



**Twenty-First Annual  
Undergraduate Summer  
Research Symposium**

September 5, 2014  
Hogan Ballroom

*Dear Members of the Holy Cross Community,*

*Welcome to the 2014 Undergraduate Summer Research Symposium. Now in its 21<sup>st</sup> 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 2014. 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.*

*2014 Symposium Organizing Committee*

*Julia Paxson, Department of Biology  
Elizabeth Landis, Department of Chemistry  
Daniel Bitran, Science Coordinator*

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

Members of the Alumni / Parents Summer 2014 Research Scholarship Fund

Mora M. and Timothy J. Babineau, M.D. '82  
Anne E. and John Kirby Bray '79, P10  
Katina G. and Edward J. Burke, Jr. '86  
Mary R. and Herman R. Charbonneau '56, P97  
Deborah C. and Timothy W. Diggins '80  
Catherine E. and Domenic J. Dinardo '75, P17, 06  
Wendy R. and Kenneth J. Edwards, M.D. '80, P12  
Laurie D. and William C. Goggins, M.D. '88  
Michele K. and David M. Joy '74, P11  
Dan Kennedy, Ph.D. '68  
Marion and Samuel E. Krug, Ph.D. '65  
Jeanne and James Moye P15, 10  
Jane and Joseph T. Murray '58, P86  
Jacqueline H. and George A. Paletta, Jr., M.D. '84, P15  
Nancy Savage '79 and Stephen P. Skinner '77  
Katherine L. and Paul S. Stuka '77  
Lindsay B. and Richard K. Watson, Jr. '80, P12  
Kim and Wendell P. Weeks P15  
Kathleen and Stephen R. Winslow P16, 14  
Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowships  
Patricia McGovern Hill '82 and Peter J. Hill '82 Family Summer Research Scholarships  
Robert J. Stransky Student Research Fellowships in the Sciences  
Carroll Program Summer Research Fellowships, Robert R. Henzler '55  
Richard B. Fisher '47 Summer Research Fellowship Program  
Greisch Family Summer Research Fellowship Fund for Students in Sociology  
Shanahan Award for Scholarship in Mathematics and Computer Science  
Office of the Dean, College of the Holy Cross  
Dr. Robin Vannote in support of Student Research in Ecology and Evolution  
Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts  
BD Corporation  
National Institutes of Health  
National Science Foundation  
The Camille and Henry Dreyfus Foundation  
Research Corporation Cottrell College Science Award

American Chemical Society Petroleum Research Fund  
Massachusetts Space Research Consortium Grant for Summer Fellowships  
Autism Speaks  
American Cancer Society's Alvan T. and Viola D. Fuller Research Fellowship  
Bald Head Island Conversancy, North Carolina  
Beth Israel Deaconess Medical Center, Advanced Orthopedic Studies  
Brookhaven National Laboratory  
Emory University School of Medicine, Department of Pathology  
Hartford Hospital, Dept. of Surgery, Division of Trauma/Surgical Critical Care  
Hartford Hospital, Stroke Center  
Hauptman-Woodward Medical Research Institute  
Lloyd Foundation of the PNC Charitable Trusts  
Massachusetts General Hospital Bicentennial Scholars Program  
Massachusetts General Hospital, Department of Neurology and Cancer Center  
Massachusetts General Hospital, Dept. of Vascular and Endovascular Surgery  
Massachusetts General Hospital for Children, Mucosal Immunology and Biology Research, and Center for Celiac Research and Treatment  
Medical College of Wisconsin, Biotechnology and Bioengineering Center; Children's Hospital of Wisconsin  
National Institute for Diabetes and Digestive and Kidney Diseases  
National Security Agency and the Leadership Alliance Program  
North Carolina State University REU Program  
North Dakota State University, Department of Chemistry and Biochemistry  
Rays of Hope Foundation  
Tufts School of Medicine, Baystate Medical Center  
University of Connecticut Health Center, Department of Cell Biology  
University of Connecticut Health Center, Department of Molecular Biology and Biophysics  
University of Virginia, Department of Surgery  
University of Texas at Austin, Department of Biomedical Engineering  
Worcester Polytechnic Institute, Department of Chemistry and Biochemistry

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

## Table of Contents

(Note: Presenter names are underlined.)

- The Holy Cross Community Garden: A Liberal Arts Tool for Harvesting Education.** C. Nguyen, M. Watson, M. Sterk-Barrett, and A. Borghini. Department of Philosophy and Community Based Learning, College of the Holy Cross
- Analyzing Homeric Content in Two Manuscripts.** A. Boudon, C. Ryan, A. Simrell, M. Ebbott, and N. Smith. Department of Classics, College of the Holy Cross
- Consequences of Antifederalist Politics in American Political Thought.** T. Rice and D. Klinghard. Department of Political Science, College of the Holy Cross
- Developing Methods for Examining Social Coordination.** D. Vogus and R. Schmidt. Department of Psychology, College of the Holy Cross
- Some Like it Hot: Temperature Dependence of Thermophilic Intein Activity.** M. Jaramillo, J. Williams, J. Reitter, and K. Mills. Department of Chemistry, College of the Holy Cross
- A Structural and Biophysical Analysis of Protein Splicing.** M. Koulopoulos, Z. Giaccone, J. Reitter, and K. Mills. Department of Chemistry, College of the Holy Cross
- In the Loop: Relating Intein Flexibility to the Temperature Dependence of Activity.** A. Bonano, A. Yakely, M. Jaramillo, J. Williams, J. Reitter, and K. Mills. Department of Chemistry, College of the Holy Cross
- Investigation of Unusual Activity of Intein Splice Junctions.** D. Castillo, S. Cahn, J. Reitter, and K. Mills. Department of Chemistry, College of the Holy Cross
- The Historical Debate Over the Principles Underlying the Patent and Copyright Clause.** C. Fimognari and D. Klinghard. Department of Political Science, College of the Holy Cross
- Functionalization of Nanoporous Gold.** C. Chevalier, R. Chevalier, and E. Landis. Department of Chemistry, College of the Holy Cross
- Quantum Scattering Using the Finite-Element-Method (FEM).** S. McAlinden, E. Farrell, and J. Shertzer. Department of Physics, College of the Holy Cross
- The Scribal Tradition of Jerome's *Chronicle* in Two Manuscripts.** N. Jalbert, S. Neville, C. Schufreider, and N. Smith. Department of Classics, College of the Holy Cross
- Rhenium Compounds with Imidazolecarboxaldehyde Ligands or Aspartame.** S. Valente, A. Neeper, and R. S. Herrick. Department of Chemistry, College of the Holy Cross
- Geometric Flows of Plane Curve.** J. De La Cruz Santos, R. Gallagher, S. Hadaidi, and A. Cooper. Department of Mathematics, North Carolina State University
- Supersymmetry Breaking in a Metastable Vacuum.** B. Kain and Z. Fernandes. Department of Physics, College of the Holy Cross
- Copper-Catalyzed Synthesis of Beta-lactams.** S. Namirembe and A. K. Isaacs. Department of Chemistry, College of the Holy Cross
- Which God? Which Apologist? Transcendence, Paradox and the Incarnate Word.** S. Merola and J. Gavin, S.J. Department of Religious Studies, College of the Holy Cross
- Molecular Systematics of Appalachian Cave Beetles.** A. Sullivan, A. Carlson, and K. Ober. Department of Biology, College of the Holy Cross

19. **Copper-Catalyzed Reactivity of Ketenimines.** *J. L. Chen and A. K. Isaacs. Department of Chemistry, College of the Holy Cross*
20. **Catalytic Asymmetric Monophosphorylation of Diols.** *B. Sculimbrene and M. Lougee. Department of Chemistry, College of the Holy Cross*
21. **Transfer and Processing of the Seminal Fluid Protein Antares During and After Mating of *Drosophila melanogaster*.** *K. Baranowski and G. Findlay. Department of Biology, College of the Holy Cross*
22. **Characterizing *Drosophila* Saturn Protein Function.** *A. Gubala and G. Findlay. Department of Biology, College of the Holy Cross*
23. **Expression of the Membrane Protein Cyclooxygenase-2 Using Recombinant Baculovirus.** *L. Yacobucci and B. Orlando. Hauptman-Woodward Medical Research Institute*
24. **Were the Billions Brazil Spent on World Cup Stadiums Worth it?** *V. Matheson and G. Ross. Dept. of Economics and Accounting, College of the Holy Cross*
25. **Synthetic Studies on (+)-*cis*-Sylvaticin.** *M. L. Maliszewski and K. J. Quinn. Department of Chemistry, College of the Holy Cross*
26.  **$\beta$ -sheet Formation in Peptides Containing Tri-Alanine.** *B. Chartier and S. Petty. Department of Chemistry, College of the Holy Cross*
27.  **$\alpha$ -Synuclein Misfolding and  $\beta$ -Sheet Aggregation in Parkinson's Disease.** *M. Stuckey and S. Petty. Department of Chemistry, College of the Holy Cross*
28. **The Effects of Surface Growth Conditions on the Morphology and Cytoskeleton of Mammalian Cells.** *S. Haddad<sup>1</sup>, M. Stanton<sup>2</sup>, C. Lambert<sup>2</sup>, R. Bellin<sup>1</sup>, and W. Holmes<sup>1</sup>. <sup>1</sup>Department of Biology, College of the Holy Cross, and <sup>2</sup>Department of Chemistry and Biochemistry, Worcester Polytechnic Institute*
29. **Caged Phosphates in Organic Molecules.** *A. Dame and B. Sculimbrene. Department of Chemistry, College of the Holy Cross*
30. **Efforts Toward the Synthesis of Crispine A.** *S. Yalamanchili and K. J. Quinn. Department of Chemistry, College of the Holy Cross*
31. **Implicit List-Learning in Pigeons Using a Low-Information List.** *D. Cameron, J. Gould, and C. Locurto. Department of Psychology, College of the Holy Cross*
32. **Research in Forensic Economics: Miscellaneous Topics.** *T. Tran and D. Schap. Department of Economics and Accounting, College of the Holy Cross*
33. **Religiosity and Uncertainty Aversion.** *J. Hamilton and J. Svec. Department of Economics and Accounting, College of the Holy Cross*
34. **Returns to a Private Education: Controlling for Selection on Observables.** *R. Elliott and A. Nathan. Department of Economics and Accounting, College of the Holy Cross*
35. **Heparan Sulfate and Sulfatase Activity: Effects of Changing Sulfation Patterns on Tumorigenesis in Mammary Epithelia.** *L. Connolly, R. Bellin, and W. Holmes. Department of Biology, College of the Holy Cross*
36. **On the Kronecker Product of a Hook and a Box.** *B. Hallahan and C. Ballantine. Department of Mathematics and Computer Science, College of the Holy Cross*
37. **Do Sporting Events Displace Crime? The Case of the Bulls and Chicago.** *J. Congdon-Hohman and G. Koosharian. Department of Economics and Accounting, College of the Holy Cross*

38. **Development of a Discovery Platform for Identifying Potential Breast Cancer Tumor Associated Antigens.** *M. O'Meara, D. Kita, K. Rahman, C. Devarakonda, and K. P. Claffey. Department of Cell Biology, University of Connecticut Health Center*
39. **A Synthetic Approach to Disulfide-Bridged Beta-Sheet Mimics.** *E. Schneider and B. Linton. Department of Chemistry, College of the Holy Cross*
40. **Impact of Digital Music on Jazz Performance Attendance.** *A. J. Dalton IV and M. Boyle. Department of Economics and Accounting, College of the Holy Cross*
41. **Evaluating Methodological Procedures to Conduct an Adult Autism Prevalence Study.** *M. Solberg and M. Rosanoff. Autism Speaks*
42. **Eliminating the Cultural Barriers in Autism Spectrum Disorders in Hispanic and Latino Communities.** *M. Florimon and M. Rosanoff. Autism Speaks*
43. **Extinction of Conditioned Fear in Mice.** *A. J. DeNofrio and A. C. Basu. Department of Psychology, College of the Holy Cross*
44. **Wasabi Aversion in *Drosophila* Adults and Larvae.** *S. E. Smith and S. M. Webster. Department of Biology, College of the Holy Cross*
45. **Race Matters: Health Perceptions for Women of Color.** *M. Okero and R. Beard. Department of Sociology and Anthropology, College of the Holy Cross*
46. **Relationship Between Climate, Topography, and Talus Slopes in the Sierra Nevada, and Implications for Landscape Evolution.** *N. Bradley and S. Mitchell. Department of Biology, College of the Holy Cross*
47. **Preliminary Studies on Fabricating Weather System Devices for the Analysis, Research, and Detection of Lightning.** *M. E. Minelli and H. Takai. Department of Physics, Brookhaven National Laboratory*
48. **The American Collegiate Moot Court Association Brief Writing Competition 2014: Fourteenth Amendment and First Amendment of the Constitution.** *B. Fogerty and S. Sandstrom. Pre-law Program, College of the Holy Cross*
49. **Systematic Review of Gender Differences in Clinical Outcomes of Patients with Neurofibromatosis Type 1.** *T. Dutton<sup>1,2</sup>, V. Merker<sup>1</sup>, and S. Plotkin<sup>1</sup>. <sup>1</sup>Department of Neurology and Cancer Center, Massachusetts General Hospital; <sup>2</sup>American Cancer Society, New England Division*
50. **Web-Based Mathematical Software.** *C. J. Cao and A. D. Hwang. Department of Mathematics and Computer Science, College of the Holy Cross*
51. **Effect of Limb Demand Ischemia on Autophagy and Mitochondrial Biogenesis in Diet Induced Obese Mice.** *H. Albadawi, R. Oklu, J. D. Milner, T. P. Uong, H. J. Yoo, and M. T. Watkins. Division of Vascular and Endovascular Surgery, Massachusetts General Hospital*
52. **CT Angiography for Cerebral Vasospasm in Subarachnoid Hemorrhage: Utilization at Hartford Hospital.** *T. J. Genovese and M. D. Ollenschleger, Department of Radiology, Hartford Hospital*
53. **Staging Shakespeare's Spectacular Violence.** *H. Whall and F. Doyle. Department of English, College of the Holy Cross*
54. **Expression, Purification, and Spectral Analysis of the UL52 Zinc Finger Domain.** *J. H. Markowski, M. A. Zambrello, and J. C. Hoch. Department of Molecular Biology and Biophysics, University of Connecticut Health Center*

55. **Paleontological Fieldwork in Utah and Wyoming.** A. Kimelblatt, A. Randall, and L. Claessens. *Department of Biology, College of the Holy Cross*
56. **“When you see your story told, *tu existencia se valida*”:** Dolores Prida and the (Re)presentation of Spanglish in Theatre. K. Canastra and J. Alba-Salas. *Department of Spanish, College of the Holy Cross*
57. **Tools for Developing Web Software and Interactive Applications.** H. Tucceri and A. Hwang. *Department of Mathematics and Computer Science, College of the Holy Cross*
58. **Factors Affecting Hydrogen Bonding and Aggregation.** E. Kuhn and B. R. Linton. *Department of Chemistry, College of the Holy Cross*
59. **Measuring Behavioral Responses to Stimulation of the Bristles in *Drosophila melanogaster*.** D. D. Luu and S. M. Webster. *Department of Biology, College of the Holy Cross*
60. **Felt and Enacted Stigma Experience by Individuals Living with Multiple Sclerosis.** K. Carr and R. Beard. *Department of Sociology and Anthropology, College of the Holy Cross*
61. **Celiac Disease Associated Autoantibodies and Celiac Disease Symptoms in the Type-1 Diabetes Population and their Relatives.** E. A. Addonizio and M. Leonard. *Mucosal Immunology and Biology Research Center, and Center for Celiac Research and Treatment, Massachusetts General Hospital for Children*
62. **Alexander Hamilton: A Tarnished Reputation.** J. Murphy and D. Brand. *Department of Political Science, College of the Holy Cross*
63. **I Missed Your Cancer!?: An Eye-Tracking Study of Lung Cancer Detection in Radiology.** Z. Zaniewski<sup>1</sup>, M. Rosen<sup>2</sup>, and G. J. DiGirolamo<sup>1</sup>. <sup>1</sup>*Department of Psychology, College of the Holy Cross* and <sup>2</sup>*Department of Radiology, University of Massachusetts Medical School*
64. **Injured Nesting Sea Turtles on Bald Head Island and its Effect on Fecundity.** J. Seebode and J. Reneker. *Bald Head Island Conservancy*
65. **Peptide Bond Cleavage through Cyclization of Asparagine.** Z. T. Giaccone, J. N. Reitter, A. Steeves, H. J. Kulik, and K. V. Mills. *Department of Chemistry, College of the Holy Cross*
66. **Exploring Changes in Children’s Spatial-Relational Representations of the Day-Night Cycle.** A. Franco and F. Anggoro. *Department of Psychology, College of the Holy Cross*
67. **Optimization of Copy Number Test for DiGeorge Syndrome.** A. Castro, D. Mahnke, and A. Tomita-Mitchell. *Biotechnology and Bioengineering Center, Medical College of Wisconsin; Children’s Hospital of Wisconsin*
68. **Is ATOM Still Relevant for the Acute Care Surgeon?** J. Griffin, D’A. K. Joseph, K. J. Burns, and L. Jacobs. *Department of Surgery, Division of Trauma/Surgical Critical Care, Hartford Hospital*
69. **Mason Jar of Home: An EP Album Based on the Poetry of T. S. Eliot.** M. Dunbar and E. MacCarthy<sup>1</sup>. *Department of Music, College of the Holy Cross* and <sup>1</sup>*Department of Music, University of West Virginia*
70. **Synthesis of Novel Ligands through Mannich Condensation and Reductive Amination.** K. Niederhoffer, N. Landry, and J. Farrell. *Department of Chemistry, College of the Holy Cross*
71. **Phosphorylation regulates class IIa HDAC activity in osteocytes.** B. Beqo, Y. Lang, N. Gray, P. Divieti-Pajevic, M. Wein, and H. Kronenberg. *Endocrine Unit, Massachusetts General Hospital*
72. **The Knights of Columbus and Irish Catholic Male Identity in Worcester, 1919-1929.** C. Hyde and J. Poche. *Department of History, College of the Holy Cross*

