modulation of apoptotic and pro-inflammatory responses. SS-31 may be useful as a therapeutic adjunct for limb salvage in patients following revascularization.

We thank the Massachusetts General Hospital, Department of Surgery, Division of Vascular and Endovascular Surgery, Nod and Henry Meyer Research Fund for financial support.

Poster 82

Modeling Bystander Programmed Cell Death in the Lungs induced by Ricin Toxin

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Ricin toxin is one of the deadliest toxins known, as three milligrams of inhaled ricin is enough to kill an adult within 36 hours. The high lethality associated with aerosolized ricin suggests that cells in the lungs have an increased susceptibility to ricin. Once in the cell, ricin targets ribosomes, shutting down protein synthesis and initiating programmed cell death (PCD). The expanding number of PCD pathways and their overlapping elements has required a re-evaluation of the mechanism of ricin-induced cell death. Preliminary studies point to apoptosis and necroptosis as the likely pathways triggered by ricin, however *in vitro* studies are unable to mimic the high levels of cell death observed *in vivo*. This has lead to the idea that bystander PCD is occurring within the lungs and causing the increased cell death and inflammation. By co-culturing two human cell lines, A549 and U937, an *in vitro* model of bystander PCD has been established. Upon addition of ricin to lung epithelial cells co-cultured with monocytes, the epithelial cells experience accelerated and amplified cell death, as compared to cells cultured without monocytes. Exposing lung epithelial cells to other PCD initiators such as TRAIL and TNF-α also results in accelerated death. This decreased cell viability suggests that TRAIL and TNF-α are the possible cytokines being released by monocytes in the lungs and contributing to the intense cell death and inflammation that are the hallmarks of ricin intoxication. Understanding the mechanisms and pathways of PCD induced by ricin has the potential to help develop effective therapies that could be critical in the event that ricin is used as a biothreat.

We thank the National Institute of Allergy and Infectious Disease for financial support.

Poster 83

Investigating Sex-Specific Mechanisms of Fertility and Lifespan on a High Glucose Diet in *C. elegans*

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In 2013, the CDC reported that the average American consumed 82 grams of sugar daily; almost 3 times more than recommended. High glucose consumption causes 'toxicity' that has consequences for human health, including a rise in obesity and type 2 diabetes. These diseases have effects on lifespan, healthspan, and fertility. The model organism *Caenorhabditis elegans* has been used to study high glucose diet (HGD) and its effects. Past experiments in our lab have shown that although HGD decreases fertility in both sexes, it decreases lifespan in hermaphrodites but increases it in males. The mechanisms that lead to these sex-specific responses are unknown. One possibility is that HGD triggers an increase in apoptosis in the hermaphrodite germline, causing a decrease in lifespan and fertility. Consistent with this model, hermaphrodite mutants in the important apoptosis gene *ced-3* do not have decreased fertility on HGD. However, the male germline does not undergo apoptosis. To study whether this is a source of sex-specific difference, we are studying the role of *ced-3* in male *C. elegans* in the response to HGD for both fertility and lifespan. A second non-mutually exclusive possibility is that males can convert glucose to the sugar trehalose, which is known to be beneficial for aging. We are investigating this model biochemically, by measuring trehalose levels, and genetically, by knocking down the enzymes required for the glucose to trehalose conversion.

We thank Dr. and Mrs. Anthony M. Marlon '63 for their generous support of the Summer Research Program.

Poster 84

Probing the Function of Type 2 Diabetes (T2D) Gene Regulatory Elements Using CRISPR/Cas9 Epigenome Editing

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Type 2 Diabetes (T2D) results from the combined effects of genetics and environment. Genome-Wide Association Studies (GWAS) can be conducted to characterize DNA sequences that vary in disease compared to healthy states. GWAS in human pancreatic islets have identified >100 genetic loci associated with T2D risk. These loci contain SNPs (Single Nucleotide Polymorphisms), 90% of which lie in non-protein coding regions of the genome. Epigenetic analyses in our laboratory have revealed that these SNPs overlap promoter and enhancer gene regulatory elements (REs) in human islets. We hypothesized that these variants contribute to islet dysfunction by altering RE function and ultimately changing gene expression. The goal of this project was to build a system to manipulate islet REs to understand their contribution to beta cell dysfunction and T2D. We employed the CRISPR/Cas9 genome editing system to epigenetically silence islet REs. Specifically, we introduced a modified Cas9 protein, dCas9-KRAB, into beta cells to deposit repressive histone marks and turn off specific genes. To test this system, we targeted the promoters of two genes: *Elavl4* and *Ins1*. We targeted these genes in insulin-producing mouse beta cells using 4 guide RNAs for each target. Cells that integrated each gRNA were selected, and experiments are ongoing to determine their effects on *Ins1* and *Elavl4* expression using quantitative PCR (qPCR).

I thank the Jackson Laboratory for Genomic Medicine for financial support.

Poster 85

Analysis of Historical Stock Price for Facebook, Twitter, and LinkedIn through Change Point Detection

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In statistics, linear regression is an approach for modeling the relationship between a scalar dependent variable y and independent variable x. Based on the fact that stock prices frequently rise and fall, a simple linear regression model is not an effective way to represent the relationship between stock price and time. Change point analysis is used in situations where the parameters of the regression model are expected to change through time and the model is able to determine whether a change has taken place and the location of the change. Through the statistical computing language R, an efficient change point algorithm was created which generates the number of change points and their location for any data set in three steps, including: a) calculate the minimum sum of squared error for every possible substring of the data set; b) recursively piece these substrings together; and c) work backwards through the recursive calculations to determine the optimal placement of the change points. The location of change points corresponds with important events within each company, such as launching new products, acquisitions, and lawsuits.

We thank Mr. Richard Fisher ’47, P79 for financial support.

Poster 86

Biomedical Fiber Scaffolds Formed by Electrospinning and STRAND Spinning Techniques

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Intrinsic biological conditions place specific requirements on the materials used in medical devices, 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 controllable 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. Fibers formed by these techniques are being used for retinal cell implantation and drug-release experiments, to study the effect of different spinning techniques on results.

We thank the NSF through Grant # DMR-1358978 and the Mike Daniels Internship Fund for funding assistance.