73. **Cell-bound Complement Activation Products in Patients with Inflammatory Diseases.** *M. McGeary and C. Liu. Lupus Center of Excellence, Allegheny Health Network*
74. **The ‘Point’ of an Image: Understanding How Messages Can Be Relayed in Art.** *S. Granison and L. Schomp. Department of Visual Arts, College of the Holy Cross*
75. **Trunk Muscles, Balance, and Falls in Elderly Adults.** *E. Parker, B. Allaire<sup>1</sup>, D. E. Anderson<sup>1,2</sup>, and M. L. Boussein<sup>1,2</sup>. <sup>1</sup>Center for Advanced Orthopedic Studies, Beth Israel Deaconess Medical Center, and <sup>2</sup>Harvard Medical School*
76. **Spatial Working Memory in Mice.** *K. Moriarty and A. Basu. Department of Psychology, College of the Holy Cross*
77. **The Effect of Multiple Concealable Stigmatized Identities On Well-being.** *E. Inman and S. Chaudoir. Department of Psychology, College of the Holy Cross*
78. **Modeling Microscopic and Macroscopic Traffic Flow Utilizing the Particle Filter and Ensemble Kalman Filter.** *C. Cochrane, J. DeGuire, B. Fan, E. Holmes, M. McGuirl, P. Murphy, J. Palmer, B. Sandstede, and C. Xia. Department of Applied Mathematics, Brown University*
79. **The Problem of Morality and Modernity for Friedrich Nietzsche and Leo Strauss.** *A. Sliwowski and M. Dinan. Department of Political Science, College of the Holy Cross*
80. **Developing an Assay to Quantify the Ability of Lung Mesenchymal Stem Cells to Repair Cells Damaged by Exposure to Cigarette Smoke Extract.** *J. Bourgeois, J. Burns, E. Fiorentino, G. Motta, and J. Paxson. Department of Biology, College of the Holy Cross*
81. **The Role of Subjectivity in Referral Assessments for Transsexual, Transgender, and Gender-Nonconforming Clients.** *C. M. Wolfe, S. Chaudoir, and K. J. Rawson. Department of Psychology and Department of English, College of the Holy Cross*
82. **Modeling Chronic Immune Activation in HIV-1 Infection.** *K. Goettler and D. Damiano. Department of Mathematics and Computer Science, College of the Holy Cross*
83. **Indium and Bismuth Mediated One-Pot Deacetylation and Allylation.** *A. L. Fyles, D. Kumar, and G. R. Cook. Department of Chemistry and Biochemistry, North Dakota State University*
84. **Ion Beam Profile Monitor.** *K. Conte and P. Oxley. Department of Physics, College of the Holy Cross*
85. **Determining the Density of an Atomic Beam using Laser Absorption.** *J. Wihbey and P. Oxley. Department of Physics, College of the Holy Cross*
86. **Articulating Agency and Identity at a Cambodian-Vietnam Border Market.** *V. Khin and A. M. Leshkovich. Department of Sociology and Anthropology, College of the Holy Cross*
87. **“Forced Upon Us:” Economic Desires and the Crisis of Identity in Rhodesia.** *D. King and M. Munochiveyi. Department of History, College of the Holy Cross*
88. **Silica Coating and Bioconjugation on Gold Nanoparticles.** *T. Holland, C. L. Bayer, and S. Emelianov. Department of Biomedical Engineering, University of Texas at Austin*
89. **Acute Hind Limb Ischemia Reperfusion in the Recombinant Polygenic Type 2 Diabetic Mouse.** *T. Uong, H. Albadawi, R. Oklu, J. D. Milner, H.-J. Yoo, and M. T. Watkins. Department of Vascular and Endovascular Surgery, Massachusetts General Hospital*

90. **Using 3D Models to Estimate Mass of the Dodo.** A. Kimelblatt, A. Randall, and L. Claessens. *Department of Biology, College of the Holy Cross*
91. **On Globally Defined Solutions of the Generalized CLM Equation.** G. Yalla, S. Davies<sup>1</sup>, I. Alevy<sup>2</sup>, and J. Guzman<sup>2</sup>. *Department of Mathematics, Carnegie Mellon University*<sup>1</sup>, and *Division of Applied Mathematics, Brown University*<sup>2</sup>
92. **Rhodiola Crenulata Inhibits WNT Signaling in the MDA-MB-231 Triple Negative Breast Cancer Cell Line.** E. Amaro Gonzalez, L. Mateo Bassa, X. Williams, and S. Smith Schneider. *Pioneer Valley Life Sciences Institute*
93. **Staff Attitudes Regarding the Impact of an Animal Assisted Therapy Program on Military Behavioral Health Patients.** S. Brisson and A. Dekker. *Fort Belvoir Community Hospital*
94. **What is Water?** C. May, N. LaRovere, D. Sorokin, and D. Bitran. *Department of Psychology, College of the Holy Cross*
95. **A Longitudinal Assessment of HIV-Related Stigma and its Detrimental Effects on Psychological, Behavioral, and Physical Health Outcomes Among People Living with HIV/AIDS.** E. Richards and S. Chaudoir. *Department of Psychology, College of the Holy Cross*
96. **The Probabilistic Change Point Algorithm.** M. Antonellis and E. Ruggieri. *Department of Mathematics and Computer Science, College of the Holy Cross*
97. **A Historical Performance of Frescobaldi's *Fiori Musicali*.** A. Ross and J. D. Christie. *Department of Music, College of the Holy Cross*
98. **Morphological Variation in the Calling Structures of a Ground Cricket, *Eunemobius carolinus*.** K. Morsch and K. N. Prestwich. *Department of Biology, College of the Holy Cross*
99. **Automation and Stability Assessment of a Laser Spectrometer.** J. Golemi, T. Krueger, and T. Roach. *Department of Physics, College of the Holy Cross*
100. **Transit Systems and Algorithms: Enhancing the Use of Public Transportation.** M. Z. Dardas and B. Merolli. *Department of Mathematics and Computer Science; and O'Callahan Science Library, College of the Holy Cross*
101. **The Dominican Republic and Haiti: Analyzing a Post-Earthquake Relationship.** R. González and R. Carrasquillo. *Latin American and Latino Studies, College of the Holy Cross*
102. **Faith, Doubt, and Questioning in Later Life.** M. Duddy, E. Hillis, S. Moroz, and A. Futterman. *Department of Psychology, College of the Holy Cross*
103. **The Impact of Faith Experiences on Families of Those with Autism.** M. Bassaly, S. Schuetz, and S. Crawford Sullivan. *Department of Sociology and Anthropology, College of the Holy Cross*
104. **Love and the Kingdom.** K. Manansala and P. J. Fritz. *Department of Religious Studies, College of the Holy Cross*
105. **What Works in Ending Female Genital Cutting: Lessons from Egypt, Kenya, and Senegal.** M. Casey and V. Langohr. *Department of Political Science, College of the Holy Cross*
106. **Construction of a Portable Cosmic Ray Telescope.** M. Wasser and T. Narita. *Department of Physics, College of the Holy Cross*
107. **Philosophy and the Poetic Word.** T. Nowak, C. Dustin and J. Lawrence. *Department of Philosophy, College of the Holy Cross*
108. **Identifying Essential Regions in the Anti-HIV Protein Apobec3G.** R. Casazza and A. Sheehy. *Department of Biology, College of the Holy Cross*

109. **Lack of Carbohydrate Catabolite Repression in *Clostridium ljungdahlii*.** *P. McNamara and M. Vargas. Department of Biology, College of the Holy Cross*
110. **An Investigation of UNC-89 using Transgenic *C. elegans*.** *K. Deehan, G. Benian, and H. Qadota. Department of Pathology, Emory University School of Medicine*
111. **Investigating the Use of Naturally Occurring Immunoglobulin M (nIgM) as a Preventative Therapy for Autoimmune Diabetes.** *K. Brayman, P. Chhabra, and M. Langman. Department of Surgery, University of Virginia.*
112. **Effect of B-type Natriuretic Peptide on Emergency Department Diagnosis of Congestive Heart Failure.** *N. Cormier, S. Oh, and H. Smithline. Baystate Medical Center, Tufts Medical School*

## Poster 1

### The Holy Cross Community Garden: A Liberal Arts Tool for Harvesting Education

*C. Nguyen, M. Watson, M. Sterk-Barrett, and A. Borghini*  
*Department of Philosophy and Community Based Learning*  
*College of the Holy Cross*

In American society the food chain between producer and consumer continues to lengthen, causing people to increasingly become disconnected with the food that they eat. This divide raises many environmental, social, and political concerns regarding food systems as they exist. As a response, there has been an emergence of collegiate vegetable gardens in the United States in recent years. To analyze this phenomenon, we examined the following questions: Why are academic institutions leading movements to initiate community gardens, and in what ways are these efforts beneficial? Furthermore, why should the College of the Holy Cross establish its own community garden, and through what means could this be accomplished? These questions were investigated via a literature review, discussions with Holy Cross faculty members and administrators, and research visits to four New England campuses with operational community garden programs. Throughout our research, we observed that the cultivation of a college garden serves as an academic tool prompting food-based dialogue on campus, and nurturing the relationship between the environment and the community as a whole. Overall, our findings demonstrate that there are numerous cognitive, personal, and social benefits Holy Cross could attain through the establishment of a community garden—benefits that would support the College’s goal of fostering the intellectual and spiritual life of its members.

We thank the Mellon Foundation for financial support.

## Poster 2

### Analyzing Homeric Content in Two Manuscripts

*A. Boudon, C. Ryan, A. Simrell, M. Ebbott, and N. Smith*  
*Department of Classics, College of the Holy Cross*

The *Iliad* has been a subject of scholarly interest for millennia. Two manuscripts, the Venetus A and the Escorial Upsilon 1.1, illustrate this interest through the strikingly different sets of scholia, editorial notes that comment on the text, that each contains. The scholia inform on various topics, providing definitions of obscure words, discussions on the proper reading of a line, and background information on characters and places. As part of the larger Homer Multitext project we have created digital diplomatic editions of the text and scholia of *Iliad* 11 in both the Venetus A and the Upsilon 1.1. Our editorial work is keyed to photography of the manuscripts, subjected to an automated verification process, and made easily replicable through the use of virtual machines. Assembling the parallel editions of the two manuscripts in a digital environment is allowing us to better understand their relationship within the textual transmission of the epic and to draw conclusions about the transmission of ancient scholarly material to the tenth- and eleventh-century CE scribes of our manuscripts. One important deduction our methods have allowed us to demonstrate is that commentary from the great 2<sup>nd</sup> century BCE Homeric scholar Aristarchus may have been transmitted through multiple channels.

We gratefully thank the generous contribution made by Nancy Savage '79 and Stephen P. Skinner '77 to the Alumni/Parent Summer Research Scholarship Fund for support of this work.

### Poster 3

#### Consequences of Antifederalist Politics in American Political Thought

*T. Rice and D. Klinghard*

*Department of Political Science, College of the Holy Cross*

It is accepted that the division between Federalists and Antifederalists is ideological. As a result of the Antifederalists' adherence to the ideals of the Revolution in the face of constitutional ratification, modern scholarship is more apt to focus on the politics of the Federalists while focusing on the political thought of the Antifederalists. Thus, the Antifederalists have been indelibly linked with a philosophical approach to a political problem. But what if this perception is no more than the result of a successful political and rhetorical campaign launched by the Antifederalists? This project considers the possibility that the Antifederalists rested on philosophy as a political tool in an attempt to impede the success of the Federalists' program. I endeavor not only to highlight political tactics of the Antifederalists and reiterate their philosophical congruence with the Federalists, but also to shed light on the use of philosophy as a political tool. By linking basic political disagreements with foundational concepts, the Antifederalists demonstrate the divisive but ultimately ineffective tactic of creating philosophical contention through misleading rhetoric and issue simplification.

I am indebted to the Charles Carroll Program and Robert R. Henzler '55 for their financial support.

### Poster 4

#### Developing Methods for Examining Social Coordination

*D. Vogus and R. Schmidt*

*Department of Psychology, College of the Holy Cross*

Past research has demonstrated that when two people interact, they coordinate their individual behaviors into a joint pattern of action, which can be explained by mathematical models of synchronization. However, this social motor coordination research has mainly utilized less naturalistic tasks, such as pendulum swinging, to investigate the unconscious synchronization involved. Our study aims to establish more naturalistic methods to evaluate social motor coordination, so that its breakdown in pathologies can be investigated. In this study, pairs of undergraduate participants were asked to complete three interaction tasks. In the first, the participants told knock-knock jokes to each other. The second was an alphabetizing task, in which the participants worked together to list twenty words into alphabetical order. The third task was a survival scenario task, in which participants had to decide what items they would need if they were stranded on a desert island. In the final task, participants were instructed to sort poker chips together either in an inphase pattern or an antiphase movement pattern. Participants' movements were recorded using either a video (Microsoft Kinect camera) or magnetic-based (Polhemus G4) acquisition systems. We predict that participant's movements during these tasks will be coordinated, in that participants activity will be significantly correlated in time and will exhibit inphase ( $0^\circ$ ) and antiphase ( $180^\circ$ ) relative phase patterns. We hope to apply this more naturalistic method of measuring social motor coordination in the future, particularly in the study of the social deficit in schizophrenia.

This work was funded by National Institutes of Health Grant R01GM105045.

## Poster 5

### Some Like it Hot: Temperature Dependence of Thermophilic Intein Activity

*M. Jaramillo, J. Williams, J. Reitter, and K. Mills*  
Department of Chemistry, College of the Holy Cross

Protein splicing is the self-catalyzed excision of an intervening polypeptide (intein) from flanking polypeptides. (exteins), concomitant with the ligation of the exteins. Similar inteins found in two thermophilic archaeobacteria, *Pyrococcus abyssi* and *Pyrococcus horikoshii*, interrupt the activity of DNA Polymerase II. NMR data and a shared 75% sequence identity suggest a structural homology between the inteins with the exception of a longer, disorganized loop in *P. abyssi*. The longer loop is hypothesized to provide a less rigid structure that allows splicing to occur at lower temperatures. We have compared the extent at which N-terminal cleavage and splicing of both inteins occur at different temperatures. N-terminal cleavage and splicing occur to a greater extent at lower temperatures for the *P. abyssi* intein compared to the *P. horikoshii* intein. We plan to create an assay in order to examine the structure of the two inteins at different temperatures and how exposed the loops are to the surrounding environment. The addition of thermolysin, a thermostable protease, should result in increased cleavage of the exposed intein loop at lower temperatures for *P. abyssi* compared to that of the shorter loop in *P. horikoshii*. Future experiments will observe the capability for both inteins to undergo C-terminal cleavage at varying temperatures.

This material is based upon work supported by the National Science Foundation (MCB-1224089) and the Dreyfus Foundation.

## Poster 6

### A Structural and Biophysical Analysis of Protein Splicing

*M. Koulopoulos, Z. Giaccone, J. Reitter, and K. Mills*  
Department of Chemistry, College of the Holy Cross

Protein splicing is the process by which a polypeptide chain, called an intein, self-catalyzes its excision from two flanking polypeptides, called exteins, with these two exteins ligating together. We are interested in how these inteins catalyze the splicing reaction and we therefore are studying the mechanism by both structural and biophysical methods. An atomic-level resolution **structure** of an intein precursor could provide insight into the prearrangement of catalytic intein residues. This summer we have attempted isolating the intein of the extreme thermophile *Pyrococcus horikoshii* to compare to an existing *P. horikoshii* intein precursor the lab has crystallized. We have begun to optimize a technique for purifying this intein by experimenting with different gene contexts. Upon purification, we will crystallize the protein segment for analysis against our existing precursor crystals. We have also been studying the third step of the protein splicing mechanism, asparagine cyclization, by **biophysical** means via fluorescence-based assay using a model peptide. Data from fluorescence experiments are guiding us towards focused questions regarding the effect varying active-site amino acids on the cyclization and subsequent acyl rearrangement.

We thank the generous contribution made by Kim and Wendell P. Weeks P15, to the Alumni/Parent Summer Science Research Scholarship Fund. This material is based upon work supported by the National Science Foundation (MCB-1224089) and the Dreyfus Foundation.

## Poster 7

### In the Loop: Relating Intein Flexibility to the Temperature Dependence of Activity

*A. Bonano, A. Yakely, M. Jaramillo, J. Williams, J. Reitter, and K. Mills*  
*Department of Chemistry, College of the Holy Cross*

Protein splicing is the self-catalyzed removal of inteins, intervening polypeptides, in coordination with the ligation of the exteins, flanking polypeptides. We are examining the DNA Pol II inteins found in the extremophiles *Pyrococcus abyssi* (*P. abyssi*) and *Pyrococcus horikoshii* (*P. horikoshii*). The inteins from *P. abyssi* and *P. horikoshii* are largely homologous except for the presence of a large, disorganized loop in the *P. abyssi* intein, in contrast to the smaller and organized loop in the *P. horikoshii* intein. We have observed temperature dependence of the activity of the two inteins, which we hypothesize is due to the difference in their respective structures. The smaller loop may allow for a more rigid structure in the *P. horikoshii* intein resulting in a higher temperature needed for protein splicing. The *P. abyssi* intein has a longer loop resulting in a less rigid structure, so a lower temperature is needed for protein splicing. To test this hypothesis, we will swap the loops on the *P. abyssi* and *P. horikoshii* inteins to determine whether that alters the temperature dependence of the inteins' activity. Our work this summer was to use recombinant DNA technology to alter the genes for the inteins to make a chimera of the *P. abyssi* intein with the *P. horikoshii* loop and vice versa. We are using site-directed mutagenesis to insert restriction sites to cut the plasmids. From there, we will use blunt-end ligation to insert the DNA sequences that code for each loop into the other plasmid to produce the chimeras. Finally, we will express the proteins from the chimeras to test our hypothesis.

This material is based upon work supported by the National Science Foundation (MCB-1224089) and the Dreyfus Foundation.