Poster 87

Worcester's History Through the Hearts of the Community

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Worcester, Massachusetts is known as the Heart of the Commonwealth and during the summer months of 2016 it has certainly shown that heart. For my research project, I worked closely with the staff at the Worcester Historical Museum as they prepared for the upcoming Worcester in 50 Objects exhibit. In particular, I conducted and transcribed oral history interviews, a key tool of modern social and cultural historians, with over fifteen city residents as a means to document the historic items or places submitted by Worcesterites. Through these oral histories, I sought to discover personal, relatable linkages between a wide range of Worcesterites and the objects they considered of value as a means of showcasing the city's populist historical narrative. As a native Worcesterite, I was driven by the urge to rediscover the heart and multi-dimensional history of the city. I wanted to discover what kinds of objects Worcester's demographically diverse citizenry valued and why, with the hope that I would uncover a value shared by all. Unsurprisingly, the majority of people I spoke with considered the overall population, and the many niches that the population separates into, as our strongest asset. Working with the Museum's web design staff, I combined the oral interviews with my photographs of the objects into an online component that will supplement the larger exhibit located in the museum. Creating a digital platform for ordinary people to share their conceptions of the city and to voice their personal stories as Worcester residents was an exciting way for me to challenge common top-down approaches to history writing and to emphasize the idea that we all have a stake in our community's history and narratives. I hope to have accomplished a narration of Worcester that reflects its rich and diverse population.

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

Poster 88

Habitat Preferences and Potential Juvenile Settlement Sites for Queen Conch (*Strombus gigas*) populations off of South Caicos, Turks and Caicos Islands

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The vital Strombus Gigas fishery off of South Caicos, Turks and Caicos Islands, has shown signs of strain in the past few decades. To protect the local stock and its fishery, management plans and marine protected areas (MPA) were implemented, such as the East Harbour Lobster and Conch Reserve (EHLCR). However, it is not clear whether these actions have been effective. In order to better protect the species, we assessed critical features of its preferential habitat. These findings can potentially assist changing management and protection policies, as well as reveal better locations for MPA boundaries. Research teams performed underwater visual surveys (UVS) of various sites off of South Caicos, TCI to investigate patterns between habitat cover and *S. gigas* abundance. However, it is also possible that other factors besides habitat composition influence which locations are more suitable for *S. gigas* survival. We found that the Queen Conch population off of South Caicos prefers the expected seagrass, algal plain, and coral rubble habitat types characteristic of the species throughout the Caribbean region. Some surveyed sites exhibited comparatively high abundances of *S. gigas*, and as the sites were all in a similar geographic region and composed of similar habitats, their existence hints at other factors influencing habit quality. These may include current patterns, the presence of natural barriers like trenches and large sand plains, and the specifics of food availability at different locations. Two regions outside of the EHLCR also had disproportionately high levels of juveniles, and are potentially sites of juvenile recruit, settlement, and growth.

We thank the School for Field Studies for financial support.

Poster 89

Sustainable Food Production at Holy Cross

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As the ecological and economic consequences of industrial agriculture become increasingly apparent, minimizing impacts will be a crucial factor in global food production. In order to draw attention and intellectual investment to this concern, many colleges and universities around the world have established campus farms that educate students about ecologically responsible food production in a hands-on environment. My research is meant to examine the potential logistical and financial feasibility of a larger campus farm at Holy Cross. By conducting interviews with several campus farms and local farming projects, accessing average agricultural yields, and creating excel models that project annual revenues and costs, I conclude that the four farming systems investigated would yield a positive annual net return between $1,736.16 to $6,245.34. This encouraging finding suggests that with proper backing and initial investment, the College of the Holy Cross could operate a campus farm in an economically and environmentally sustainable manner.

I thank the Dean of the College, the Environmental Studies Program, and the Center for Interdisciplinary Studies for financial support.

Poster 90

Conceptualizations of Schizophrenia: Implications for Ethical Treatment

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Schizophrenia is now primarily researched and treated using the biomedical model, which holds that biological factors cause mental illness, the symptoms of which create the social stigma and the warrant for treatment of the individual. Utilizing this model for diagnosis has marginalized previous theories and treatments for schizophrenia, many of which still retain legitimacy and usefulness in understanding the concept of "health," a value which can and should be understood in different ways. The biopsychosocial model of George Engel is a better way to understand health as relating biology to disease, psychology to illness, and the social dimension to sickness. It allows for any among this triad to take precedence, therefore allowing multiple ways of understanding schizophrenia. This paper will examine how important values from past conceptualizations of schizophrenia are insufficiently accounted for in the biomedical model. It will show the significance of these historical theories of mental illness in order to reintegrate them into a multimodal approach to schizophrenia. This approach will incorporate the ideals and approaches from many different eras, linking them together in order to better conceptualize schizophrenia. This should lead towards a more adequate and ethical treatment of individuals suffering from this disorder.

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

Poster 91

Incidence of Venous Thromboembolism in Patients Undergoing Radical Cystectomy Before and After Implementation of Changes in Thrombotic Event Management

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In 2013, the Urological Oncology Service of the Tallwood Urology and Kidney Institute at Hartford Hospital changed their Venous thromboembolism (VTE) management protocol. VTE, consisting of pulmonary embolisms (PE) and deep vein thrombosis (DVT), is a common cause of post radical cystectomy (RC) morbidity. We assessed the impact of these changes on VTE incident rates 90-days post RC. Retrospective chart review of 215 patients undergoing RC from Jan. 1 2007 to Mar. 1 2016 was performed; cases prior to 2013 were considered Cohort 1 while post 2013 cases were Cohort 2. Univariate and multivariate analyses were used to evaluate the impact of the 2013 protocol. There was a significant decrease in PE rates after the changes. In addition to this, significantly more patients in Cohort 2 had a past personal history of VTE. The changes made in 2013 have improved patient care. Despite Cohort 2 facing significantly higher risks, such as past incidents of VTE, there were significantly fewer incidents of PE after the implementation of new VTE management protocols.

We thank the Tallwood Urology and Kidney Institute at Hartford Hospital for financial support.

Poster 92

Music Education and its Effect on At-Risk Youth

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The focus of this study was to determine how music education from non-profit programs in Worcester public schools' affect early to middle adolescents. Research has shown that art programs can have a positive influence on inner city students. These programs become a sanctuary through the tough times that the students encounter (Roffman et al. 2003). Being an active volunteer for the non-profit organization, Neighborhood Strings, I was interested in how the program was meaningful for these youth. I interviewed nine students in one hour long sessions, three male and six female participants ranging from 10 to 14 years of age. Using the computer data analysis program, HyperResearch, each interview was transcribed and coded according to certain significant themes I identified throughout the interview process. The prevalent topics that the students brought up in the interviews were consistent with the literature. These themes included: having a greater feeling of community, having an excitement for learning, a motivation to play in the future, a sense of autonomy when playing, and a sense of pride for knowing how to play the instrument.

We thank the Summer Research Program in the Humanities, Social Science, and Fine Arts for financial support and the Neighborhood Strings program and their students for their support of the research.

Poster 93

Characterization of Transglutaminase Crosslinking Sites in Beta-lactoglobulin using MALDI-TOF-MS

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Transglutaminases (TGases) are a large family of thiol enzymes most well known for their ability to catalyze the formation of isopeptidic crosslinks between glutamine and lysine residues. The crosslinking capacity of mammalian tissue transglutaminase (TG2) has been linked to critical physiological roles (e.g. wound healing, blood clotting), while microbial TGase (mTGase) crosslinking is commonly utilized in the food industry for modifying food proteins. Despite these various roles and applications, the substrate specificity of this family of enzymes remains poorly understand, as both primary sequence and tertiary structure of the substrate protein are believed to dictate substrate recognition. Moreover, the characterization of protein crosslinking sites by mass spectrometry (MS) analysis is an inherently complex task. Recently our lab has developed an innovative MS characterization workflow–the X-Chem Finder–to aid in the characterization of protein crosslinks. Here we demonstrate the novelty of our workflow by characterizing the exact TGase-crosslinked sites in bovine beta-lactoglobulin under denaturing conditions. Our substrate specificity comparison studies indicate that Q5 and K141 in beta-lactoglobulin are the crosslink sites upon TG2 crosslinking, while Q35 and K75 serve as the primary crosslinking sites for mTGase. Continued use of our X-Chem Finder workflow will undoubtedly lead to improved crosslink analysis capacity as well as a greater understanding of TGase substrate specificity.

We thank the National Science Foundation and Northeastern University REU Chemical and Biological Department for financial support.

Poster 94

The Problem with Environmental Ethics

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Environmentalism and its advocacy are prominent topics in modern society, though a clear rationale for why the environment is important to humans beyond its material resources has never been presented. Through our research, we studied the ethics of five prominent philosophers to determine how their conceptions of the world and man's role in it relate to environmental responsibility. Our study led to the conclusion that the most modern of the philosophers, Henry David Thoreau and Martin Heidegger, present a superior foundation of ethics, one that is rooted in an appreciation and concern for the natural world, transcending anthropocentric concerns. Thoreau's conception of wildness and Heidegger's similar embrace of a natural spontaneity and a lack of control highlight the importance of a life rooted in nature. It is through the perception of the natural world that humans are able to embrace their proper role and character. For this reason, the term "environmental ethics" implies an inherent misunderstanding of what ethics is. Armchair philosophy, which regards ethics as a set of rules we must define, fails to grasp the necessity of character development in order to live a good life. Experience is essential to ethics. It provides an understanding of one's place in Nature, a realization of a mysterious source of all life, and an appreciation of life as a gift, as well as the acknowledgement that death is a natural limit that supplies meaning to life. Thus, the foundation of ethics is necessarily environmental, and viewing "environmental ethics" as a subset of an overarching ethics is incorrect. Our research culminated in a public opinion survey which revealed that a majority of people do not have a clear idea of what ethics is and fail to understand why environmentalism is important. Many offered answers that conflicted with previous responses, which points to considerable ambiguity in their ethical notions.

We thank the summer research program in humanities, social sciences, and arts for financial support.

Poster 95

Analysis of Neuronal Dendritic Arborization in Mouse Forebrain

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Dendritic reconstruction is a semi-quantitative biological technique used to assess the arborization of single neurons and their connectivity with afferent neurons. We have processed brain samples from C57BL/6J mice with the Golgi method and reconstructed pyramidal, stellate, and granule cells of the amygdala, primary somatosensory cortex, and hippocampus, respectively. These cell types have been previously shown to remodel dendrites in studies of associative fear learning and memory, chronic stress, and short term memory. A review of the literature highlights the importance of structural plasticity and dendritic remodeling of amygdalar, cortical and hippocampal neurons as neural correlates of cognition and behavior in healthy subjects as well as those displaying cognitive and behavioral impairments. Dendritic arborization was measured semi-quantitatively in mice using Neurolucida software (MBF Bioscience, Inc.), which allows the researcher to trace a neuron's soma, dendrites and spines in three dimensions. We then measured dendritic arborization quantitatively with Sholl analysis which projects concentric circles on the reconstruction of a neuron to count dendritic intersections at regular intervals of 10 μM distance from the soma. We will apply this method to assess neurological effects in our studies of putative environmental and genetic risk factors associated with psychiatric illness.

We thank Richard B. Fischer '47 P79 for financial support.

Poster 96

Effects of Environmental Enrichment on Emotional Regulation in Mice

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Environmental Enrichment (EE) produces behavioral, cognitive, and biological effects in laboratory rodents. Previous findings by our research group suggest that EE may reduce anxiety-like behavior in mice, but that the matter requires further study because of potential effects on locomotor activity, which may confound interpretations of anxiety-like behavior. We further explored the effects of EE on emotional regulation in male and female C57BL/6J mice by administering a battery of behavioral tests: Open Field (OF), Grooming Assay (GA), Marble Bury (MB), Stress-Induced Hyperthermia (SIH), Novelty Suppressed Feeding (NSF), and Forced Swim (FS). There were no significant differences between the enriched and standard mice in the OF, GA, MB, and FS tests. In the NSF test, EE mice exhibited a longer latency to bite the food pellet than SE mice, which could be interpreted as increased anxiety-like behavior, but may also be related to increased exploratory behavior. The SIH assay revealed that in males, the effect of handling on body temperature was blunted by EE, suggesting an effect of EE on regulation of the hormonal stress response (HPA-axis). Further testing is required to examine whether this effect is sex-specific and to increase the statistical power of our study. Our future efforts will focus on elucidating the neural basis of this environmentally-induced change in HPA axis regulation.