## Poster 8

### Investigation of Unusual Activity of Intein Splice Junctions

*D. Castillo, S. Cahn, J. Reitter, and K. Mills*  
*Department of Chemistry, College of the Holy Cross*

Protein splicing is the self-catalyzed rearrangement in which the intervening sequence (intein) removes itself from a protein and then ligates the flanking protein segments (extein). The mature protein can now fold into an active conformation. The intein of interest comes from *Methanoculleus marisnigri* (Mma). The wildtype intein splices poorly with C-terminal glutamine but faster with C-terminal asparagine. We want to use a directed evolution system to select for mutant inteins that splice more efficiently with C-terminal glutamine. The splicing activities of the inteins were tested with a phenotypic assessment using thymidylate synthase (TS). The intein interrupts a gene for TS such that splicing of the intein is required for *Escherichia coli* (E.coli) growth on minimal media. It was hypothesized that E.coli cells with the wildtype intein would yield less growth than those with the mutation to a C-terminal asparagine. However, the assay showed that neither intein spliced from the TS protein. Another area of interest is to investigate the unusual activity of various *Pyrococcus abyssi* (*Pab*) MIH intein mutants under different pH conditions. When we substitute the final residue of the N-extein to aspartic acid we get unusual cleavage activity. We want to explore the mechanism of that cleavage activity in relationship to work done by others in the lab with a model peptide system to investigate the pH dependence of this reaction.

This material is based upon work supported by the National Science Foundation (MCB-1224089) and the Dreyfus Foundation.

## Poster 9

### The Historical Debate Over the Principles Underlying the Patent and Copyright Clause

*C. Fimognari and D. Klinghard*

*Department of Political Science, College of the Holy Cross*

Congressional authority to grant patents and copyrights is a right established in Article 1, Section 8, Clause 8 of the Constitution. The purpose of this clause has been debated throughout American history and bears relevance for contemporary legal patent disputes. Two different historical interpretations of the clause lead to different notions of its proper application. One interpretation is that the clause secures a preexisting right of inventors to the fruits of their labor, while the more popular interpretation is that the clause exists to grant an exclusive right for a limited period of time to encourage technological progress for the overall benefit of society. My research explores this conflict in American patent law interpretation from its origin in English copyright law through the nineteenth century in order to comprehensively describe an important debate that, as the result of a few key Supreme Court decisions, has been largely obscured today. By reconstructing this historical debate through the examination of Supreme Court precedent, state and federal laws in the eighteenth and nineteenth centuries, and the writings of Madison and Jefferson, this research seeks to establish the significance and purpose of the patent and copyright clause as well as how its interpretation has changed over time in order to better address modern patent disputes and examine the relationship between technology and political thought.

We thank the Mellon Foundation for financial support.

## Poster 10

### Functionalization of Nanoporous Gold

*C. Chevalier, R. Chevalier, and E. Landis*

*Department of Chemistry, College of the Holy Cross*

Nanoporous gold (NPG) is gold with very small pores on the surface, pores the size of nanometers that cannot be seen without the use of a high powered microscope. These pores produce properties of the gold that differ from that of flat gold due to increased edge sites and corrugation. The NPG surface has interested many scientists to study it for applications including catalysis and sensing. We explored the stability of thiols and diazonium groups on the NPG. Various thiols were attached to the bare NPG surfaces using the technique of functionalizing in a solution of thiol molecules. Cyclic voltammetry was used to attach diazonium molecules to the NPG surface. Several techniques were used to observe the density of the layers. The binding strength and stability of these molecular monolayers were also tested. NPG dealloying times were compared to observe a difference in the surface area and stability of the compounds on the NPG

We give special thanks to Kathleen and Stephen R. Winslow P16, 14 (CC), and Jane and Joseph T. Murray '58, P86 (RC) for their generous contribution to the Alumni/Parent Summer Science Research Scholarship Fund. We also thank a Research Corporation Cottrell College Science Award for financial support.

## Poster 11

### Quantum Scattering Using the Finite Element Method (FEM)

*S. McAlinden, E. Farrell, and J. Shertzer*  
*Department of Physics, College of the Holy Cross*

The finite element method (FEM) is a numerical algorithm for solving second order partial differential equations. Our research involved using the FEM to solve the Schrödinger equation for quantum mechanical systems, including both bound states and scattering states. We first considered a beam of particles scattered by a rectangular potential barrier. We calculated the wave function, as well as the transmission and reflection coefficients as functions of the particle energy and barrier height. This problem is an important test case, because it is one of the few scattering problems that can be solved exactly. In this poster, we compare our results to the exact solution. The advantage of the FEM is that one can obtain accurate numerical solutions for more complicated potentials, which cannot be solved analytically. We are currently extending this analysis to calculate the diffraction pattern for electrons passing through a single slit using a two-dimensional version of the FEM.

We would like to acknowledge the generous support of Katina and Edward Burke Jr. '86 (SM), and the Alumni/Parent Summer Science Research Scholarship Fund (EF).

## Poster 12

### The Scribal Tradition of Jerome's *Chronicle* in Two Manuscripts

*N. Jalbert, S. Neville, C. Schufreider, and N. Smith*  
*Department of Classics, College of the Holy Cross*

The *Chronicle* of Saint Jerome charts the history of the world from the time of Abraham through the reign of the Roman Emperor Theodosius. Jerome translated most of the *Chronicle* from the Greek work of Eusebius of Caesarea, but extended its scope from Eusebius' death through his own times, with further additions, throughout Eusebius' material, of interest to Jerome's Latin audience. The only modern edition of Jerome's *Chronicle* is a comparative, or *critical*, edition that attempts to reconstruct a single original form of the work by omitting all content diverging from Jerome. A critical edition misrepresents the malleable genre of the chronicle. As seen from Jerome's own expansion of Eusebius, the *Chronicle* must be viewed as a living document: the entire tradition of scribal contribution deserves to be studied. To this end, we are creating the first complete diplomatic edition of two manuscripts of Jerome, Geneva Library 49, and St. Gallen, Vadianische Sammlung 298. The scribe of the Geneva 49 manuscript shares our interest in recording differing versions of the *Chronicle*. He uses the word *aliter* ("differently") to note divergences from other sources. These differences are not mere variants in phrasing, but highlight conflicts in ordering the chronological sequence of events, for example, whether one bishop was the fourth rather than the third person to hold his office, or even whether another bishop ministered in Greece rather than Asia Minor. The creation of a diplomatic edition challenges our perception of scholarship over time: if scribes were making conscious choices and not mistakes, then their role in the manuscript tradition changes from mere copyists to scholars participating in a far-reaching historiographical conversation.

We gratefully acknowledge the Andrew W. Mellon Foundation and contributions by Deborah C. and Timothy W. Diggins '80 to the Alumni/Parent Summer Research Scholarship Fund.

### Poster 13

#### Rhenium Compounds with Imidazolecarboxaldehyde Ligands or Aspartame

*S. Valente, A. Neeper, and R. S. Herrick*

*Department of Chemistry, College of the Holy Cross*

Rhenium compounds have attracted much interest from researchers in recent years. Rhenium is similar to another element  $^{99m}\text{Tc}$ , which is a highly used nuclide in nuclear medicine. The similarities between these elements has fueled the interest in studying  $^{188}\text{Re}$ .  $^{99m}\text{Tc}$  is a gamma photon emitter that makes it useful for vivo diagnosis.  $^{188}\text{Re}$  is a  $\beta$  emitter that makes it useful for tumor therapy. Due to the fact that these two elements have similar properties, a pair of Tc and Re compounds could be used first for diagnosis and then therapy on a specific tumor. The focus of this summer's research was on attaching imidazolecarboxaldehyde ligands to a rhenium tricarbonyl halide center and aspartame to a rhenium tricarbonyl bromide center. These compounds were prepared by heating either rhenium pentacarbonyl chloride or rhenium pentacarbonyl bromide with each ligand separately. The ligands include imidazole-2-carboxaldehyde, 1-methyl-2-imidazolecarboxaldehyde, and 4-imidazolecarboxaldehyde. Rhenium pentacarbonyl bromide and aspartame were heated to form a rhenium aspartame compound.  $^1\text{H}$  and  $^{13}\text{C}$  NMR, IR, and X-ray crystallography were used to characterize these compounds. Future work in this area will be to improve upon the preparation of these imidazolecarboxaldehyde and aspartame compounds and to uncover the details of their geometries by solving their molecular structures.

This research was made possible by a grant from the American Chemical Society Petroleum Research Fund (51085-UR3). The Herrick lab would also like to acknowledge C. J. Ziegler.

### Poster 14

#### Geometric Flows of Plane Curve

*J. De La Cruz Santos, R. Gallagher, S. Hadaidi, and A. Cooper*  
*Department of Mathematics, North Carolina State University*

The process of deforming a curve by the curvature vector at each point is known as the curve-shortening flow (CSF). Grayson showed that CSF averages the shape of a curve, causing simple, closed curves to become asymptotically circular. This project applies the idea of curvature flow to polygons. We give a novel definition for the 'curvature vector' at a vertex of a polygon. Deforming in the direction of this curvature vector yields a flow of polygons, the polygon curvature flow (PCF). We numerically investigate the behavior of this flow and show that it exhibits several of the qualitative properties of CSF. We conjecture that PCF makes polygons asymptotically regular.

Thanks to our advisor Dr. Andrew Cooper for his help and guidance on this project, as well as our graduate assistant Dan Scofield. We would also like to thank North Carolina State University for accommodating us during the mathematics REU. Finally, we would like to thank the National Science Foundation and the National Security Agency for providing funding for our project.

## Poster 15

### Supersymmetry Breaking in a Metastable Vacuum

*B. Kain and Z. Fernandes*

*Department of Physics, College of the Holy Cross*

We studied the work of Fischler et al. who analyzed a supersymmetry-breaking model occurring in a metastable vacuum. Largely motivated by questions concerning supersymmetry breaking, their model sought to test the likelihood of ending up in a non-zero, and therefore supersymmetry breaking potential, after the rapid expansion and cooling of a universe. In order to accurately model the transition, we formed our equations in the direction of two different particles and added a temperature correction to both. From the model we were able to obtain graphs of the potential energy which contained either one or two minima depending on our choice of temperature, and represented the vacua. Using the model we began to slowly lower the temperature in both particle directions in order to watch the transition of these minima. While at very high temperatures we saw the minima lie at the origin, as we lowered the temperature we were able to observe a second vacuum forming with a non-zero potential. Focusing on the transition, it appeared that if our universe did indeed start at the origin, it would be likely that we would end up in the previously mentioned supersymmetry-breaking vacuum, as a barrier began to form whereby the universe would be prevented from entering the zero potential vacuum. The findings agree with experimental research which states that if supersymmetry is indeed valid, that it must be broken within our universe.

We are grateful to the Richard B Fisher Summer Research Fellowship for supporting this work.

## Poster 16

### Copper-Catalyzed Synthesis of Beta-lactams

*S. Namirembe and A. K. Isaacs*

*Department of Chemistry, College of the Holy Cross*

$\beta$ -lactams are important synthetic intermediates as they are building blocks of a wide range of compounds such as penicillin, and provide powerful defense against microbial infections.  $\beta$ -lactam antibiotics inhibit the biosynthesis of the cell wall by deactivating cell membrane enzymes, resulting in a significant decrease in the proliferation of bacteria. However, bacterial resistance to antibiotics has emerged as one of the major public health concerns of the current decade. The synthesis of diverse  $\beta$ -lactams via novel methods could provide an answer to bacterial resistance by exposing bacteria to new antibiotics that were previously unattainable by classic synthetic methods. In the Isaacs lab, we sought to discover and optimize a novel approach towards the synthesis of  $\beta$ -lactams. We utilized the recently discovered click chemistry that utilizes copper as a catalyst to synthesize ketenimine species that are engaged with the desired nucleophile to avail the  $\beta$ -lactam. The substrates were synthesized via a two-step protocol to give the desired bisalkyne. In a one-step copper-catalyzed click reaction, the electrophilic alkyne transforms into a 1,4-disubstituted 1,2,3-triazole that spontaneously decomposes to the ketenimine intermediate. The nucleophilic component engages with the ketenimine in a [2+2] cycloaddition reaction to form a fused 4-membered ring system. This methodology enables the synthesis of previously unattainable  $\beta$ -lactam precursors.

We thank the Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowship Program for financial support.

## Poster 17

### Which God? Which Apologist? Transcendence, Paradox and the Incarnate Word

*S. Merola and J. Gavin, S.J.*

*Department of Religious Studies, College of the Holy Cross*

When Christians and atheists debate about God, are they even talking about the same subject? Or, is each side setting up its own “straw-God,” a non-existent creature that is used to satisfy an agenda, but has no relation to the transcendent? This very issue has plagued contemporary Christian apologetics: how to defend an ineffable God to a determinist and materialist culture. An approach to this question may be found in Origen of Alexandria’s *Contra Celsum*, a third-century apology written against the Platonist philosopher Celsus. Origen says that humans apprehend the divine only by truly apprehending that our knowledge of God is paradoxical, or mysterious. For this concept to resonate with the modern mind, however, the human need for the transcendent must first be reawakened. The apologetics of David Bentley Hart illumine this necessity. Hart uses everyday experiences of being, consciousness and bliss to reveal the human orientation to the divine. In doing so, he unveils the paradox of humanity: humans are finite creatures whose *telos* is ineluctably transcendent. Once this is established, Origen’s apologetics become accessible. Origen’s task is not so much to prove that God exists, but that He revealed Himself and became incarnate in the person of Jesus Christ, the Logos of the Father. Origen shows that Christ is the paradox that makes sense of humanity’s paradoxical desire for God.

We offer our profound gratitude to the Andrew W. Mellon Foundation for financing this project.

## Poster 18

### Molecular Systematics of Appalachian Cave Beetles

*A. Sullivan, A. Carlson, and K. Ober*

*Department of Biology, College of the Holy Cross*

Isolated environments, such as deep cave systems, allow for the study of speciation events and evolutionary adaptations of living organisms. Organisms that live deep in caves commonly become so specialized to their environment that dispersal is limited and species once considered to have wide distributions are discovered to be multiple species lineages due to a lack of gene flow between populations. The ground beetle genus *Pseudanophthalmus* inhabits caves in the Appalachian Mountains of North America and contains more than 225 species. Using molecular sequence data from the *wingless*, *ArgK*, *28S*, and *COI* genes, we inferred the evolutionary relationships of 159 cave beetles from several species of *Pseudanophthalmus* and members of the closely related species *Darlingtonia kentuckiensis*, including several previously undescribed species. Using Bayesian methods and a maximum likelihood framework, we reconstructed the evolutionary tree of these beetles and estimated the time since the lineages last shared a common ancestor. Using various polymerase chain reaction (PCR) techniques we have successfully amplified the genes of interest and compiled them into a comprehensive database for future phylogenetic analysis. While sample size for each gene varies, cumulatively they provide a robust evolutionary framework to examine the colonization history, biogeography, and speciation of *Pseudanophthalmus*.

We thank Catherine E. and Domenic J. Dinardo '75, P17, 06 for their generous contribution to the Alumni/Parent Summer Research Scholarship. Additionally, we thank M. Niemiller for collecting and providing all specimens used in this study.

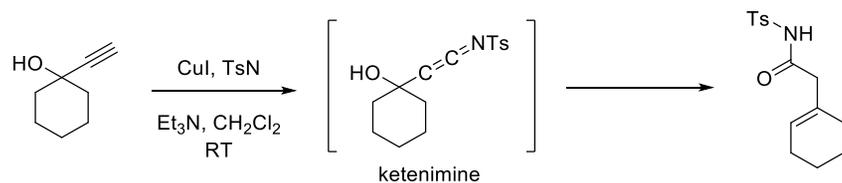
## Poster 19

### Copper-Catalyzed Reactivity of Ketenimines

*J. L. Chen and A. K. Isaacs*

*Department of Chemistry, College of the Holy Cross*

Ketenimines are reactive intermediates that engage with a diverse range of nucleophiles. We applied a 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, a 1,4-disubstituted 1,2,3-triazole results from the acyclic substrate that spontaneously decomposes to the desired ketenimine intermediate which can then engage with a nucleophile at the electrophilic carbon.



We sought to expand the substrate scope of nucleophiles that can engage with the ketenimine by utilizing activated benzenes and alcohols. This methodology enables the synthesis of corresponding nitrogen-containing heterocycles and biological relevant compounds.

We thank Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowship Program for financial support.

## Poster 20

### Catalytic Asymmetric Monophosphorylation of Diols

*B. Sculimbrene and M. Lougee*

*Department of Chemistry, College of the Holy Cross*

The chemical synthesis of phosphorylated molecules is a major interest in the Sculimbrene lab, particularly FTY720-phosphate. The immunosuppressant drug FTY720 contains two alcohol groups, commonly called a diol. Either of these alcohols may be phosphorylated to form FTY720-phosphate. However, the active immunosuppressive compound corresponds to phosphorylation of only the pro-(S) alcohol. FTY720 is administered as a pro drug, meaning it is ingested in the diol form and the body selectively phosphorylates the pro-(S) alcohol to form the active drug, (S)-FTY720-phosphate. The Sculimbrene lab has developed a method for the Lewis acid catalyzed mono-phosphorylation of diols, including a model compound for FTY720-phosphate. The next step towards a chemical synthesis of (S)-FTY720-phosphate is developing chiral Lewis acid catalysts for the phosphorylation reaction. Chiral catalysts, like enzymes, can provide the asymmetry necessary for phosphorylation of only the pro- (S) alcohol. The project began with a large-scale two-step chemical synthesis of the chiral ligand TADDOL. We are currently studying methods to attach the chiral ligand to a Lewis acid and screening the reactions asymmetric catalyst in the phosphorylation of FTY720.

We thank Laurie D. and William C. Goggins, MD, '88, for their generous contribution to the Alumni/Parent Summer Science Research Scholarship fund.

## Poster 21

### Transfer and Processing of the Seminal Fluid Protein Antares During and After Mating of *Drosophila melanogaster*

*K. Baranowski and G. Findlay*

*Department of Biology, College of the Holy Cross*

Learning how reproductive pathways function in insects is important because it can yield approaches for manipulating insect disease vectors and potentially controlling diseases. *Drosophila melanogaster* is an excellent model organism to study the reproductive pathway of insects. After mating, *Drosophila* females exhibit modified behavior and physiology, including increased egg production and resistance to remating. These changes are caused by the storage of sperm and other transferred proteins, called seminal fluid proteins, within specialized storage organs in the female reproductive tract. Stored proteins interact with female proteins and with one another in several pathways, most notably the sex peptide (SP) pathway. SP is a seminal fluid protein that underlies the behavioral and physiological changes in mated *Drosophila* females. Antares is one protein in the SP pathway. When antares is absent in males, mated females exhibit reduced egg production and are receptive to remating. Using Western blots, we found that antares does not undergo proteolytic processing and that the protein persists in female reproductive tracts for at least 4 hours after mating. To evaluate how antares fits into the SP pathway, other members of the pathway were silenced using RNA interference. This allowed us to observe the effect of their absence on antares. We found that the transfer of antares from males to females is not impeded by ablating the expression of any other member of the pathway. These results are consistent with previous reports that antares acts upstream in the pathway that facilitates the transfer of other seminal proteins to females.