We thank Richard B. Fischer '47 P79 for financial support.

Poster 97

Measurement of Kynurenic Acid in Mouse Brain Samples

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Kynurenic acid (KYNA) is an endogenous metabolite of the amino acid, tryptophan. It acts as an antagonist of the NMDA receptor by competitively inhibiting the binding of co-agonists, glycine and D-serine, thus allosterically inhibiting glutamate binding. KYNA is implicated in the psychiatric disorder, schizophrenia: KYNA concentrations are elevated in post-mortem brain samples of patients with schizophrenia. We are working to establish and validate a method to measure KYNA in mouse brain samples. Brain samples were frozen rapidly on dry ice to preserve amino acid levels and stored at -80^{o}C. For processing, samples were thawed on ice and homogenized by sonication. Protein concentration was quantitated by Bradford assay. Brain homogenate was diluted accordingly to a desired protein concentration and then acidified using trichloroacetic acid (TCA) to denature the proteins. After centrifuging the denatured proteins into a pellet at 12,000 x *g*, the supernatant then underwent ether extraction and was filtered to remove impurities before being analyzed by reversed-phase High Performance Liquid Chromatography (HPLC). The stationary phase was a C18 column, and the mobile phase contained zinc acetate, sodium acetate and acetonitrile. KYNA was detected using a fluorescence detector at an excitation wavelength of 344 nm and an emission wavelength of 398 nm. Our research group has recently demonstrated pro-cognitive effects of enriched environment in mice. This method will be used to probe the neural basis of these effects.

We thank Wendy and Kenneth J. Edwards, M.D. '80 P12 for financial support.

Poster 98

Distinguishing Trace Fear Conditioning from Pseudoconditioning in Mice

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Precise parametric control of Pavlovian fear conditioning paradigms can be used to investigate the function of specific neural circuitry. The cortex, hippocampus, and amygdala are differentially required for specific forms of associative fear learning and memory, depending on the time interval that separates the conditioned stimulus (CS) and the unconditioned stimulus (US). In a delay fear conditioning paradigm, the US immediately proceeds the CS, often overlapping in time, whereas in trace fear conditioning, the US follows the CS after several seconds. Delay conditioning is dependent on the amygdala, but not the hippocampus, whereas trace conditioning is dependent on the hippocampus, but not the amygdala. Of concern when using trace conditioning protocols is the potential for pseudoconditioning, in which the subject exhibits freezing, a fear-related defensive behavior, without being conditioned to a CS. This form of generalized fear can result from spontaneous fear of the stimuli and/or contextual fear. To assess the extent of true cue-associated trace conditioning, we tested an "unpaired" control group, in which the US is presented exactly between two CS presentations. Lower freezing in the unpaired control group than the trace conditioned group indicates the presence of trace associative memory. To experimentally distinguish pseudoconditioning from trace conditioning, we created a protocol with minimal intensity of both the CS and the US in an attempt to minimize generalized fear. The result was lower average freezing in the unpaired group relative to the trace conditioned group, however, further testing will be required to increase statistical power. We hope this study will contribute to the development of methods to investigate specific neural substrates of associative learning and memory.

We thank Wendy and Kenneth J. Edwards, M.D. '80 P12 for financial support.

Poster 99

Peripheral Tibial Nerve Stimulation for Overactive Bladder Syndrome: Predictors of Treatment Success and Acceptance

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More than 37 million adults in the United States suffer from overactive bladder syndrome (OAB), a condition characterized by urinary urgency, frequency, and nocturia, with or without urinary incontinence. Peripheral tibial nerve stimulation (PTNS) is a minimally invasive, third line treatment for OAB. While safety and efficacy are established for PTNS, predictors of treatment success and adherence are not. This retrospective cohort study assessing treatment success and acceptance included data from 34 women who had undergone at least one PTNS treatment for OAB within the study's timeframe. The therapy consisted of 12 weekly treatment visits followed by monthly maintenance visits if the patient deemed the therapy to be helpful. After treatment data was collected, patients were identified as satisfied, unsatisfied, or undecided based on their response to PTNS, as recorded from their visit summary. Overall the success of the PTNS therapy was high, at 64.7%, consistent with previous studies. It was also determined that the fourth treatment visit is the most likely to predict whether a patient will be satisfied or unsatisfied by the twelfth treatment.

We thank Hartford Hospital for financial support.

Poster 100

Effects of Climatic and Edaphic Factors on Seedling Establishment of *Lespedeza virginica* and *L. capitata*

R. Tomizawa, R. Hevey, and Pati Vitt
Chicago Botanic Garden

Predicted increases in future temperatures will likely cause plant species to migrate to higher latitudes or elevations. However, population range shifts may be limited by narrow niche breadths. In a previous study, soil was found to influence the range distribution of Rhododendron species. Understanding how soil factors limit seedling establishment, a life stage that displays greater sensitivity to climate change than adults, is important in predictions on population stability. In our study, 5 soil samples were analyzed for nutrient levels and textures. Seeds from two native prairie species, *Lespedeza virginica* and *L. capitata*, were germinated and grown into these soils. The seedlings were kept under three different temperature regimes: 17.5°/ 9.5° C, 20.0°/ 10.0° C, and 22.5°/ 12.5° C for three weeks before harvest and measurement. Our results showed higher temperature regimes caused higher shoot lengths but lower total biomass. This is an indication of faster growth in the higher temperatures but a potential decrease in vigor. Percent silt and NH_4 levels in soils significantly explained differences in seedling growth. Silt is characterized as having high water retention, and could be negatively correlated to NH4. It may be that seedling growth was driven by soil moisture rather than negatively impacted by NH_4.

We thank NSF (award DBI-1461007) for financial support.