We thank Mary R. and Herman R. Charbonneau '56, P97 for their generous donation to the Alumni/Parent Summer Research Scholarship fund.

## Poster 22

### Characterizing *Drosophila* Saturn Protein Function

*A. Gubala and G. Findlay*

*Department of Biology, College of the Holy Cross*

Learning to manipulate insect reproductive pathways is an important way of controlling the spread of insect disease vectors. *Drosophila melanogaster* is an excellent insect model organism in which to study sperm storage, a function of many insect species. *Drosophila* females store sperm in specialized organs, and release the sperm once the environment is optimal. In order for sperm storage to occur, there must be correct spermatogenesis in the male, successful transfer to the female, and an effective change in sperm swimming to allow for accurate localization to the sperm storage organs. Previous work using RNA interference has identified the *saturn* gene as important for male fertility by causing a defect in either spermatogenesis or sperm storage. Sperm transfer appears to be unaffected by the *saturn* gene. Our first project was to confirm the identity of the *saturn* gene, since the initial RNAi screen affected the expression of not one, but three separate genes. Using additional RNAi lines, gene expression analysis, and fertility assays, we qualitatively and quantitatively determined that *CG32141* is the *saturn* gene. We then used fluorescence microscopy to examine the behavior of mutant and control sperm that express green fluorescent protein (GFP) in the nucleus. Since sperm were present in the female reproductive tract after mating, *saturn* is not required for sperm transfer. In future experiments, we will quantify the levels of sperm present in the male before mating and in the female storage organs after mating, to test whether *saturn* is required for spermatogenesis or sperm storage, respectively. We are also developing a knock out allele of *saturn* to check for the same fertility defect when the gene product of *saturn* is completely absent.

We thank Marion and Samuel E. Krug, Ph.D. '65 for their generous donation to the Alumni/Parent Summer Research Scholarship fund.

## Poster 23

### Expression of the Membrane Protein Cyclooxygenase-2 Using Recombinant Baculovirus

*L. Yacobucci and B. Orlando*

*Hauptman-Woodward Medical Research Institute*

Cyclooxygenase (COX) is the enzyme responsible for the formation of prostaglandins. Selective inhibition of COX-2 versus COX-1 is desirable since COX-2 produces prostaglandins involved in pain, inflammation, and fever. COX produces prostaglandins via the oxygenation of fatty acids present in the phospholipid bilayer of cellular membranes. COX is traditionally inhibited by NSAIDs such as Ibuprofen, Flurbiprofen, and Celebrex. However, the use of NSAIDs can result in negative side effects including gastrointestinal and cardiac complications. The Bac-to-Bac system is used to generate recombinant baculovirus. Infecting insect cells with baculovirus will result in high-level expression of recombinant proteins. Cyclooxygenase-2 expressed in the Bac-to-Bac System will be utilized for site-directed spin labeling experiments to determine the mechanism of NSAID mediated allostery. Each of the constructs we've made is a mutation of a residue(s) in the COX-2 membrane binding domain or constriction site. SDSL-EPR and activity assays data will be used to study the dynamic nature of this region of COX-2.

We thank the Hauptman-Woodward Medical Research Institute for financial support.

## Poster 24

### Were the Billions Brazil Spent on World Cup Stadiums Worth it?

*V. Matheson and G. Ross*

*Department of Economics and Accounting, College of the Holy Cross*

Brazil spent \$11.6 billion dollars on the 2014 World Cup, with at least \$3.6 billion of that going towards the construction costs of 12 new or refurbished stadiums. We looked at the past five World Cup hosts' stadiums and their usage four years after to project what may happen to Brazil in the near future. We found stadium costs through news outlets and other sources, as well as attendances from team websites. We then compiled an estimate of how much each stadium was used. The winners in terms of cost and usage were the United States, France, and Germany. The losers were Japan, South Korea, and South Africa. From the initial numbers, Brazil appears to be among one of the worst cases. Only time will tell if their investment really is a bust. An article pertaining information about this study was published on the popular news source fivethirtyeight.com.

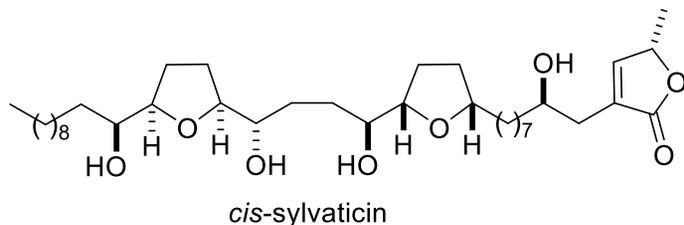
We thank the Office of the Dean of the College of the Holy Cross for its financial support.

## Poster 25

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

*M. L. Maliszewski and K. J. Quinn*

*Department of Chemistry, College of the Holy Cross*



*cis*-Sylvaticin is a cytotoxic natural product isolated from the leaves of the *Rollinia mucosa* plant belonging to the Annonaceous acetogenin family. On this poster, we will describe a second generation, two-directional route to the bis(tetrahydrofuran) core that takes advantage of its local  $C_2$  symmetry. The key step in the synthesis is a silicon-tethered triple ring-closing metathesis (RCM), which will establish the carbon-carbon connectivity of the central portion of the molecule. Our focus this summer has been the development of a practical, eight-step route for the asymmetric preparation of the substrate for the key RCM step from the chiral pool material (+)-diethyl tartrate. Thus far, we have successfully completed the synthesis of a  $C_2$ -symmetric dienediol possessing the requisite absolute stereochemistry and have confirmed the viability of the RCM with a stereoisomeric substrate. Completion of the total synthesis will require desymmetrization to append the alkyl and the butenolide-containing side chains.

Financial support in the form of a Robert J. Stransky Student Research Fellowship in the Sciences is gratefully acknowledged.

## Poster 26

### $\beta$ -sheet Formation in Peptides Containing Tri-Alanine

*B. Chartier and S. Petty*

*Department of Chemistry, College of the Holy Cross*

Proteins are important biological molecules that are needed to perform many essential biological processes. In order to carry out these processes proteins need to fold into a very specific three-dimensional structure. The folding process is determined by many things including the interactions of the protein's side chains with each other and with the surrounding solvent. Proteins do not always fold properly however, and this leads to misfolded proteins that are non-functional. A build-up of misfolded proteins can lead to loss of function and the formation of possibly toxic aggregates. Many diseases such as Alzheimer's disease, Parkinson's disease, and Huntington's disease are associated with protein misfolding. Aggregates that form from misfolded proteins have been found to have a higher concentration of  $\beta$ -sheet structure than is found in the natively folded protein. Trialanine is a short peptide sequence that is common in a variety of important proteins and is able to form  $\beta$ -sheet in isolation. This research focuses on how the trialanine's ability to form  $\beta$ -sheet is modified by placing different amino acids on the N and C-terminus of the trialanine chain. Most of the amino acids that were added were found to inhibit trialanine's ability to form  $\beta$ -sheet. Trialanine with acidic amino acids were found to have some unexpected peaks. The results show that varying the position of isoleucine in the alanine chain changes the peptide's ability to form  $\beta$ -sheet.

I would to thank Mora M. and Timothy J. Babineau M.D. '82 for their generous contribution to the Parent/Alumni Summer Science Research Scholarship fund.

## Poster 27

### **$\alpha$ -Synuclein Misfolding and $\beta$ -Sheet Aggregation in Parkinson's Disease**

*M. Stuckey and S. Petty*

*Department of Chemistry, College of the Holy Cross*

The buildup of amyloid fibrils in the brain is known to cause many neurodegenerative diseases. These amyloid fibrils form when proteins misfold into a conformation rich in  $\beta$ -sheet. These  $\beta$ -sheets can aggregate with one another to form the amyloid fibrils responsible for the break-down of specific neurological processes.  $\alpha$ -synuclein is a pre-synaptic protein identified as a SNARE-protein chaperone enabling neurotransmitter release.  $\alpha$ -synuclein is natively disordered, but is known to misfold into a  $\beta$ -sheet conformation. Mutations and overexpression of  $\alpha$ -synuclein cause the protein to aggregate; these aggregates are found in the form of Lewy bodies in the brains of Parkinson's disease patients. Parkinson's disease progresses gradually and impedes motor function. Previous research has shown that the deletion of residues 85-94 of the  $\alpha$ -synuclein protein ( $\Delta$ 85-94 AGSIAAATGF) inhibits amyloid formation. We synthesized all tripeptides of this sequence and analyzed their structural tendencies using infrared spectroscopy in order to identify the nucleating region of protein misfolding. Peaks indicative of  $\beta$ -sheet would be found at  $1620\text{-}1625\text{cm}^{-1}$  and  $1690\text{cm}^{-1}$ . Four of these tripeptides showed signs of  $\beta$ -sheet conformation while the remainder appeared to adopt a "random coil" structure. Increasing temperature caused changes in both types of peptide, which will be explored. We will continue searching for  $\beta$ -sheet inducing sequences by synthesizing polypeptides four amino acids in length and analyzing secondary structure using infrared spectroscopy.

The authors would like to thank the Alumni/Parent Summer Research Scholarship for funding this project.

## Poster 28

### **The Effects of Surface Growth Conditions on the Morphology and Cytoskeleton of Mammalian Cells**

*S. Haddad<sup>1</sup>, M. Stanton<sup>2</sup>, C. Lambert<sup>2</sup>, R. Bellin<sup>1</sup>, and W. Holmes<sup>1</sup>*

*<sup>1</sup>Department of Biology, College of the Holy Cross, and <sup>2</sup>Department of Chemistry and Biochemistry, Worcester Polytechnic Institute*

Mammalian cells are traditionally cultured and studied on flat plastic or glass surfaces, which do not resemble the *in vivo* environment where cells are originally derived. Studies have shown that cells cultured on two-dimensional surfaces experience higher cellular stress levels and acquire a different morphology than cells grown on three-dimensional surfaces; therefore, two-dimensionally grown cells are less likely to withstand the same extent of cytotoxic stresses. Various commercial three-dimensional matrix products have been used for laboratory research; however, these products are expensive and difficult to utilize. We have created rough PDMS surfaces using silicon carbide paper with features that allow cultured cells to proliferate in a three dimensional-like fashion. Our data show alterations in the cellular morphology between cells cultured on smooth and rough PDMS surfaces. We have observed increases in actin stress fiber formation of cells cultured on smooth surfaces and a loss of actin stress fibers on the rough surfaces. Cells cultured on three-dimensional surfaces show differences in filamentous/globular-actin ratios. The changes to the actin cytoskeleton led us to consider modifications to the extracellular matrix that supports the cell. We then looked at the expression of Matrix metalloproteinase 14 (Mmp14), an enzyme that aids in altering the extracellular matrix and is upregulated in cells grown on three-dimensional surfaces. We will continue exploring F/G-actin ratios and protein expression in various mammalian cell lines.

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

## Poster 29

### Caged Phosphates in Organic Molecules

*A. Dame and B. Sculimbrene*

*Department of Chemistry, College of the Holy Cross*

Phosphates are an important functional group in organic molecules that have many biological and pharmaceutical applications. Phosphates are involved in almost all biological pathways, and thus methods to study this important functional group are needed. One method involves caging the phosphate, which places the phosphate in an inactive state by adding a particular group of atoms to the molecule. The active phosphate can then be released at a specific location and time, in test tubes or cellular studies, by excitation with light. In order to synthesize caged phosphates, caged phosphorylating reagents are needed. These phosphorylating reagents can be synthesized from precursor alcohols in two steps. There are two types of caging groups that the Sculimbrene lab is working on synthesizing (2-nitrophenyl and coumarin), each defined by a unique chemical structure and the wavelength of light necessary for excitation. The Sculimbrene lab has synthesized the precursor alcohols, 7-hydroxy-4-(hydroxymethyl)coumarin, 7-methoxy-4-(hydroxymethyl)coumarin, and bis(2-nitrophenyl)methanol, which we plan to convert to phosphorylating reagents. In the future, these caged phosphorylating reagents will then be tested in phosphorylations and uncaging experiments.

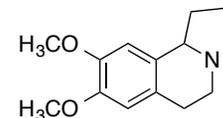
We would like to thank Wendy R. and Kenneth I. Edwards, M.D., '80 P12, for their generous contribution to the Alumni/Parent Summer Science Research Scholarship Fund.

## Poster 30

### Efforts Toward the Synthesis of Crispine A

*S. Yalamanchili and K. J. Quinn*

*Department of Chemistry, College of the Holy Cross*



crispine A

The tricyclic pyrroloisoquinoline ring system is a substructure of numerous natural occurring compounds that possess a diverse array of biological activities. Crispine A, which is isolated from the *Carduus Crispus* plant and shows promising biological activity against human cancer cell lines, is a simple example. We are investigating a concise synthetic approach to crispine A that involves a proposed one-pot ring-closing metathesis (RCM)/alkene isomerization/Pictet-Spengler cyclization that would result in the formation of two new C-C bonds and two new rings. Key to the success of our proposed key step is the known isomerization of allyl amines to enamines under metathesis conditions and expectation that enamine/iminium equilibrium will provide a suitable electrophile for electrophilic aromatic substitution. Validation of our strategy by successful synthesis of crispine A would allow us to extend this approach to more complex pyrroloisoquinoline natural products.

Financial support in the form of a Robert J. Stransky Student Research Fellowship in the Sciences is gratefully acknowledged.

## Poster 31

### Implicit List-Learning in Pigeons Using a Low-Information List

*D. Cameron, J. Gould, and C. Locurto*

*Department of Psychology, College of the Holy Cross*

Implicit learning in humans is the acquisition of knowledge in the absence of awareness. In nonhumans, this type of learning may be defined as learning when there are no reinforcement contingencies that demand that learning take place. This experiment analyzed pigeons' implicit list-learning ability. We had previously studied this type of learning under conditions where the elements of the list possessed visual, spatial, and dynamical differences, a condition we termed "high information." In the present experiment, the elements of the list lacked spatial and dynamic cues, therefore changing it to a "low-information" list. The list for this experiment consisted of five visual images (elements) projected serially onto a touchscreen (A → B → C → D → E). An element could occur in any one of five spatial positions on the touchscreen. Reinforcement was delivered on a random schedule during trials which equated reinforcement over all five elements in the trial. The pigeons began this experiment with daily baseline sessions of 40 trials for five weeks. After each pigeon repeatedly and successfully completed the forty daily baseline trials, we began testing the pigeons' knowledge of the list by a process called reversal testing. In reversal testing, elements such as A and E were switched in order to see if there was a significant increase in the latency to respond. The results from this experiment were measured through the analysis of median latencies during the presentation of the list during baseline trials as compared to reversal trials.

We acknowledge the financial support of a National Institutes of Health grant R15RR031220.

## Poster 32

### Research in Forensic Economics: Miscellaneous Topics

*T. Tran and D. Schap*

*Department of Economics and Accounting, College of the Holy Cross*

Loss of Chance: This research examined aspects of the 'loss of chance' doctrine, which permits recovery by successors in death cases in which medical negligence contributed to a reduced survival probability. In particular, detailed research was conducted on the three states (Michigan, New Hampshire and South Dakota) for which a loss of chance rule emerged from the courts, only to be later revoked by legislative action. We primarily used LexisNexis to compile the relevant information, but also used other various online sources. States Blog: Updated the tabled information for the States Project Blog at the National Association of Forensic Economics website, which compiles the laws of the fifty states related to four aspects of the practice of forensic economics (e.g., discounting and taking account of taxes and inflation). We checked that the cited material was still "good law" (not subsequently overturned or limited in applicability), using LexisNexis and various other sources. The updated table will be launched sometime in August 2014. Reduction Method Table: Created a table depicting each state's reduction method in cases of wrongful death, where awards to the estate or statutory beneficiaries of a decedent are reduced to account for either the personal consumption or personal maintenance of the decedent. Research was conducted through LexisNexis and a set of helpful secondary sources. Right of Action Table: Created a table depicting the right of action as an estate or statutory beneficiary (or both in a few states) for bringing a wrongful death case in each state. Research was conducted through LexisNexis.

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

### Poster 33

#### Religiosity and Uncertainty Aversion

*J. Hamilton and J. Svec*

*Department of Economics and Accounting, College of the Holy Cross*

An extensive literature has established a correlation between an individual's religiosity and his risk preferences. We hypothesize that this literature has conflated risk and uncertainty and that an individual's religiosity is actually correlated to his uncertainty preferences. Drawing from the existing literature our measures of religiosity and attitudes towards risk and uncertainty, we developed a survey testing each respondent's religiosity, risk preferences, and uncertainty preferences to see if our hypothesis was correct. The ultimate hope was to determine whether it is truly one's uncertainty preferences, and not risk preferences, that are associated with an individual's religiosity. We find modest support for our hypothesis, though with only 28 respondents, the results should be viewed as merely suggestive and indicate a need for more comprehensive research.

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

### Poster 34

#### Returns to a Private Education: Controlling for Selection on Observables

*R. Elliott and A. Nathan*

*Department of Economics and Accounting, College of the Holy Cross*

Private schools have been thought to provide a better education for their students when compared to their public counterparts. However, do private schools actually add value to students' education or do they just select the best students? This paper uses the *National Education Longitudinal Study of 1988 (NELS:88)* to see the impact that private and public schools had on their students math and reading composite standardized test scores while controlling for selection on observables. Average treatment effects (ATET) on the treated are at least twice as large and average treatment effects (ATE) are at least three times as large as ordinary least squares estimates (OLS). These results suggest that perhaps private schools are actually not selecting the best students, but rather selecting average students and adding value to them.

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

## Poster 35

### Heparan Sulfate and Sulfatase Activity: Effects of Changing Sulfation Patterns on Tumorigenesis in Mammary Epithelia

*L. Connolly, R. Bellin, and W. Holmes*

*Department of Biology, College of the Holy Cross*

Cellular proliferation in mammary epithelia is tightly controlled by the expression of regulatory proteins. The shedding of synthesized protein complexes within the breast cancer tumor microenvironment can modulate tumorigenesis. When shed from the fibroblast cell surface, the protein syndecan-1 becomes a soluble co-factor that can mediate cell signaling through complexation with various ligands in the mammary epithelia. Syndecan-1 has highly conserved binding sites for heparan sulfate chains which function as important cofactors to regulate molecules involved in cellular processes. Previous data suggests that media supplemented with heparin sulfate, the manufactured analog of heparan sulfate, could be altering the growth conditions in the tumor microenvironment. The sulfate functional groups on the heparin chain give the molecule a strong negative charge and we hypothesize that this negative charge on heparan sulfate affects cellular proliferation. To test this idea, we propose to modify the sulfation patterns of heparin sulfate through the characterization and application of a sulfatase enzyme that will remove the negatively charged sulfate functional groups. Once these heparin sulfate chains with varying levels of sulfation are generated, we can then assess the effect on cellular proliferation.

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

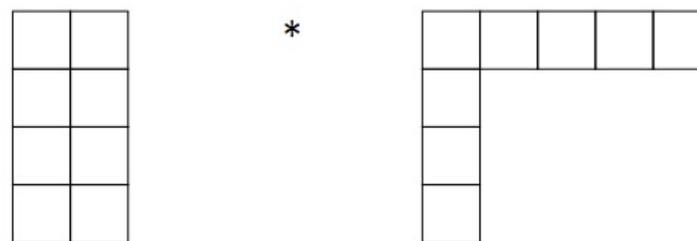
## Poster 36

### On the Kronecker Product of a Hook and a Box

*B. Hallahan and C. Ballantine*

*Department of Mathematics and Computer Science,  
College of the Holy Cross*

The algebra of symmetric functions is the collection of functions such that taking any permutation of their arguments does not change the function. This collection is endowed with the operations of addition and multiplication. One basis of this algebra consists of the Schur functions, which correspond to partitions. The Kronecker Product of Schur function is an operation that produces a symmetric function. There is no simple combinatorial rule for writing the Kronecker Product in the basis of the Schur functions. Jonah Blasiak found a combinatorial interpretation for the coefficient of a given Schur function in the decomposition of the Kronecker product of two other Schur functions when one of the corresponding Young diagrams is a specific shape, a hook. We are attempting to find a simpler rule for the special case when the other shape is a box.



We thank Dan Kennedy, Ph.D., '68 for his generous contribution to the Alumni/Parent Summer Science Research Scholarship Fund.

## Poster 37

### **Do Sporting Events Displace Crime? The Case of the Bulls and Chicago**

*J. Congdon-Hohman and G. Koosherian*

*Department of Economics and Accounting, College of the Holy Cross*

This study examines the prevalence of gun crime in Chicago and looks to build on previous studies that test the link between sports and crime. In 2012 the FBI named Chicago the ‘murder capital’ of the United States because of its high level of gun violence. Chicago offers precise, publicly available crime information, allowing us to study its crime at an hourly level. Chicago is unique because it is a metropolitan area with many professional sporting franchises across multiple sports like basketball, football, baseball and hockey. Using hourly data from various sources in addition to Chicago’s crime data over a fourteen year period, we performed time series analysis examining the relationship between various measures of criminal activities, and Bulls game data, controlling for year, month, day, hour, and weather. Specifically, we examined assaults and batteries with a handgun, homicides and these crimes occurring at a private residence. Competing hypotheses predicted that games would increase, diminish or displace crime to later hours in the day. The variables created for game specific data included whether a game was played in a specific hour, the winning records of the Bulls and the opponents, game location, whether the impact changes as the game goes on, what happens in hours after the game, etc. We found some a positive relationship between gun crime and Bulls games, though not rising to traditional levels of statistical significance. We also found a stronger and statistically significant positive relationship between Bulls games and residential crime. This result suggests that games may move people off the streets and into their homes, but not lessen the likelihood of crime. By expanding this study to demographic pluralities in neighborhoods of Chicago, we found statistically significant evidence to suggest a positive relationship between gun crime and Bulls game in areas that have a self-identified Hispanic plurality.

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

## Poster 38

### **Development of a Discovery Platform for Identifying Potential Breast Cancer Tumor Associated Antigens**

*M. O’Meara, D. Kita, K. Rahman, C. Devarakonda, K. P. Claffey*  
*Department of Cell Biology, University of Connecticut Health Center*

A major approach in the development of cancer treatments involves exploiting the differences between normal cells and tumor cells. This technique while successful is also limiting due to our narrow understanding of tumor biology. The lack of known molecular targets on tumor cells is a major limiting factor in the development of vaccines and drugs to treat cancer. Tumor antigens have the potential to be used in the development of anti-cancer vaccines, as immunotherapy targets, and as markers to aid in early detection of cancer. We describe here a discovery platform for identifying potential tumor associated antigens (TAAs) by using a patient’s immune system, which will produce antibodies in response to tumor cells. The variable heavy chain (VH) domain of antibodies is of particular interest here because this along with the variable light chain domain is the region of antigen specificity in the protein. Our lab previously developed a technique for isolating the VH domains of B cells undergoing clonal expansion and somatic hypermutation in the sentinel lymph nodes (SLN) of breast cancer patients. A library of VH cDNA clones was generated from the sentinel lymph nodes of nine different breast cancer patients and the DNA sequenced. These VH clones were then subcloned into expression vectors, which would allow production of the VH domain, along with a C-terminal mouse Fc domain; these two domains fuse, creating a VH antibody. Following production, these antibodies are screened against different breast epithelial cell lines, both tumor and “normal” non-tumor. Once these antibodies are characterized, further experiments can be done to identify and validate their cognate antigen, thereby providing potential new targets for immunotherapy.

Thank you to UCHC for financial support.

## Poster 39

### A Synthetic Approach to Disulfide-Bridged Beta-Sheet Mimics

*E. Schneider and B. Linton*

*Department of Chemistry, College of the Holy Cross*

Naturally occurring beta-sheets are a common structural motif appearing in complex biological molecules. The synthesis of beta-sheet mimics allows us to isolate and probe their intramolecular hydrogen-bonding tendencies. Previous beta-sheet mimics contained competing hydrogen-bond donors and acceptors on the same side of the disulfide tether. We hope to strengthen our mimic by positioning H-bond donors together on one side of the bridge, and H-bond acceptors on the opposite side. Our beta-sheet also contains aromatic spacers that provide structural rigidity; an asset to induced hydrogen bonding. This new approach provides an additional layer of difficulty in the synthetic scheme. The di-substituted nature of our aromatic spacers challenged us to limit our reactions to only one side. Similarly, as we began combining different components of our beta sheets, we faced stubbornly resistant reactivity. As our work continues into this year, we hope to complete our synthesis and delve into the aggregation effects of our beta-sheet.

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

## Poster 40

### Impact of Digital Music on Jazz Performance Attendance

*A. J. Dalton IV and M. Boyle*

*Department of Economics and Accounting, College of the Holy Cross*

Through the advent of digital music platforms and vehicles for the access of media online, the Internet has become a vital instrument for the sale and transmission of artistic content in the 21<sup>st</sup> century. As broadband Internet access reaches new corners of the globe, digital music services are rapidly increasing in popularity and economic importance. While increased access to music has had many positive impacts, this trend raises questions regarding the influence that digital consumption may have on live concert attendance, especially within the jazz performance community. Rooted in improvisatory performance practices, jazz is a uniquely organic musical genre that relies heavily on the “live experience”. As such, alternative means of access present a case to study the importance of this experience to audiences at large. Utilizing data obtained through the National Endowment for the Arts Survey of Public Participation in the Arts, I find that the presence of access to digital music has a negative impact on jazz performance attendance. Additionally, I show that both race and educational attainment play a role in determining attendance of such performances. These results directly reflect both the challenges and opportunities for growth within the musical genre.

This project was funded through the support of the Office of the Dean of the College.

## Poster 41

### Evaluating Methodological Procedures to Conduct an Adult Autism Prevalence Study

*M. Solberg and M. Rosanoff*  
*Autism Speaks*

Autism Spectrum Disorder (ASD), once considered a rare disorder, is now an emerging public health issue. The U.S. Centers for Disease Control and Prevention (CDC) currently estimate that every 1 in 68 children is affected by an ASD. The prevalence of ASD amongst adults is unknown. Given the large number of children now being diagnosed, it is thought that a large population of adults is affected by an ASD; however, many adults may be misdiagnosed or undiagnosed. A necessary step moving forward is to conduct a population based study to measure the current prevalence of autism in American adults. This literature review represents a thorough investigation of the literature on autism prevalence among adults, as well as examines other epidemiological research methods to measure prevalence of other mental health disorders. Specifically, this review will identify methodological approaches to diagnosing schizophrenia and depression among an adult population. Only one study was found which measured the prevalence of autism among adults in a total population sample. An additional 19 studies, both population and non-population-based, identified strategies to diagnose mental health conditions among adult and elderly populations. To date, research on the prevalence of autism among adults is severely limited due to the difficulty of conducting such a study design. However, after evaluating similar research on schizophrenia and depression, past studies revealed the possibility to make reliable prevalence estimates. After assessing the methodological procedures used within these studies the strengths and limitations of these processes were weighed and then used to make appropriate and applicable recommendations for a future adult autism prevalence study. A special thanks to Autism Speaks for funding this project.

## Poster 42

### Eliminating the Cultural Barriers in Autism Spectrum Disorders in Hispanic and Latino Communities

*M. Florimon and M. Rosanoff*  
*Autism Speaks*

Previous studies have indicated that Hispanics/Latinos tend to be diagnosed with Autism Spectrum Disorder (ASD) much later than non-Hispanics/Latinos and the quality of care once diagnosed is not always the same. The majority of the barriers preventing Hispanics/Latinos from being diagnosed tend to be culturally based yet programs created to treat autism do not usually include cultural considerations. A systematic literature review of English and Spanish articles was conducted to examine the cultural barriers associated with ASD in these communities, with a special focus on the language component and to find concrete solutions by examining the effectiveness of programs and methods used towards these communities. It was revealed that language is the main cultural barrier preventing Hispanics and Latinos from being diagnosed. Bilingualism, assessment tools, access to care/information, misconceptions, and diagnostic difficulties proved to be other major cultural barriers for these individuals. Studies demonstrate that the success of programs and methods of treatment towards these communities depends on the presence of certain key elements that effectively target these barriers such as educational workshops and training programs. After extensively examining the cultural barriers and existing programs, I made a series of recommendations on what needs to be done in order to address these barriers and improve these programs.

A special thanks to Autism Speaks for funding this project.

## Poster 43

### Extinction of Conditioned Fear in Mice

*A. J. DeNofrio and A. C. Basu*

*Department of Psychology, College of the Holy Cross*

Neural systems involved in the formation of emotional memories are conserved across mammalian species. Synaptic mechanisms by which emotional memories are formed, and those by which they cease, involve the NMDA receptor pathway for glutamatergic neurotransmission. Functional modulation of the NMDA receptor is poorly understood. Pavlovian fear conditioning is a well-established paradigm for the empirical investigation of emotional learning and memory. As a first step toward studying the role of NMDA receptor modulation in these functions, we have attempted to observe cued fear conditioning and extinction using a delay-conditioning paradigm in C57Bl/6 mice. In a single fear conditioning session, subjects were presented with a conditioned stimulus (CS; pure tone of 30s, 90dB, 2800Hz) that co-terminated with an unconditioned stimulus (US; mild foot shock, 2s, 0.75mA), three times. We measured a robust conditioned response (CR) to the tone on the subsequent day. We observed within-session extinction over the course of 15 CS alone presentations. Subsequent sessions of CS alone presentations showed within-session extinction of the CR, but failed to show any significant between-session extinction. We believe the lack of between-session extinction could be related to generalized fear. We plan to refine our procedures and use them to study the role of endogenous NMDA receptor modulators in extinction of conditioned fear. We hope this research will contribute to increased understanding of vulnerability to psychiatric illness and improved treatments for disorders such as schizophrenia, anxiety disorders, and PTSD.

We thank the Dean's Office for financial support.

## Poster 44

### Wasabi Aversion in *Drosophila* Adults and Larvae

*S. E. Smith and S. M. Webster*

*Department of Biology, College of the Holy Cross*

There are a variety of substances that are identified as bitter and pungent by humans that can also be detected by the common fruit fly, *Drosophila melanogaster*. One such substance is wasabi, which is made pungent by the presence of isothiocyanate (ITC). ITC is detected by the TRPA1 ion channel, which is known to be involved in other sensory neural responses and can induce pain, irritation, and inflammation. The TRPA1 channel can be found in both humans and *Drosophila*, which makes the fruit fly an excellent model organism for better understanding the mechanism of this chemical detection system. As there is little published data addressing the behavioral effects of exposure to ITC in *Drosophila* larvae, my research aimed to explore this further. I utilized four different assays measuring feeding and aversion in both adult flies and larvae. The known aversive substance, quinine, was used as a control for assessing the ability of the various assays to measure avoidance behavior. As expected, the data indicate that adult flies have an innate avoidance behavior when presented with a choice between ITC and a neutral food choice. Interestingly, as the fly starvation time increases, the aversive behavior towards ITC decreases. Conversely, larvae do not exhibit an initial aversion or feeding preference in the presence of either ITC or quinine. As these results differ from published data regarding larval aversion to quinine, it is likely that we will need to develop a more informative assay for studying larval avoidance and feeding. We plan to modify the experiments by staging the larvae more precisely, as well as testing larvae throughout different stages of development. Once this is established, my research will aim to examine if TRPA1 influences larval avoidance, and if so in which cells it is required.

Funding was provided by a Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowship.

## Poster 45

### **Race Matters: Health Perceptions for Women of Color**

*M. Okero and R. Beard*

*Department of Sociology and Anthropology, College of the Holy Cross*

How many times a day do you think about your race? For many people, the thought rarely crosses their mind. For those who do think about their racial status, however, it is typically a routine aspect of their daily lives and they are often negatively influenced by it. Race can get under one's skin, figuratively and literally. Yet examining racism as a social variable has not been widely studied in sociology or elsewhere from the subjective experiences of those most intimately affected. While social epidemiologists and demographers conduct important research on the effects of stress on people's health via increased cortisol levels, this study asked women of color to reflect on their personal views, values, and experiences of stress. I conducted 20 semi-structured interviews either in-person or over the phone with women of color at Holy Cross, including students, faculty, and staff. Grounded theory techniques were utilized to collect, code, and analyze textual data. A number of common themes were discovered among the three study groups. Core findings include the consistent awareness of race, health disparities for themselves or family members, and environmental stressors unique to Holy Cross. Importantly, being a woman of color is a double-edged sword because while respondents were proud of their racial identity, the expectations, judgments, and treatment from others rendered it a burden as well. While the dual prejudices of being a person of color as well as a woman were complex and sometimes made it difficult for them to pinpoint the root of perceived treatments or judgments, these data provide valuable insights. It is vital to both practice and policy that the voices of women of color are both better understood and heard.

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

## Poster 46

### **Relationship Between Climate, Topography, and Talus Slopes in the Sierra Nevada, and Implications for Landscape Evolution**

*N. Bradley and S. Mitchell*

*Department of Biology, College of the Holy Cross*

Talus slopes (scree slopes) are deposits of fractured rocks that accumulate at the base of steep mountain slopes. These rock fragments are loosened from the cliffs through a process called "frost cracking," where the formation of ice opens fractures in the rock and loosens the pieces, which then fall down the slope via gravity. There are two mechanisms of frost cracking: freeze-thaw (operating at oscillations at 0°C) and ice segregation (maximized when air temperatures range between -3 and -8 °C) (Hales and Roering, 2005, 2007). We proposed to test whether the "frost cracking window" of -3 to -8°C can be used to predict the distribution of talus slopes in the Sierra Nevada in California. We used ArcGIS 10.2 and digital aerial photographs to identify and digitize talus slopes in our study area. Once identified, we used 5-m digital elevation data to analyze the elevation, slope, and curvature of these slopes. We also used climate data from local weather stations to determine the frost cracking window in this landscape. Our results indicate that talus slopes occur immediately below the elevation where the average annual temperature is 0°C (at about 4,162m). We conclude that in the Sierra Nevada, freeze-thaw is the dominant frost cracking process controlling the distribution of scree production; the -3 to -8°C frost cracking window cannot be used as a proxy for predicting talus slopes in all landscapes.

We thank Jeanne and James Moyer P15, 10, for their generous contribution to the Alumni / Parent Summer Research Scholarship Fund.

## Poster 47

### **Preliminary Studies on Fabricating Weather System Devices for the Analysis, Research, and Detection of Lightning**

*M. E. Minelli and H. Takai*

*Department of Physics, Brookhaven National Laboratory*

Understanding the factors of weather, specifically temperature, UV rays, lightning, cosmic rays, and cloud coverage is highly dependent on collecting, accumulating, and analyzing test results. A number of these components are problematic, such as creating a device to harvest and communicate data is difficult when the knowledge of these factors is limited. There are multiple theories on how lightning is created and, consequently, even more proposals on detection. In an effort to understand this factor to the fullest extent, it is necessary to build and program an apparatus that is not dependent on a short-life power source. Parameters for such a device include wirelessly collected statistics that can be sent to a master program without the need for day-to-day attention. In order to use the programs of Arduino and Raspberry Pi, which will assist in this project, a full comprehension of lightning, its theories, and the detection is imperative before programming can begin. This project began with a great deal of research to understand lightning and how to collect data on the phenomenon so that we could define what data can be collected through programming and whether we would collect data via a magnetic loop and electronics, the availability of or need to develop surveillance software to record images, or audio input. By programming these apparatuses, the goal is to understand how weather factors, especially lightning, affect magnetic and electric fields fluxes here on Earth.