Poster 101

Portable Cosmic Ray Telescope Array Calibration Through Data Analysis Focused on Time

C. Goessling, S. Habein, and T. Narita
Department of Physics, College of the Holy Cross

Cosmic Rays are currently being studied by large cosmic ray telescope arrays consisting of up to 500 telescopes. These telescopes are built into the ground and allow for large amounts of data to be recorded but only in that fixed location of the array. Our portable cosmic ray telescopes allow us to record events in different areas across large distances and elevations. Each telescope is run individually with its own GPS unit and its own timer. The telescopes have a measured time drift from each other but the GPS resyncs their timers every second. Using the timer correction, the simultaneous muon events can be detected in the data through time analysis: allowing a time allowance between the recorded events in both telescopes within which the two events can be considered simultaneous. The likelihood of a false coincidence is <<1%. We ran the telescopes over a twelve-and-a-half-hour time period. The count rate for telescope 1 was 1.18±0.03/s and the count rate for telescope 2 was 1.17±0.03/s. When analyzing the count rate in ten minute intervals, both telescopes' count rate remained steady, with a reduced χ^2 fit of 0.98 and 0.99 respectively.

We thank the College of the Holy Cross Physics department for their support and Diane D. Brink, P12 for funding our research this summer.

Poster 102

Construction, Calibration, and Data Analysis of the College of the Holy Cross Portable Cosmic Ray Telescope Array

S. Habein, C. Goessling and T. Narita
Department of Physics, College of the Holy Cross

Cosmic rays are primarily high-energy protons and atomic nuclei. Originating in supernovae explosions, the energy of cosmic rays average forty million times that of the particles being accelerated at CERN. Once a cosmic ray collides with the upper atmosphere, they shatter into kaons and pions. These kaons and pions then decay in muon showers, of which many make it to earth's surface. The College of the Holy Cross's cosmic ray telescope array aims to study the size, shape, and density of these showers. After careful calibration of each individual telescope, the Holy Cross array has finally reached the threshold number of telescopes to begin these investigations. With three telescopes currently working in tandem; we have taken our initial measurements. We are very pleased with the data they have produced, however, many more trials and hours of analysis are needed to draw conclusions. The telescope array is also being used to understand muon count rates dependence on angles away from a vertical position.

We thank the College of the Holy Cross Physics Department for their support as well as a special thanks to Mr. and Mrs. Edward J. Burke, Jr. '86 for their support in funding all of our work done this summer.

Poster 103

Dispelling Generalizations and Misconceptions of Taiwan and American Culture through Food

J. Siangco, A. Chan, A. Chung, A. Wang, P. Wang, S. Yen, and I. Chuang
Cultural Conflict and Identity Roundtable, Taiwan-America Student Conference

Taiwan is an island nation whose history and culture is overlooked and often taken to be a part of the People's Republic of China. United States and Taiwan official diplomatic relations ended in 1979 and ever since then has maintained non-diplomatic relations through education, trans-pacific entrepreneurship, environmental sustainability, and media. Through intensive hands on research throughout Taiwan and conversing with Unites States university students, we explored the topic of cultural conflict and identity through both nation's food culture. Food, being an integral part of everyone's daily lives, has shifted from being simple a provider of nutrition to the indication of the culture within a society. Our research was based on the topic of globalization, people of assorted backgrounds and identities being brought together. This highlights the importance of understanding and respecting different cultures, culture being defined as the beliefs, values, and attitudes practiced and accepted by an individual or group. Moreover, the food we eat shapes our identities and eating food is a way to convey our different beliefs. In Taiwan, oyster omelet was voted by the Taiwanese as the best food to represent Taiwan. As Taiwan is a subtropical island, seafood continues to be a predominant source of diet. In the United States however, due to multiculturalism, no one food can be used to identity the United States as a whole.

We thank the Taiwan-America Student Conference for financial support.

Poster 104

Deletion of *pilT* Gene Increases Biofilm Formation of *Clostridium ljungdahlii* in Complex and Defined Media

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Microbial electrosynthesis is a process where a solar-powered electrode feeds electrons to a biofilm of *Clostridium ljungdahlii* on its surface to stimulate the strict anaerobic bacterium to produce biofuels. In previous work, it was shown that deletion of the *pilT* gene produces a mutant strain of *C. ljungdahlii* that overproduces pili, thus increasing the thickness of biofilm formation on the electrode, in turn producing a greater yield of biofuels. This work focuses not only on demonstrating further evidence of the relationship between *pilT* deletion and biofilm thickness but also to test whether this mutant strain can be grown on the defined 879 media that is used in microbial electrosynthesis, in addition to the YTF media used in previous studies. The *pilT* mutant strain and wild-type strain of *C. ljungdahlii* are grown simultaneously in six separate well plates at 37°C under strict anaerobic conditions in complex media and defined media respectively. Over a period of six days, I remove one well plate each day for quantitative analysis in order to observe the change in biofilm thickness versus planktonic cell density over time. This quantitative analysis involves both measuring the absorbance of planktonic cells at 600nm using UV Vis spectroscopy, which provides the optical density of planktonic cells, and staining the biofilm with 0.2% crystal violet dye for 30 minutes. Afterwards, I extract the crystal violet stain from the biofilm with methanol. Finally, I measure the absorbance of the extracted crystal violet in methanol solution at 570 nm using UV-Vis spectroscopy to indirectly measure biofilm thickness.

We thank Peter '82 and Patricia Hill '82 P12 for financial support.

Poster 105

Community Responses to Deindustrialization in Worcester, Massachusetts

M. DeSantis, J. Poché, and S. Yuhl
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Although public discourse often notes that Worcester experienced a period of deindustrialization in the second half of the twentieth century and that this process greatly affected the city's residents, little research has been conducted on this topic. Using primary sources, mainly newspaper records, we sought to fill this gap in the historical record by studying the closures of Worcester factories as well as the reactions these closures elicited from local community members such as city government officials, newspaper writers, and mill workers themselves. We used as a case study the three plant closures of the American Steel & Wire Company, a subsidiary of U.S. Steel. As late as the 1960s, this company was the city's second largest employer. By 1977, the company was gone. The demise of American Steel & Wire is representative of the decline of industry in Worcester and the increasing desperation of Worcesterites to save the city's well-paying industrial jobs. Whereas community members celebrated the city's redevelopment efforts after the first two factory closures, the last closure generated a considerable amount of resistance and emotional despair. The final plant fell victim to U.S. Steel's quest to reduce labor costs when company officials elected to close the plant in the midst of a strike to avoid providing the plant's employees with increased wages and benefits. Thus, the final plant closure was also part of the post-1960s deunionization of the America labor force that occurred as corporations moved manufacturing operations from heavily-unionized cities in the Northeast and Midwest to cheaper labor markets in the South and abroad.

We thank Robert R. Henzler '55 for financial support.

Poster 106

Facing the Challenges of Veteran Reintegration

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College of the Holy Cross

It is estimated that upwards of twenty-two veterans commit suicide every day. It is clear to us that when soldiers return from deployment, the integration process does not take 'invisible wounds' into account. Our goal is to better understand what the reintegration process is like so that we can prevent issues that may exacerbate these wounds. We designed a research study that sought to gather data on the phenomenological, moral, and emotional strains of the reintegration process. Our initial research survey was split it into three parts: moral injury, camaraderie and connection, and the lived experience. This past summer, we reached out to the greater Worcester area to register participants for our study. We visited several veteran centers and shelters where we directly interacted with veterans. The next stage of the study is the interview process. Based on our survey data, we created strategic interview questions which will be used to interview approximately fifty to sixty veterans. We are excited about our accomplishments, but we are still only halfway through the entire study process. Throughout the 2016-2017 academic school year, we will continue to provide support to the professors who are conducting and leading the study.

We thank the College of the Holy Cross Summer Research Program for financial support.

Poster 107

Factors Affecting Remission of Nocturnal Enuresis: A Follow-up Study

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Nocturnal enuresis (NE) is a common symptom that affects the social life and mental status of a child in several respects. Risk factors of NE include poor arousal from sleep, excessive overnight urine production, delay in attaining bladder control, low socioeconomic status, sex, and psychological disorders. Different pathological etiologies are associated with a dissimilar rate of enuresis remission. Therefore, numerous children fail to achieve remission until later in life. Furthermore, these children are also more likely to experience other urological disorders, such as nocturia, despite NE resolution. Therefore, long-term follow-up of children with enuresis is necessary. In our study, a total of 408 children aged 6–12 years and diagnosed with primary nocturnal enuresis from a 2004 epidemiological study in Taiwan were enrolled. After a 5.5-year follow-up period, the remission rates of the children of each age group were evaluated, and the corresponding treatment methods were employed daily. Furthermore, the major risk factors that influenced the remission rates in these children were investigated. The overall remission rate was 93.1% among all age groups, and the median age of remission was 9.9 years. Comparing the previous and after results of this study, the treatment method utilized by the parents in response to enuresis was significantly different. More parents chose combination therapy and sought medical attention as the children grew older, particularly the parents of children with severe NE. We also found that girls, young children, those with low enuresis frequency, and light sleepers had higher remission rates than their counterparts did.

We thank the Changhua Christian Hospital for financial support.

Poster 108

Cinegogía: Latin American Film Studies & Digital Humanities

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The recent explosion of film studies has provided educators with a variety of opportunities to enrich the Latin American Studies curriculum. However, there are many questions about what pedagogical methods work successfully. *Cinegogía* is an open-access bilingual digital platform devoted to the teaching and study of Latin American cinemas that fills a void in the field of Latin American Film Studies, which relies heavily on paper journals and criticism written in English. This digital archive hosts an online repository for the following Latin American Film Studies resources: syllabi for teaching film at different levels of the curriculum, a searchable bilingual filmography database, reviews and guides for frequently taught movies, cinematographic glossaries, and links to national *cinematecas*. The hybrid nature of this project required a unique set of linguistic, disciplinary, and technical expertise. Over the course of the research period, we identified the most effective software and web publishing platforms, designed the online modules, selected customizable plugins to enhance functionality, developed our own bilingual metadata system, researched copyright options for contributors, and uploaded over 150 items across four collections. *Cinegogía* is showcased on the Latin American Studies Association's Film Studies webpage. Moving forward, our research team plans to expand the filmography database, integrate an interactive bibliography using Zotero, curate a videographic submissions area, and add new modules for guest lectures and film reviews.

We thank the Summer Research Program in the Humanities, Social Sciences and Arts for its financial support. We also thank Prof. K.J. Rawson and Holy Cross' ITS and EdTech development team for their advice and encouragement.

Poster 109

Developing a Method for Anti-Markovnikov Selective Oxidative Amination of Ketyl Olefins

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There is little literature precedent for anti-Markovnikov selective amination reactions. A "redox-relay" process for anti-Markovnikov selective oxidative amination of terminal olefins, primarily homoallylic alcohols, has been shown by Kohler et al. Oxidative amination has the additional benefit of reestablishing a degree of unsaturation for further functionalization. Our goal was to expand the scope of the proposed oxidative amination reaction by using ketones and other carbonyl-containing compounds as starting material. The desired outcome was oxidative amination with anti-Markovnikov selectivity comparable to that of the alcohols; this result, however, was not observed. An initial problem was base-promoted isomerization of the starting allylic ketone to the α,β-unsaturated ketone, followed by Michael addition of the nucleophile to afford the Markonikov product. Various methods were tried in attempt to discourage the isomerization. Homoallylic ketones showed moderate anti-Markovnikov selectivity, but faced an additional problem of double-addition to the α,β-unsaturated intermediate, as well as very low overall yields. Various amides and carboxylic acids formed no product. Future work would explore the addition of strong oxidants to the reaction conditions to halt the reaction pathway immediately after the aminopalladation step, allowing for difunctionalization.

We thank all donors to the Harold R. Snyder Scholarship Fund for financial support.