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

## Poster 48

### **The American Collegiate Moot Court Association Brief Writing Competition 2014: Fourteenth Amendment and First Amendment of the Constitution**

*B. Fogerty and S. Sandstrom*

*Pre-law Program, College of the Holy Cross*

Abortion rights have long been a topic of political and legal debate. Recently, several states have attempted to pass laws designed to discourage women from procuring an abortion. One of the ways which the states have attempted to accomplish this goal is by restricting physicians in what they are allowed to talk about during the informed consent process, and by compelling physicians to give women certain information. In addition, some states mandate that women undergo an ultrasound prior to procuring an abortion. We have investigated a hypothetical law posed by the American Collegiate Moot Court Association as part of this year's certified case. Every year the ACMA creates a case on two constitutional issues. This year they took the issues of abortion rights and free speech and made a case based on a law which severely curtailed the free speech rights of doctors, to the point that women had difficulty obtaining information needed to make her decision. The law also required women to undergo a transvaginal ultrasound prior to undergoing an abortion. The women were also forced to pay out of pocket for the ultrasound procedure because insurance companies were forbidden to cover the costs of the test. We looked at the tests used by the courts to determine whether the statute would be constitutional on both First and Fourteenth Amendment grounds. Then, we created arguments that could be used to support the legality of the statute, as well as arguments to oppose the statute.

We thank the Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts.

## Poster 49

### Systematic Review of Gender Differences in Clinical Outcomes of Patients with Neurofibromatosis Type 1

*T. Dutton<sup>1,2</sup>, V. Merker<sup>1</sup>, and S. Plotkin<sup>1</sup>*

*<sup>1</sup>Department of Neurology and Cancer Center, Massachusetts General Hospital; <sup>2</sup>American Cancer Society, New England Division*

Neurofibromatosis type 1 (NF1) is the most common neurogenetic tumor suppressor syndrome with a birth incidence of 1 in 3000. Clinical manifestations include café-au-lait macules, neurofibromas, learning disabilities, vasculopathy, and bony abnormalities. Recently, studies have reported an effect of gender on mortality rate and neoplasm development in patients with NF1. However, a comprehensive analysis of the gender differences observed in NF1 clinical outcomes has not yet been described. In this systematic review, we screened 77 abstracts and 47 full-text articles based on strict inclusion and exclusion criteria. Ultimately, 15 articles were reviewed for gender differences in regards to mortality, malignant peripheral nerve sheath tumors (MPNST), optic pathway gliomas (OPG), plexiform neurofibromas, cutaneous neurofibromas, and glomus tumors. The quality of evidence in each study was methodologically evaluated, and gender differences were synthesized and assessed for agreement between studies. Overall, multiple studies suggested an increased incidence of tumors in NF1 females compared to their male counterparts. The most robust finding was a strong female preponderance for OPG, and the subsequent need for treatment due to visual decline. Other findings included excess mortality and higher neurofibroma tumor volume in females, and a lower MPNST survival rate in males. Further research is necessary to validate these findings and to understand the molecular mechanisms behind specific gender associations.

We thank the American Cancer Society's Alvan T. and Viola D. Fuller Junior Research Fellowship.

## Poster 50

### Web-Based Mathematical Software

*C. J. Cao and A. D. Hwang*

*Department of Mathematics and Computer Science,  
College of the Holy Cross*

A modern web browser is a powerful interactive computation platform. Our project consists of programming in HyperText Markup Language, Cascading Stylesheets, Scalable Vector Graphics, and JavaScript, including jQuery and d3 - libraries of pre-written JavaScript which allows for easier development of JavaScript-based applications. We have developed interactive, web-based applications for teaching a variety of mathematical concepts, such as series convergence, Riemann sums, and Taylor polynomials.

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

## Poster 51

### Effect of Limb Demand Ischemia on Autophagy and Mitochondrial Biogenesis in Diet Induced Obese Mice

*H. Albadawi, R. Oklu, J. D. Milner, T. P. Uong, H. J. Yoo,  
and M. T. Watkins*

*Division of Vascular and Endovascular Surgery,  
Massachusetts General Hospital*

Diabetes is a major risk factor for peripheral arterial disease, which frequently manifests as intermittent claudication due to lower limb demand ischemia (DI). This study evaluates the effect of exercise and DI on autophagy and mitochondrial biogenesis in a diabetic mouse model of claudication. Two groups of C57BL6 male mice were fed a 60% high fat diet for 26 weeks to induce diabetes. Mice were subjected to unilateral femoral artery ligation (FAL, n=6) or sham surgery (n=6) and were allowed to recover for 14 days for stabilization. Subsequently, the FAL mice underwent 60 min of daily treadmill exercise (12m/min speed, 10° incline) for 4 weeks to induce DI in the ligated limb. The exercised contralateral (EX) limb acted as an internal control to assess the effect of exercise on muscle independent of DI. In contrast, sham (SH) mice remained sedentary. Hind limb perfusion was recorded at baseline before surgery and once a week thereafter. Muscle tissues from SH, DI, and EX hind limbs were analyzed by western blotting for markers of autophagy, LC3B type II/I ratio, and mitochondrial biogenesis, which was quantified by the expression ratio of mitochondrial fusion (Opa-1) and fission (Drp-1) proteins. Statistical analysis was performed using ANOVA with post hoc analysis. Exercise upregulated autophagy in the tissue with normal limb perfusion, but it failed to enhance autophagy in the limb that experienced demand ischemia. Variable levels of autophagy were observed to positively correlate with limb perfusion in demand ischemia. Furthermore, exercise does not appear to significantly alter mitochondrial biogenesis in diabetic muscle regardless of the degree of perfusion. These results may have an implication for the evaluation of diabetic patients that suffer from claudication.

We thank MGH and the NIH for financial support.

## Poster 52

### CT Angiography for Cerebral Vasospasm in Subarachnoid Hemorrhage: Utilization at Hartford Hospital

*T. J. Genovese and M. D. Ollenschleger*  
*Department of Radiology, Hartford Hospital, CT*

**Introduction:** Subarachnoid hemorrhages can often lead to cerebral vasospasm in which the blood vessels constrict, leaving the patient in danger of brain damage secondary to ischemia. CT angiography have been widely adopted to detect vasospasm. This study seeks to evaluate the utilization of CTA in SAH patients and determine the diagnostic yield of this test in relation to changes in patient management. **Materials & Methods:** This is a retrospective analysis of clinical data of patients who developed subarachnoid hemorrhages from 1/1/2012 to 3/11/2014. **Results:** The present study suggests that there is no difference in the distribution of CTAs and interventions done on subarachnoid hemorrhages caused by a vascular lesion from those with non-aneurysmal or peri-mesencephalic hemorrhages. Indications for the examinations were not significantly different between the two groups. The three most common indications, however, used for these examination have a rather high yield, with 74.1 - 90.1% of studies demonstrating some degree of vasospasm. Among all of the indications, change in TCDs velocities was the highest yield, with 51.5% of patients going on to have an intervention for vasospasm. **Discussion/Conclusion:** This study reaffirms that CTA remains a high-yield study in the detection of cerebral vasospasm in SAH patients. Certain limitations such as small population size and inadequate documentation of certain variables hindered the study and further examination is necessary to more adequately characterize these findings.

Thanks to Hartford Hospital and the Stroke Center for funding.

## Poster 53

### Staging Shakespeare's Spectacular Violence

*H. Whall and F. Doyle*

*Department of English, College of the Holy Cross*

Shakespeare's England was a police state. That state used a different logic to justify its power than that used by more contemporary states. The early modern state depended on the rhetoric of a naturally existing hierarchical order. A stable state would have been one that mimicked the early modern worldview, with an absolute power at its center and with everything around it defined by its relation to that center. This worldview had already come into question by the time that Shakespeare began writing. After his retirement, those questions would culminate with the English Civil War, the execution of King Charles, and the emergence of a worldview based more on the human constructs than natural ones. Shakespeare's use of theatrical violence always reflects the conflict between those two worldviews. However, his tragedies never judge one of the two as correct or triumphant. Instead he presents the older view as already containing the violent impulses that will lead to its destruction. The early modern state was violent, and would use public violence (especially public executions) as propaganda to confront opposition to its worldview. Theatrical violence then is a way to show the conflict that already exists within this supposed order, and to effect an instinctive response to it in his audience.

Thanks to the Andrew W Mellon Foundation for sponsorship.

## Poster 54

### Expression, Purification, and Spectral Analysis of the UL52 Zinc Finger Domain

*J. H. Markowski, M. A. Zambrello, and J. C. Hoch*

*Department of Molecular Biology and Biophysics, University of Connecticut Health Center*

UL52 is a subunit of hetero-trimeric helicase-primase complex found in lytic cells infected with the herpes simplex virus (HSV). Near the C-terminus end of this peptide, there is a 30 amino acid, putative zinc finger domain containing three cysteine and one histidine residues. When mutations occur at two of the cysteine locations the helicase, primase, and DNA-binding activity of the entire complex is eliminated; thus, this domain would be a suitable target for new anti-HSV pharmaceuticals. However structural data must first be acquired to visualize this binding domain. We elected to express 8 different gene sequences in *E. coli* cells to give peptides all containing the zinc finger domain yet having varied lengths and tags. The construct we selected is 16.9 kDaltons and contains 169 amino acids including the Strep tag appended to the N-terminus. Using a uniform sampling schedule, spectral data was collected and processed with both Fourier methods and Maximum Entropy Reconstruction with deconvolution. Structural determination will require more data to be collected and processed.

We gratefully acknowledge the National Institutes of Health and the University of Connecticut School of Medicine Summer College Fellowship Program for support of this research.

## Poster 55

### Paleontological Fieldwork in Utah and Wyoming

*A. Kimelblatt, A. Randall, and L. Claessens*  
*Department of Biology, College of the Holy Cross*

We undertook paleontological fieldwork in a series of Mesozoic sites in Utah and Wyoming. At Bridger Basin in Wyoming, we excavated an Eocene turtle carapace and crocodile, each buried for over 40 million years. In Dinosaur National Monument, we excavated a partial skeleton of an ichthyosaur, a large marine reptile from the Late Jurassic period. Three Triassic trackway blocks discovered here in 1989 were at last airlifted from the remote site by our research team via helicopter, the heaviest weighing 1700 pounds. The trace fossils provided evidence for a never before seen “hopping” reptile. Flaming Gorge Reservoir in Wyoming was rich in fossils; we discovered many *Knightsia* and other freshwater fish species, as well as fossilized plants and insects from the Eocene epoch. We transported fossils from the field to the fossil preparation laboratory of the Natural History Museum of Utah where we further prepared fossils and catalogued specimens. We photographed in detail each existing cranial and skeletal element of the holotype *Lythronax argestes*, the oldest known tyrannosaurid, a theropod dinosaur that lived 80 million years ago in what is now southern Utah. The photos will be used in future publications concerning the new species, and will contribute to a greater understanding of the biodiversity that existed in the past and of vertebrate evolution today. The ability to experience the excavation and preparation of fossils in their natural context will be invaluable for our research in fossil anatomy and function in the upcoming academic year, where we work with digitalized bones to compare anatomical structure to organismal behavior and dynamics.

We thank Anne E. and John Kirby Bray '79, P10 and the Alumni/Parents Summer Research Scholarship Fund for their financial support, and the Natural History Museum of Utah for providing us with our fieldwork experiences.

## Poster 56

### “When you see your story told, *tu existencia se valida*”: Dolores Prida and the (Re)presentation of Spanglish in Theatre

*K. Canastra and J. Alba-Salas*  
*Department of Spanish, College of the Holy Cross*

Spanish-speaking Latinos constitute the largest ethnolinguistic minority in the United States. While many Latinos subscribe to the traditional paradigm of linguistic and cultural assimilation, others have embraced a new hybrid identity that cannot be readily expressed in only one language. A key ingredient in this hybrid identity is so-called *Spanglish*, the mixing of English and Spanish. Spanglish has been traditionally stigmatized as a chaotic mix that threatens English and Spanish and stems from poor knowledge of both languages. However, research has shown that the Spanglish of Latinos who are native speakers of both languages is a legitimate, rule-governed language-contact variety that serves important communicative functions. Not surprisingly, Spanglish has increasingly found its way into representations of Latino experiences in popular culture and literary creation. This is particularly true in the work of Dolores Prida (1943-2013), a Cuban-born journalist and leading Latina playwright whose exiled family settled in New York City. Prida's *Botánica* follows the story of Milagros or Millie, a third-generation Latina struggling to balance her Puerto Rican background and her ‘American’ identity. The play explores the challenges of identity and self-description that many Puerto Ricans living in El Barrio, a Manhattan neighborhood also known as *Spanish Harlem*, have to face as US citizens who are ‘too American’ to be accepted as ‘true Puerto Ricans’ and ‘too Puerto Rican’ to be seen as ‘completely American’. Drawing upon interviews with Prida and an ethnolinguistic study of El Barrio conducted in the same historical moment that *Botánica* was written and first staged (Zentella 1997), my research explores Prida's use of Spanglish in (re)presenting a hybrid *Nuyorican* identity and establishes the foundation for a more ambitious project to be undertaken in my graduate studies.

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

## Poster 57

### Tools for Developing Web Software and Interactive Applications

*H. Tucceri and A. Hwang*

*Department of Mathematics and Computer Science,  
College of the Holy Cross*

A modern web browser has enough computational power and flexibility to act as an environment for interactive applications as well as a platform for software development. To do this, we used three main components: HTML, CSS, and JavaScript. HTML, or HyperText Markup Language, provides the content and document structure of a web page using the Document Object Model (DOM). CSS, or Cascading Style Sheets, controls the visual appearance and formatting of the page. The third component, JavaScript, is a computer programming language that allows client-side scripts to interact with the user, control the browser, and alter the document content that is displayed. This summer, we created a variety of interactive web applications, including a program that displays home towns of Holy Cross students from the classes of 1998 to 2018. This program uses a Voronoi diagram to display the information on a globe, enclosing each hometown in a region, or Voronoi cell. These cells consist of all points closer to a given point (the student's hometown) than any other. Interactivity is a key feature of this application; the user can change class year by pressing arrow keys, rotate the globe by dragging, zoom by scrolling, and identify the hometown by hovering.

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

## Poster 58

### Factors Affecting Hydrogen Bonding and Aggregation

*E. Kuhn and B. R. Linton*

*Department of Chemistry, College of the Holy Cross*

Hydrogen bonds are important components of protein secondary structure, known as beta-sheets. The beta-sheets occur when amino acid sequences order themselves through the use of hydrogen bonding. In order to better understand the formation of these structures, we synthesized a number of small hydrogen bonding molecules to determine what effects our manipulations would have on their intra and inter-molecular hydrogen bonding capabilities. In doing this, we examine the contextual details that impact the formation of these beta-sheets in nature. Furthermore, we have synthesized a beta-sheet mimic which should be more indicative of naturally occurring beta-sheets than a small hydrogen bonding molecule would. Having previously made a beta-sheet mimic, we will examine the effects that changing the side chains of the amino acids involved might have on the aggregation of the molecules in high concentrations. Specifically, we have replaced an effectively neutral side chain with one that may act to interrupt the exterior hydrogen bonding of the mimic. Comparing this mimic to the small molecules that act as controls, we can distinguish what might contribute to stronger or weaker hydrogen bonding and, by extension, more or less robust beta-sheets.

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

## Poster 59

### Measuring Behavioral Responses to Stimulation of the Bristles in *Drosophila melanogaster*

*D. D. Luu and S. M. Webster*

*Department of Biology, College of the Holy Cross*

Mechanosensation is the process of interpreting physical stimuli like touch, sound, or vibration from one's surroundings. *Drosophila melanogaster* provides a useful model study for human hearing and balance because the fly bristle is similar to the human hair cells in the inner ear. We can measure mechanosensation by observing behavior because flies naturally respond to the touch of a bristle by initiating a grooming reflex. To study the grooming behavior, we created mosaic flies marked by green fluorescent protein (GFP) on a subset of mechanosensory bristles and initiated a grooming assay by stimulating the bristle with a light touch. After testing eight different types of bristles, we found that flies marked by GFP on the post-alar bristles are the best responders. The post-alar bristles responded 40% of the time when stimulated once every two minutes for five times. Post-alar bristles are also useful in that the flies responded at least once in every trial. By screening different types of fly bristles from a control fly, we were able to establish a baseline for future testing of mutants. Our next step is to test the grooming reflex in mutant mosaic flies to study whether mutations affect the mechanosensory pathways compared to our control.

We thank the Renee and Anthony M. Marlon, M.D. '63 Summer Research Fellowship Program and the Department of Biology for financial support.

## Poster 60

### Felt and Enacted Stigma Experience by Individuals Living with Multiple Sclerosis

*K. Carr and R. Beard*

*Department of Sociology and Anthropology, College of the Holy Cross*

Multiple Sclerosis (MS) is a chronic illness impacting millions of people worldwide at a time of life commonly considered their prime years. The condition may severely restrict everyday life, threatening performance of daily tasks associated with work, physical activity, or parenting. Yet, compared to many chronic illnesses, MS continues to be overlooked by leading health organizations as well as social and behavioral scientists alike, which results in limited funding, research, media attention and, subsequently, public awareness. Semi-structured, in-person interviews with 17 individuals diagnosed with MS were conducted. Grounded theory techniques were used to collect, code, and analyze textual data. Among these unique illness narratives, a number of common themes were discovered. Core findings revealed a unique stance on health-related stigma. "MSers" discussed both experiences of felt and enacted stigma. As an idiosyncratic chronic illness, the type of stigma they reported depended on their symptoms and whether these symptoms appeared visible to social others or remained invisible. MS has the ability to vacillate from an invisible ailment to visible. Practitioners are not equipped to aid "MSers" in dealing with these experiences of stigma after the diagnosis of MS. It is important to understand these experiences of people with MS in order to support them and abate these incidents of stigma. This information can be used to better understand chronic illnesses not only from a biomedical approach, but also to make society aware of the social consequences of becoming diagnosed and living with a chronic illness.

We thank the Mellon Foundation for supporting our summer research.