Poster 110

Investigation of Analgesic Separations: A Forensic Case Study

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Liquid Chromatography (LC) is a versatile instrumental method useful in isolating individual components within complex chemical mixtures. Forensically, LC is especially helpful for detection of very low concentrations of evidence found at a crime scene. In this research, we created a forensic-themed case study using LC methodology to challenge upper-level undergraduate understanding of chromatography and instrumental methods. Provided chromatograms that show separation of known analgesics under varied instrumental parameters, students are asked to select and justify optimized parameters for separation and then identify or explain the appearance of unlabeled compounds from another set of chromatograms. Reversed-phase LC, paired with UV-Vis detection, was used to compare three different stationary phases for the separation of a mixture of seven common over-the-counter analgesic compounds, including acetaminophen (Tylenol), aspirin, and ibuprofen (Motrin). Mobile phase polarity and pH were varied to optimize the separation on each column. It was discovered that C18-PFP and RP-Amide columns were able to resolve all seven peaks, yet differences in selectivity led to distinct analyte elution orders. With this data set, students will need to critically evaluate the data to conduct an investigation of the "crime," thinking as chromatographic experts. In addition, students will need to communicate their findings to both specialized (scientific) and general (judicial) audiences.

We thank the Robert J. Stransky Foundation for financial support, making this research possible.

Poster 111

Worcester Mural Archive

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In our increasingly digital world, public art is an organic way to bring people together, provide social commentary, catalyze change, or prompt people to open their eyes and see the world around them differently. Public art is a vibrant record of cultural change over time. The archive preserves these changing walls even as nature takes its toll, popular styles of art change, and the walls are painted over again and again. The themes and styles present in the works that line our streets show us how our world is evolving and remind us of things that we found important enough to memorialize in paint, sculpture, or other media. However, the presence of public art also tells a story of the socioeconomic climate of its home. Art from the years of the Works Progress Administration tell a tale of a rebuilding country, whereas present works speak of gentrification. Through this collection of murals, we hope to provide context so that you, the viewer of the art, can draw more informed conclusions about the work, learn about its creators, or simply appreciate the beauty of the work if you are unable to view it in person. The format of the website is designed to allow readers to organically explore the work and related information, leading them to their own conclusions. In addition to the archive website, research for the project was used to create a walking tour of Worcester's downtown murals. This project emerges during an exciting time for public art in the city seeing that an international mural festival visited Worcester this summer. The tour was presented to forty individuals and all proceeds from the tour were donated to the POW!WOW! Worcester mural festival.

We thank Mr. Stephen P. Skinner '77 and Ms. Nancy Savage Skinner '79 for financial support.

Poster 112

Treated on the Stroke Service

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This is a retrospective case control study focusing on stroke 30-day readmission at Hartford Hospital, in order to identify risk factors associated with stroke readmission. Patients were included in the study if they were readmitted within 30 days with discharge diagnosis of stroke, within the studies time period. Variables including socio-demographic factors, clinical comorbidities, stroke characteristics, length of stay, and mortality were analyzed for statistical significance. A total of 135 patients readmitted within 30 days of discharge were included, and a control of 1,631 patients was analyzed. Potential risk factors were assessed using chi-square test of proportions and multivariable logistic regression was also performed to identify independent predictors of stroke readmission. The stroke 30-day readmission rate for Hartford Hospital during the study's two year time period was 7.3%. Overall, 67% of index admissions were for Ischemic stroke, 19% hemorrhagic stroke, and 14% TIA. The most common reasons for readmission were infection (30%), recurrent stroke (17%), and cardiac complications (14%). Index admission to a non-neurology service is an independent risk factor of 30-Day readmission. The overall mortality associated with stroke 30-day readmission was high and not influenced by recurrent stroke. In conclusion, early post-discharge stroke clinic follow-up, and admission to neurology service may help reduce the associated morbidity and cost with readmission.

We thank the Research Department of Hartford Hospital and the Hartford Hospital Stroke Center for financial support.

Poster 113

Nesting and Feeding Habitat Assessment of South Caicos Shorebirds and Development Recommendations

K.Washer, A. Murray, S. Prendergast, and N. Moore
The School for Field Studies Center for Marine Resource Studies

The goal of this study is to provide advice to developers on what areas and habitat types in South Caicos need to be protected to allow for maintenance of avian populations. The coastlines and cays of South Caicos and Big Ambergris Cay were assessed for their suitability for nesting bird populations and for foraging. The habitats of the species *Phaethon lepturus*, *Larus atricilla*, *Pandion haliaetus*, *Pelecanus occidentalis*, *Nyctanassa violacea*, and several dove species were assessed by looking for nests in areas where the species had previously been seen during their breeding season. Bird counts were conducted at sand flats and salt pans that are feedings grounds of plover, stilt, turnstone, sandpiper, heron, and egret species. The reaction of birds to the presence of researchers was also noted. The results show that mangrove and shrub sites hosting *P.occidentalis* and *N. violacea* nests need protection by limiting human access while the rocky cliff sides hosting *P. lepturus* do not. *L. atricilla*, *P. halietus*, and dove species are capable of nesting in both natural and human built structures and therefore need little or no protection. The salt pans and sand flats of South Caicos and Big Ambergris Cay host a high abundance of birds that are easily disturbed by human presence including *P. occidentalis* and plover species, therefore human access to these areas should be limited to create an ideal foraging environment. Development in South Caicos is unlikely eliminate all avian populations because some species will adapt to urbanization. However, responsible development can prevent decline of avian species richness and overall bird abundance.

We thank the School for Field Studies for financial support.

Poster 114

Brain Control of Micturition in Mice

A. M. Hanneke, L. Szczepanik, and J. Geerling
Beth Israel Deaconess Medical Center

Existing assays for continence and voiding are inadequate for live neuroscience experiments in awake, behaving mice. To enhance work in this area, we developed a non-invasive technique called *micturition video thermography* (MVT). Similar to existing void spot assays, we place mice in individual cages with filter paper flooring, but also record them from above with a thermal camera. Freshly voided urine has warm thermal contrast and then cools by convection 1-2 °C below ambient temperature as it spreads through the filter paper. The final area of this cool void spot can then be measured, and its volume derived from linear calibration data. Over many recordings, we find that micturition-associated behaviors in male and female C57B6/J mice are highly stereotyped. They void rarely, and primarily in the cage corners. Awake, un-instrumented mice store and void substantially larger volumes than cystometry measurements in urethane anesthetized mice. Continent mice voided on average 1-3 voids per a 2 hour recording. Recordings were capture on two cameras, E40 and A65 FLIR Systems Thermal Cameras. Calibrations were created for both cameras to calculate the void volumes for each mouse void. In summary, MVT is a robust, non-invasive assay for the timing, location, volume, and behaviors associated with voiding. This technique allows experimental designs incorporating serial tests and within-animal controls, and can be followed by other assays for bladder pressure (cystometry) and sphincter activity (electromyography).