## Poster 61

### **Celiac Disease Associated Autoantibodies and Celiac Disease Symptoms in the Type-1 Diabetes Population and their Relatives**

*E. A. Addonizio and M. Leonard*

*Mucosal Immunology and Biology Research Center and Center for Celiac Research and Treatment, Mass General Hospital for Children*

Celiac Disease (CD) is an autoimmune enteropathy triggered by gluten ingestion in genetically susceptible individuals. While CD affects only 1% of the worldwide population, its prevalence in individuals with Type 1 Diabetes is estimated to be between 4 and 5%. There are certain genetic markers that make one susceptible to developing CD. An individual must have the human leukocyte antigens (HLA) DQ2 and DQ8 to possess CD. These alleles, specifically HLA DQ2, are also associated with other autoimmune diseases such as Type I Diabetes. Therefore, individuals with Type I Diabetes are more likely to have other autoimmune diseases such as CD. Furthermore, CD has genetic attributes and is, therefore, more prevalent in family members. When considering CD in relation to family members and individuals with T1DM, it is important to understand genetic factors to analyze the risks and prevalence of the disease in a population. This research focuses on the Friends for Life Event in Orlando, Florida. At Friends for Life, various blood and stool samples from patients with T1DM and their first and second-generation family members were collected and analyzed. A large-scale screening was conducted for the presence of tissue transglutaminase 2 (IgA) antibodies. All participants underwent venipuncture and were typed for HLA DQ2/DQ8 and informed of their CD status (elevated or normal tTg IgA) and genetic compatibility. Participants completed a screening intake form inquiring of their past and current symptoms as well as their medical history. From this analysis, further insight will be gained on the prevalence of CD in individuals with T1DM and their relatives and the prevalence of genetic risk factors in patients with T1DM and their families.

## Poster 62

### **Alexander Hamilton: A Tarnished Reputation**

*J. Murphy and D. Brand*

*Department of Political Science, College of the Holy Cross*

Alexander Hamilton, the United States' first Treasury Secretary, has long been accused of trying to create a financial system and government that would benefit the merchant and manufacturing classes of the nation at the expense of farmers. In other words, Hamilton was often portrayed by his political enemies as a crony capitalist, seeking only to enrich his close friends and associates who had special ties to government. In his *Report on Public Credit*, Hamilton called for the federal government to assume the debt of all of the states in the Union. His faith in public debt led many to believe that he was looking to promote a corrupt government where the legislator would fall under the control of speculators and bankers, but he clearly expresses his reservations about the long-term effectiveness of public debt. His *Report on Manufactures* is often thought of as a theoretical document outlining his vision for the future; the report included suggestions for bounty programs and protectionist policies which many Republicans saw as an attempt to force the federal government to empower manufacturers. However, the report had practical consequences that affected legislation in Congress over the next several months. The manufacturing class was ultimately dissatisfied with Hamilton's financial policies and started to vote for the Republican Party because Thomas Jefferson offered stronger protectionist policies. Ultimately the research concludes that Hamilton was not by any means a crony capitalist, but a nationalist. His policies to establish public credit and a national bank were an attempt to wed the merchant and manufacturing classes to the national government.

We thank Robert R. Henzler, '55 and the Charles Carroll Program for the generous support this project has received.

## Poster 63

### I Missed Your Cancer!? An Eye-Tracking Study of Lung Cancer Detection in Radiology

*Z. Zaniewski<sup>1</sup>, M. Rosen<sup>2</sup> and G. J. DiGirolamo<sup>1</sup>*

*<sup>1</sup>Department of Psychology, College of the Holy Cross and <sup>2</sup>Department of Radiology, University of Massachusetts Medical School*

Radiologists should be highly proficient at rapid visual analyses. This vital skill is utilized daily in the reading of hundreds of anatomical studies in the detection of small targets (e.g., a cancer nodule in the lung). In this clinical environment, missing a target can mean the difference between successful treatment and mortality. Yet, in spite of years of medical training and significant clinical experience, radiologist's misdiagnose ~30% of their total caseload. Shockingly, neither a standardized or evidence-based method of training radiologists exists, nor any means to detect when these errors occur. We tested 6 experienced radiologists from the University of Massachusetts Medical Center reading 18 axial chest CT studies (9 abnormal and 9 clear), each consisting of between 200-400 slices. Radiologists scrolled through each study and were asked to identify the presence and location of small, potentially cancerous nodules by clicking on them with the mouse. We tracked the location and duration of eye fixations in each region on each image, and the accuracy at detecting lung cancers. On average, the radiologists only detect 50% of the cancer nodules (range: 88%-25%). Most importantly, there was a significant difference in the duration of fixations on regions within and across images, with  $F(2, 10) = 8.43, p < .008$ . Even when radiologists consciously missed the cancer nodule, their eyes went to the nodule and fixated on it significantly longer than regions in the same image without nodules ( $p < .02$ ), or any region in a normal image ( $p < .03$ ). These data suggest that nodules are being unconsciously perceived, and by tracking the eyes during radiological viewing, we might be able to automatically alert radiologists to regions where nodules exist that they may have missed consciously.

We thank the Office of the Dean for financial support.

## Poster 64

### Injured Nesting Sea Turtles on Bald Head Island and its Effect on Fecundity

*J. Seebode and J. Reneker  
Bald Head Island Conservancy*

Six of the seven species of sea turtles are listed as threatened or endangered worldwide. Sea turtles often can acquire injuries while at the surface, from both natural and anthropogenic causes. These injuries may be lethal or affect the fitness of the turtle. A study was performed to understand if the number of sea turtles with injuries has changed and if these injuries affect the number of eggs a sea turtle will produce. Data from sea turtles that nest on Bald Head Island, North Carolina was used to determine the severity of the injury as well as the number of injuries for each year. Fecundity was measured using the historic sea turtle data for number of eggs laid. The study results show no big changes in the number of sea turtles with injuries nesting on Bald Head Island per year or the number of eggs an injured sea turtle will lay. Injuries, including major injuries, were however still prevalent in the population and thus it is important to work to decrease the anthropogenic causes.

We thank the Bald Head Island Conservancy for providing the statistical data used for this research.

## Poster 65

### Peptide Bond Cleavage through Cyclization of Asparagine

*Z. T. Giaccone, J. N. Reitter, A. Steeves, H. J. Kulik, and K. V. Mills*  
*Department of Chemistry, College of the Holy Cross*

Protein splicing is a post-translational modification by which an internal polypeptide, or intein, separates itself from the flanking residues, known as exteins. In the third step of the splicing mechanism, asparagine cyclization coupled to peptide bond cleavage excises the intein from the neighboring exteins. We have studied Asn cyclization experimentally using a model peptide assay in which bond cleavage is coupled to fluorescence. Through these experiments, we have discovered that cleavage of Asn is much faster than after Gln and that high temperature and neutral pH promote the cyclization. We have also observed cleavage after Asp at low pH. This summer, we pursued computational approaches to studying the reaction in the context of our model peptide. Molecular dynamics simulations suggest that the Asn side chain more frequently samples optimal conformations than a Gln side chain. For both peptides, the side chain oxygen is more frequently in a position for nucleophilic attack to occur. However, nudged elastic band simulations suggest the side chain nitrogen, not the oxygen, is the nucleophile and that nitrogen deprotonation is necessary for the attack to occur. Low activation energy barriers of the cyclization indicate that deprotonation rather than cyclization may be the rate-determining step. Simulations of peptides containing Asp suggest that cyclization occurs via a different mechanism than that of the native Asn and Gln residues.

This work was supported by the National Science Foundation under grant MCB-1244089 and by a Henry Dreyfus Teacher-Scholar Award (KM).

## Poster 66

### Exploring Changes in Children's Spatial-Relational Representations of the Day-Night Cycle

*A. Franco and F. Anggoro*  
*Department of Psychology, College of the Holy Cross*

Research has documented children's difficulties in acquiring basic concepts in astronomy, such as the day-night cycle and seasonal change (e.g., Plummer, 2014; Vosniadou & Brewer, 1994). Specifically, children (and even educated adults) lack understanding of how complex spatial-relational mechanisms such as rotation, orbit, and tilt produce the phenomena we experience on Earth's surface (e.g., Sadler et al., 2010). In this study, we taught 8- and 9-year-olds about the spatial-relational basis of the day-night cycle, i.e., how Earth's rotation causes day and night. We found that even though all children stated at pretest that Earth moves, the majority were unable to specify the movement. At posttest, about half of the children showed understanding of both rotation and revolution. Similarly, children progressed from uncertainty about the Sun's movement or thinking that it moves, to stating that it does not move. This understanding of planetary motion was incorporated into accurate explanations of the day-night cycle, including how different places on Earth experience day-night at different times. We also found that many children began with *descriptive* mental models of day-night derived from their observational experience (e.g., "The Sun goes up in the morning"). At posttest, they approached more scientifically accurate *causal* explanations, by expressing multi-perspective representations and describing rotation. Yet, almost no one showed understanding of how the Earth-based observations are *explained* by the scientific model (i.e., how the Sun *appears* to rise because Earth rotates). This lack of conceptual integration suggests a need for instructional conditions that support children's learning of the alignment between different spatial-relational perspectives in astronomy.

We thank the Office of the Dean for financial support.

## Poster 67

### Optimization of Copy Number Test for DiGeorge Syndrome

*A. Castro, D. Mahnke, and A. Tomita-Mitchell*

*Biotechnology and Bioengineering Center, Medical College of Wisconsin; Children's Hospital of Wisconsin*

Wisconsin Law requires screening of every newborn's blood to detect diseases not readily apparent at birth. One particular disease not currently being tested, but that could be detected through screening is 22q11.2 Deletion Syndrome. Also called DiGeorge Syndrome, this syndrome results from a loss of ~30-40 genes on the long arm of the 22<sup>nd</sup> chromosome. The most prevalent phenotype occurring in ~80% of patients with the deletion is Complex Congenital Heart Disease. We propose an accurate, timely, and cost effective test using Real Time Multiplex PCR for the detection of the deletion associated with this syndrome. TAQMAN Copy Number Assays have been developed to detect the number of copies of a particular gene of interest in patients. Currently, genomic DNA is isolated from a child's blood and screened for one gene, *TBX1*. Nine subjects (4.5%) were found to contain the deletion from a survey of 198 patients from the Congenital Heart Disease Tissue Bank (CHW). These results are consistent with previous publications. Currently, the *TBX1* assay is offered clinically as a genetic test that doctors can order for their patients at Children's Hospital of Wisconsin. Optimizing the RT-PCR test to incorporate a second gene, *CRKL*, would increase the robustness of the assay which is critical for a high-throughput, population-based screening tool. Adding *CRKL* to the *TBX1* test will not only capture patients with the typical 3 mega base pair deletion, but will also detect patients with smaller deletions that contain *CRKL* but not *TBX1*, thereby increasing sensitivity of the assay. This RT Multiplex PCR has the potential to be used in newborn screening.

Financial support was provided by the BBC and Hohenwalter Grant.

## Poster 68

### Is ATOM Still Relevant for the Acute Care Surgeon?

*J. Griffin, D'A. K. Joseph, K. J. Burns, and L. Jacobs*

*Department of Surgery, Division of Trauma/Surgical Critical Care, Hartford Hospital*

In response to the changed epidemiology of trauma, the Advanced Trauma Operative Management (ATOM) Course was developed as a method of training surgeons in the surgical management of penetrating injuries. Previous studies have reviewed the perceptions of prior participants on the value of ATOM on their knowledge, self-confidence and technical competence for the management of common penetrating injuries. The purpose of this study was to investigate participants' perception on the sustainability of the training received during the course, the necessity to repeat the course at regular intervals, and its role in the new paradigm of the acute care surgeon. Emails of all prior ATOM participants from the last 10 years were obtained from the ACS database. A ten-minute survey, consisting of 31 questions developed to evaluate current confidence level, practice model, and the need to repeat the course at regular intervals was sent to each individual. Responses were separated into two groups based upon participants' identity as a full-time trauma surgeon or not, and secondly separated into two groups based upon date of course completion. We found no difference in response between participants who identified as full-time trauma surgeons compared with those who did not when evaluating skill and confidence level. There was a difference in the response to the perception of the ability to control bleeding in participants who took the course at different times but it was not statistically significant. Additionally, 30.7% of participants stated that there would be a benefit to taking the course at least every 4 years, while a large number felt that the timing should be based upon experience with trauma and operative exposure. ATOM remains a relative and important course in the education and training of the trauma surgeon. Further investigation for the role of ATOM as a reliable training tool in the Acute Care Surgery model is needed.

We thank Hartford Hospital's Summer Student Research Fellowship.

## Poster 69

### **Mason Jar of Home: An EP Album Based on the Poetry of T. S. Eliot**

*M. Dunbar and E. MacCarthy<sup>1</sup>*

*Department of Music, College of the Holy Cross and <sup>1</sup>Department of Music, University of West Virginia*

Poets and songwriters have long grasped for answers to existential questions concerning time and one's place in it. In *Four Quartets* (1945), T.S. Eliot writes that "In my beginning is my end...In my end is my beginning" (East Coker, I, V.). The EP album *Mason Jar of Home* explores this paradox using contemporary musical and lyrical idioms. Each song on the album corresponds to one of the four "quartet" poems, exploring themes of ancestry, memory and desire. While the album is inspired by T.S. Eliot's poetry, it is not merely a contemporary refashioning. Rather, the music and lyrics engage with Eliot and his poetry from over seventy years ago to offer a new, youthful perspective on timeless themes. Together with making a methodical study of Eliot's *Four Quartets*, research and interviews were conducted to shed light on my own Irish and Scottish heritage. Just as Eliot imagines his Puritan ancestors living at East Coker in Somerset, England, the album features my grandmother reading a surviving 1901 census record of the family's ancestral home from Lylo, Ireland. This leads into the song "Lylo," where the speaker has a conversation with his ghostly great grandmother. All four songs consider the meaning of "home" from different perspectives. Preliminary research, writing, composing, and recording were completed between May and July of 2014. The band *Black Agnes* was responsible for arranging and recording the album. The band, whose very name has roots in my family's Scottish history, is a four piece indie rock band based in Portsmouth, NH, and its members are Mike Dunbar (vocals), Collin Garcia (Guitar), Nico Zottos (Bass) and Brian Finnell (Drums). The recording session took place at Rocking Horse Studios in Pittsfield, NH, under the direction of Emmy-nominated producer Brian Coombes, and the CD was issued for release in August 2014.

We thank the Mellon Summer Research Program for financial support.

## Poster 70

### **Synthesis of Novel Ligands through Mannich Condensation and Reductive Amination**

*K. Niederhoffer, N. Landry, and J. Farrell*

*Department of Chemistry, College of the Holy Cross*

Research in the Farrell lab centers around the synthesis of novel organic ligands that are used to modify the reactivity of transition metals. To this end, we have prepared a series of new amino-phenol compounds we hope to use as ligands for transition metal complexes in energy storage research. We have used both Mannich condensations and reductive aminations to prepare these ligands. The advantages and shortcomings of each approach along with the synthesis and characterization of these compounds will be presented. Separately, we have prepared a series of Re(I) complexes that give insight into the role of ligand electronic effects on backbonding. The role of FTIR and single crystal X-ray diffraction studies and measuring the amount of back bonding in a transition metal complex will be presented.

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

## Poster 71

### Phosphorylation regulates class IIa HDAC activity in osteocytes

*B. Beqo, Y. Lang, N. Gray, P. Divieti-Pajevic, M. Wein,  
and H. Kronenberg  
Endocrine Unit, Massachusetts General Hospital*

Osteoporosis is a disease in which bones lose density and become fragile, therefore becoming more prone to fractures. Bone density and strength are controlled by bone formation by osteoblasts and resorption by osteoclasts. Sclerostin, encoded by the SOST gene, inhibits osteoblasts and is produced by osteocytes, cells embedded within the bone matrix. Osteocytes are regulated by parathyroid hormone and mechanical forces. Class IIa histone deacetylases HDAC4/5 control sclerostin expression by osteocytes. Class IIa HDAC subcellular localization is regulated by dynamic phosphorylation and dephosphorylation. When HDAC4/5 are phosphorylated, they bind to the cytoplasmic anchoring protein 14-3-3 and allow sclerostin to be expressed. When HDAC4/5 are dephosphorylated, they translocate to the nucleus where they bind to transcription factor MEF2C and suppresses sclerostin production. This summer, we investigated mechanisms controlling HDAC4/5 phosphorylation and SOST suppression. Here we show HDAC4/5 are dephosphorylated in response to two stimuli that also inhibit SOST: parathyroid hormone (PTH) and fluid-flow shear stress (FFSS). However, the pathway in which it does this is not exactly understood. PTH/FFSS dephosphorylates HDAC4/5 by inhibiting a kinase or activating a phosphatase. The identity of the HDAC4/5 kinase in osteocytes is currently unknown. Here, we show that salt inducible kinases (SIKs) are probable HDAC4/5 kinases in osteocytes. Moreover, PTH signaling causes SIK2 to be phosphorylated on serine 358, a modification known to inhibit SIK2 activity. SIK2 S358 phosphorylation occurs prior to HDAC4/5 dephosphorylation. Future studies will be performed to study the functional significance of this signaling event in osteocytes.

This work was supported by the MGH Bicentennial Scholars Program and the National Institute for Diabetes and Digestive and Kidney Diseases.

## Poster 72

### The Knights of Columbus and Irish Catholic Male Identity in Worcester, 1919-1929

*C. Hyde and J. Poche  
Department of History, College of the Holy Cross*

This research examines Irish Catholic male identity in Worcester through an analysis of the Knights of Columbus, a prominent fraternal organization. Local newspapers and archival material from the Holy Cross Archives and Special Collections provided the majority of research material. In the WWI era, the Knights of Columbus played a prominent role in the war effort. In Worcester alone, they raised over twenty-five thousand dollars and provided more than 750 troops for service. Irish Catholic support of the war publicly demonstrated the Knights' commitment to the nation and integral place in American society. However, post-War depression, food shortages, and disease led to anti-Catholic rhetoric and once again placed the Worcester Irish on the fringe of society. The Ku Klux Klan led this assault against the Worcester Irish. Local Klansmen portrayed the Irish as un-American and threatening to society. In response, the Knights used Klansmen as a foil to define themselves and to articulate their importance in American society. The Knights' rhetoric reemphasized Irish Catholic men as ideal American citizens who embodied a dutiful, respectable, and strong demeanor. The Knights' response also conveyed that Irish Catholic male identity needed to be reasserted in the post-War era. While Irish Catholic male identity promoted an invigorated, public respectability, it also demanded a militant stance to defend their religion and importance to American society.