We thank the National Institude of Health for financial support (NIDDK: Grant P20 DK103086).

Poster 115

Assessment of Calcium Intake in the Pediatric Type 1 Diabetes Population

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University of Rochester Medical Center

Patients with either Type 1 (T1D) or Type 2 diabetes (T2D) are more apt to suffer a bone fracture than patients without diabetes. The risk of fracture is greater for patients with T1D than T2D. Compared with patients with T2D and people without diabetes, patients with T1D have been shown to have lower bone densities, which may contribute to their increased fracture risk. Calcium is important in bone mineralization and ascertainment of normal bone density. These observations raise the possibility that T1D patients, compared to patients without diabetes, have low calcium intake, elevated calcium excretion or altered calcium metabolism, contributing to low bone density and increased risk of fracture. In order to examine the calcium intake of the pediatric T1D population, 103 patients between the age of 7 and 22 years were interviewed at their diabetes follow-up appointment at the Pediatric Endocrine outpatient clinic at the University of Rochester Medical Center (URMC). Calcium intake was assessed using a validated Calcium Food Frequency Questionnaire (FFQ). Dietary calcium intake in T1D participants was compared to age-matched dietary calcium intake data obtained from the National Health and Nutrition Examination Survey 2011-2012. Standard descriptive statistics were used to describe participant characteristics and outcomes. We found that the majority (72.8%) of T1D participants at URMC were meeting the RDA for calcium intake. Our results suggest that T1D participants consumed greater amounts of dietary calcium compared to the general childhood population (median T1D calcium intake of 1573 mg vs. 927 mg, respectively), however comparisons are limited due to different methodology used to assess intake.

We thank the Strong Children's Research Center and National Institute of Child Health and Human Development grant K12-HD-068373 for financial support.

Poster 116

Novel Live Tumor Cell Diagnostic Test Utilizing Biophysical and Molecular Biomarkers to Assess Local, Advanced, and Metastatic Prostate Cancer

M. Manak and C. Curran
Cellanyx Diagnostics

Due to the lack of clinical tools for risk stratification, over-treatment of prostate cancer affects 144,000 patients annually in the U.S. Understanding the local aggressiveness and metastatic behaviors of cells from biopsies may improve risk stratification for prostate cancer patients. The study describes the development of biomarkers for creating a better risk stratification system. The biomarkers were tested as part of a platform that uses extra-cellular matrix appropriate for live cell survival, and distinguishes between cancer and normal cells on a microfluidic device that standardizes biomarker measurements. The platform also incorporates machine vision and machine learning algorithms for automated biomarker measurement and analysis. We tested the ability to culture live cells, the performance of the biomarkers, and the ability of the platform to be a risk stratification tool. We demonstrated that we can grow/maintain both cancer and normal cells, and that we can distinguish between the two using our platform. In addition, from the biomarkers, we produced metrics called LAPP (local adverse pathology potential) and MAPP (metastatic adverse pathology potential) - each able to predict three specific adverse pathologies. The biomarkers were useful for producing scoring metrics of LAPP/MAPP that have potential to be used to risk stratify patients based on predicting 6 adverse pathologies.

We thank the private investors that support Cellanyx Diagnostics and Massachusetts Life Sciences Center for funding the internship.

Poster 117

Classitronic: Composing Classical Music with Electronic Instruments

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In recent history, the worlds of computer programing and musical production have found an overlap in the digital synthesis of analog sound. With this in mind, we sought to understand more formatively the process by which "classical music", or non-populist, non-dance based music, is composed when the instrument is not a predetermined factor. In traditional composing, the process is often one of finding some melodies or chordal motifs in sketches, coming up with a form, identifying the instrumentation, and composing the piece. In this method, the instrument provides the composer with many constraints, namely with regards to range, performance technique and quality of sound. However, an electronic instrument is bridaled only by the ability of the programer. In this way, we found that composing with electronic instruments provides more freedom of range and sound, and allows the composer to enter into dialogue with instrument about what they want from the sound. Both the instrument and the piece inform and constrain each other. In doing this, we composed a piece of music for cello, piano, and an electronic instrument that utilizes sequencers and synthesizers programed with Max/MSP.

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

Poster 118

Investigating the Role of Carbohydrate Storage in the Sexually Diametric Effects of a High Glucose Diet on Healthspan and Lifespan in Caenorhabditis elegans

L. Riley and M. Mondoux
Department of Biology, College of the Holy Cross

Our laboratory, the Mondoux research lab, over the last several years has studied the effects of a high glucose diet on health, lifespan, and insulin signaling in *Caenorhabditis elegans.* We demonstrated that hermaphroditic *C. elegans*, which make up 99.9% of the *C. elegans* population, have reduced lifespans and healthspans when given a high glucose diet. However, in the course of our research we realized that males did not experience these detrimental effects. In fact, their median lifespan was extended 10% and age related loss of mobility decreased. In 2015 we published a paper with our findings: "High Glucose Diets have Sex-Specific effects in *C. elegans*: Toxic to hermaphrodites but beneficial to males". My summer research has been focused on designing a method to test the mechanism of this sexually diametric response to a high glucose diet. Due to known carbohydrate research we hypothesize that males are storing their sugar as trehalose more often than hermaphrodites, which primarily use glycogen. Trehalose sugar is a disaccharide that has been shown to exist in higher concentrations in long lived *C. elegans* mutants and been shown to have protective effects in *C. elegans* against desiccation and other stresses. In order to test this hypothesis I need to reduce trehalose synthesis in male *C. elegans* on a high glucose diet using RNA interference. If our hypothesis is correct knocking down the trehalose synthesis pathway in males will negate the positive effects of the high glucose diet and result in healthspans and lifespans reflective of a hermaphrodite on a high glucose diet. We are excited to see if the differentiated carbohydrate storage is the mechanism that determines the sexually diametric response to a high glucose diet in *C. elegans*.

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NOTES