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

### Poster 73

#### **Cell-bound Complement Activation Products in Patients with Inflammatory Diseases**

*M. McGeary and C. Liu*

*Lupus Center of Excellence, Allegheny Health Network*

The complement system plays an important role in mediating inflammatory responses as part of the body's defense mechanisms. This system has been implicated in abnormally inflammatory conditions such as asthma and allergies. Patients with Systemic Lupus Erythematosus (SLE) have been shown to have cell-bound complement activation products (CB-CAPs), which are useful biomarkers for SLE diagnosis and monitoring. In this study, we hypothesized that patients with other inflammatory conditions might have CB-CAPs as well. We thus aimed to identify CB-CAPs in the blood of patients with inflammatory diseases in order to evaluate their utility as possible biomarkers for these conditions. Eight types of blood cells were isolated from blood samples from patients with SLE, asthma and/or allergies, or another inflammatory condition and identified by cell size, density and staining. When comparing SLE patients (n=11) with asthma/allergy patients (n=15) and "other" inflammatory patients (n=7), the mean level of cell-bound C4d, a complement activation product, was generally lower for the asthma/allergy group and higher for the "other" group. More research with a larger sample size and more specific sample types are interesting targets for future studies.

Thanks to the Lloyd Foundation, a part of PNC Charitable Trusts, for their financial support.

### Poster 74

#### **The 'Point' of an Image: Understanding How Messages Can Be Relayed in Art**

*S. Granison and L. Schomp*

*Department of Visual Arts, College of the Holy Cross*

Without words, how is it that art can tell a story? How is it that an image successfully relays information? What makes some art more effective at delivering a clear message? My goal has been to create artwork that can successfully depict the emotions I intend to share. The intent, or the meaning behind the artwork, is what makes art powerful. Basic skills and talent are necessary, but the message relayed is what distinguishes ordinary and extraordinary. This is to say that message-less art may be visually nice, but great art is made by the message it can provide to others. There is a difference between having the technical skills to create something beautiful and the ability to relay a message visually. If the reason behind the artwork is lost, then the art itself loses value to the viewer. I have attempted to create original and emotional pieces that are both inspired and clear. On my poster I have displayed some of the examples of images that I used to inspire my work along side my original pieces. Degas' 'Dancer,' Henri de Toulouse-Lautrec's 'The Medical Inspection,' Frida Kahlo's 'My Dress Hangs There,' an Untitled piece by Lucas Samaras, and William Kentridge's 'Mozart's Magic Flute,' and 'Sobriety, Obesity & Growing Old.'

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

## Poster 75

### Trunk Muscles, Balance, and Falls in Elderly Adults

*E. Parker, B. Allaire<sup>1</sup>, D.E. Anderson<sup>1,2</sup>, and M.L. Bouxsein<sup>1,2</sup>*  
*<sup>1</sup>Center for Advanced Orthopedic Studies, Beth Israel Deaconess  
Medical Center, and <sup>2</sup>Harvard Medical School*

Falls are a common cause of injury in the elderly, making it important to determine risk factors that contribute to impaired balance and falling. Prior research has linked poor trunk muscle composition with functional declines in the elderly, and gluteal muscle composition with falls. Therefore, we analyzed whether trunk muscle size and composition were related to balance and predictive of future falls. We created two hypotheses: 1) Trunk muscle parameters will be negatively associated with root-mean-square sway magnitude and velocity measured on a force plate. 2) Trunk muscle parameters at baseline will be a significant predictor of falls during the follow-up period. This study was a secondary analysis of data collected in a prior study of 177 adults ages 60 and older, specifically baseline lumbar CT scans, baseline force plate balance measures, and falls data for up to 3 years prospectively. We measured trunk muscle cross-sectional area and composition (average Hounsfield units) at the L2 mid-vertebral level bilaterally for the Erector Spinae, Transversospinalis, Quadratus Lumborum, Psoas Major, Latissimus Dorsi, External Oblique, Internal Oblique, and Rectus Abdominus. The analysis has not been completed for Hypothesis 1, regarding balance. Preliminary analyses for Hypothesis 2, regarding falls, did not show significance. However, these analyses did not account for influential covariates such as subject gender. If the final results do not reach significance, it could suggest that trunk muscles do not affect fall risk as extensively as gluteal muscles.

Financial support provided by the Center for Advanced Orthopedic Studies.

## Poster 76

### Spatial Working Memory in Mice

*K. Moriarty and A. C. Basu*  
*Department of Psychology, College of the Holy Cross*

Working memory is an important aspect of cognition, conceptualized as the short-term capacity to retain and manipulate information as necessary to perform a task. In the context of the empirical study of animal behavior, working memory is operationally defined as the short-term memory for a stimulus, location or object, specific to a single test. We have designed a protocol to allow evaluation of mouse behavior related to spatial working memory without the need for food restriction, and in which the constraints on behavior are less than standard paradigms used to measure working memory in rodents. Using the Morris Water Maze, we trained and tested adult male and female C57BL/6J mice over the course of 5 consecutive days for a total of 9 sessions which each consisted of 8 paired trials. We moved the submerged escape platform after each pair of trials, alternating between two locations that were kept constant. The 5<sup>th</sup>, 7<sup>th</sup>, and 9<sup>th</sup> sessions consisted of cued first trials and hidden second trials with inter-trial intervals of 10s, 30s, and 60s respectively. Two-factor ANOVAs (session × trial type, repeated measures) revealed significant main effects of 2<sup>nd</sup> trial type (cued vs. hidden) in latency to find the platform, swim speed, and path length. We plan further studies, such as a between subjects design, to test the hypothesis that individual escape latencies on hidden trials reflect spatial working memory in this paradigm. Ultimately, we are interested in how modulation of the NMDA receptor might be involved in working memory, in normal function and in diseases such as schizophrenia and Alzheimer's disease.

We thank the Dean's Office for financial support.

## Poster 77

### The Effect of Multiple Concealable Stigmatized Identities On Well-being

*E. Inman and S. Chaudoir*

*Department of Psychology, College of the Holy Cross*

“Stigma” is defined as an attribute that is deeply discrediting, such as a physical deformity, character flaw, or ethnic/religious identification. The effects of multiple stigmatized identities can be studied through an additive (layered) or multiplicative (intersecting) lens. Current research on this subject is largely qualitative and has been unable to specify how multiple stigmatized identities interact and to what degree they impair well-being. We surveyed 110 students regarding the number and type of concealable stigmatized identities (CSIs) they possess and their quality of mental and physical health. We found participants with multiple CSIs exhibit significantly higher levels of depression and illness symptomology and lower levels of self-esteem and belongingness, compared to participants with one or no CSIs. Higher numbers of CSIs were also correlated with decreased self-esteem and belongingness. These findings demonstrate that individuals with multiple CSIs are more vulnerable to mental and physical illness and support an additive relationship between stigmas.

We thank the National Science Foundation and the Mellon Program for financial support.

## Poster 78

### Modeling Microscopic and Macroscopic Traffic Flow Utilizing the Particle Filter and Ensemble Kalman Filter

*C. Cochrane, J. DeGuire, B. Fan, E. Holmes, M. McGuirl, P. Murphy,  
J. Palmer, B. Sandstede, and C. Xia*

*Department of Applied Mathematics, Brown University*

Mathematicians and engineers have been studying traffic flow for decades. In this project we combined new methods of researching traffic flow in hope of creating a more effective way to model traffic and predict when traffic jams will occur. We have studied both macroscopic and microscopic traffic flow. In the microscopic traffic flow model we track the velocity, headway, and position of individual cars, whereas in the macroscopic traffic flow model we study the density and flux of cars over a segment of the road. We use the Lighthill-Whitham equations to model traffic flow, but we have modified this existing model to include various road conditions for more realistic settings. We also use data assimilation for our microscopic and macroscopic traffic flow models. Implementing both the Particle Filter and the Ensemble Kalman Filter has allowed us to compare data assimilation techniques in diverse road conditions. Our research shows that data assimilation works in dynamic traffic settings for both the microscopic and macroscopic traffic models. To test the efficacy of our methods we applied our models and data assimilation techniques to real data from a traffic study in Minnesota.

We thank the National Science Foundation for funding this project through a Research Training Grant on “Integrating Dynamics and Stochastics”.

## Poster 79

### The Problem of Morality and Modernity for Friedrich Nietzsche and Leo Strauss

*A. Sliwowski and M. Dinan*

*Department of Political Science, College of the Holy Cross*

In *On the Genealogy of Morals*, Friedrich Nietzsche undertakes a polemical critique of moral prejudices as they appear in late modernity. While tracing the development of moral concepts, Nietzsche destabilizes foundational principles and diagnoses the fundamentally reactive and uncompromising character of contemporary morality. However, his critique cuts down into the way in which humans comport themselves in the world, as exemplified by the reactive and totalizing character of the ascetic ideal; its demand for certainty has come to the detriment of life. Given this critique, Nietzsche sees an alternative in a philosophic way of life that is able to tolerate uncertainty as a condition of the pursuit of truth. Then, I turn to Leo Strauss' response in *Natural Right and History*, which also offers an account of the origins of "good" and "bad," traces a genealogy of moral concepts, and considers the relationship of these developments to modern liberal democracy. Strauss takes seriously both Nietzsche's critique of contemporary morality and his attack on foundational principles, but views Nietzsche's implicit denial of natural right as politically destructive. Strauss' return to the zetetic nature of Socratic philosophy answers Nietzsche's call to openness and allows for a further openness to the idea of nature: this maintains the possibility of the philosophic life as openness to the whole as well as the possibility of natural right as a viable standard.

I would like to thank Robert R. Henzler, '55, and the Charles Carroll Program for their financial support.

## Poster 80

### Developing an Assay to Quantify the Ability of Lung Mesenchymal Stem Cells to Repair Cells Damaged by Exposure to Cigarette Smoke Extract

*J. Bourgeois, J. Burns, E. Fiorentino, G. Motta, and J. Paxson*

*Department of Biology, College of the Holy Cross*

Previous research has shown that mesenchymal stem cells have protective and reparative capacity in a variety of *in vitro* and *in vivo* disease models, possibly through the use of extracellular vesicles (EVs) derived from the mesenchymal cell's plasma membrane. However, few studies have examined the role of lung mesenchymal stem cells (LMSCs), or their associated EVs, in the treatment of cigarette smoke-induced chronic lung diseases such as COPD. The purpose of this study is to develop a protocol for damaging lung fibroblast cells *in vitro* with cigarette smoke extract (CSE) and to examine the ability of LMSCs to repair the damage. Our hypothesis is that EVs from LMSC-derived conditioned media will prevent CSE-induced apoptosis and myofibroblast differentiation of lung fibroblasts in culture. To test this hypothesis we first needed to create a CSE assay to quantify cell apoptosis and myofibroblastic differentiation. Using 3T3 fibroblasts we exposed cells to 0%, 5%, 10%, 15%, 20%, and 30% filtered cigarette smoke extract in alpha MEM media for 24 hours. The extract media was then removed and the cells were cultured in regular media for an additional 24 hours. Cell viability after exposure to CSE was analyzed using a MTT assay. Our results showed that cells exposed to 5-10% cigarette smoke extract decreased in viability in comparison to control groups. Using a combination of MTT cell viability and myofibroblastic differentiation assays, we will next test the capacity of LMSC-derived conditioned media to rescue CSE-damaged cells.

We thank Lindsay B. and Richard K. Watson, Jr. '80, P12; Jacqueline H. and George A. Paletta, Jr., M.D. '84, P15; and Michele K. and David M. Joy '74, P11 for their generous contributions to the Alumni/Parent Summer Science Research Scholarship Fund.

## Poster 81

### **The Role of Subjectivity in Referral Assessments for Transsexual, Transgender, and Gender-Nonconforming Clients**

*C. M. Wolfe, S. Chaudoir, and K. J. Rawson*

*Department of Psychology and Department of English  
College of the Holy Cross*

This research analyzes the role of mental health professionals' (MHP) subjective analyses of gender narratives and presentation during the assessment of gender-nonconforming clients seeking hormonal and surgical treatment referrals. The Standards of Care (SOC) give subjective authority to MHPs to determine treatment eligibility based on SOC guidelines. The flexibility of these guidelines allows for wide interpretation of eligibility requirements. While this leads to more inclusive practices by MHPs well-informed of gender diversity, MHPs untrained in transgender counseling may refer to stereotypes and narrative expectations that exclude many clients' experiences and result in referral denial. Through exploring two client groups MHPs have demonstrated limited understandings of, homosexual transsexuals in the late 20<sup>th</sup> century and beyond-the-binary gender-nonconforming individuals in contemporary times, this research highlights the need for more informed MHP understandings of gender-nonconforming identities, expressions, and culture. Training that results in informed MHP opinions can guard against unintentional biases or assumptions that can negatively impact assessment outcomes. When MHPs are educated about less familiar gender narratives, they are able to foster more positive client-MHP relationships and improve client access to care.

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

## Poster 82

### **Modeling Chronic Immune Activation in HIV-1 Infection**

*K. Goettler and D. Damiano*

*Department of Mathematics and Computer Science,  
College of the Holy Cross*

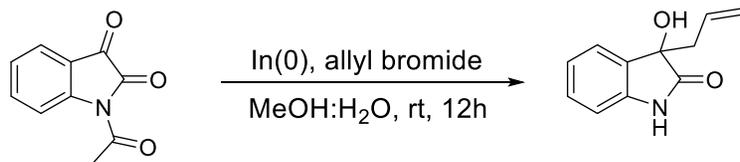
Chronic immune activation has been implicated as a major cause of the progression to AIDS in HIV-1 infection and in the limited immune reconstitution of HIV-1 patients on antiretroviral therapy. The healthy human immune system maintains low levels of rapidly proliferating and short-lived activated CD4<sup>+</sup> (helper) and CD8<sup>+</sup> (killer) T lymphocytes. In HIV-1 infection, however, the presence of virus increases recruitment into this activated population and effectively 'burns out' the immune system over time. Here we employ a system of twelve non-autonomous ordinary differential equations, modeling CD4<sup>+</sup> and CD8<sup>+</sup> T lymphocyte populations, to explore the effects of chronic immune activation and how they shape the course of HIV-1 infection. Activated cells are divided into HIV-specific and non-specific compartments. Heaviside functions are used to turn on increased recruitment of non-specific cells during infection. Parameter and target values for each compartment are estimated from literature and optimized using a simplex method and Latin hypercube sampling.

We thank the Shanahan Award for Scholarship in Mathematics and Computer Science for supporting this research.

## Poster 83

### Indium and Bismuth Mediated One-Pot Deacetylation and Allylation

*A. L. Fyles, D. Kumar, and G. R. Cook*  
Department of Chemistry and Biochemistry  
North Dakota State University



Recently, there has been a great deal of interest in exploring green sustainable methods in organic synthesis. This usually entails running reactions at ambient temperature and pressure using low-toxicity reagents and solvents. The study of indium and bismuth mediated reactions support this goal because both metals are air and water stable and are minimally toxic. We have found that both metals promote deacetylation and allylation of N-acetylisatin. The resulting 2-oxindole motif of isatin is found in the core structure of many biologically active molecules and commercially available drugs; thus, the overall transformation is a potentially useful one in medicinal chemistry. On this poster, we will present the optimization of this one-pot transformation and will propose strategies to generalize the conversion to other differentially protected ketoamides.

We are grateful to the National Science Foundation (NSF-CHE 1062701) and the Department of Chemistry and Biochemistry Department at North Dakota State University for funding this project.

## Poster 84

### Ion Beam Profile Monitor

*K. Conte and P. Oxley*  
Department of Physics, College of the Holy Cross

An ion beam profile monitoring system has been designed and partly built and tested. The system will be used to monitor the size and shape of ion beams used in collision experiments between ions and atoms. Without knowledge of the ion beam profile these experiments will be inefficient and open to systematic errors. The system consists of a monitor that the ions strike, a series of sensitive current detectors, a master timer circuit to control the current detectors, and a data acquisition card to read data into a computer. The monitor itself is a grid of 16, 0.5mm diameter tungsten wires placed in the path of the ion beam. When struck, electrons are freed from the tungsten and these electrons constitute a tiny electrical current that can be measured. Since the intensity of the ions differs across the ion beam, varying electron currents will be produced from different wires. With 8 horizontal and 8 vertical wires, the entire ion beam will be profiled in two dimensions. The monitor has been assembled but not yet tested. The currents will be converted to voltages by sensitive current detectors, which will be read by the computer-guide data acquisition card. Since the currents vary across the profile of the beam, the gain of the current detectors will be controlled by the master timer circuit we have built. The master timer, the current detector circuit and the data acquisition card have all been tested. The timer has been tested to ensure that it can send the necessary voltage pulses to control the current detector gain and to trigger the data card to read detector output voltages at the correct time. The detector circuit was tested to ensure that it can detect currents as small as one billionth of an amp. Sample data from these circuits will be shown.

We thank the Dean's Office for financial support and Dick Miller for machining expertise.

## Poster 85

### Determining the Density of an Atomic Beam using Laser Absorption

*J. Wihbey and P. Oxley*

*Department of Physics, College of the Holy Cross*

In preparation for experiments that collide lithium atoms and protons, a systematic measurement of the density of a lithium atomic beam has been made. The density of the beam is an essential quantity for interpreting collision probability, the key parameter in collision experiments. To calculate the density of the beam we measured the absorption of laser light by the lithium atoms and applied Beer's Law to infer the atom density. Experimentally, we assembled a vacuum-sealed cube that connects to the atomic beam vacuum system. Light from a diode laser was routed to the cube via an optical fiber and passed through the lithium beam and on to a photodiode. The lithium beam was chopped at a controlled frequency. Turning the beam on and off in this way allows us to measure the amount of light reaching the photodiode when lithium is present and when it is not. The percentage absorption of laser light by the atoms can then be calculated. Laser absorption values were compared for a range of laser powers and frequencies. The peak absorption measured was 4.5%, but, using a lock-in amplifier, much more sensitive measurements were made – determining absorptions as low as 0.004%. In addition, experimental time profile data for the chopped atom beam was found to be in excellent agreement with theoretical models we created. In conclusion, we have made measurements of laser absorption by lithium atoms that can be used to infer the lithium atomic beam density. By use of a lock-in amplifier, we have shown our technique to be a highly efficient method for obtaining laser absorption data, even for very weakly absorbing beams.

We thank the Dean's Office for financial support and Dick Miller for machining expertise.

## Poster 86

### Articulating Agency and Identity at a Cambodian-Vietnam Border Market

*V. Khin and A. M. Leshkovich*

*Department of Sociology and Anthropology, College of the Holy Cross*

In the Vietnamese special economic zone (SEZ) of Moc Bai located along the Cambodian border, a multifaceted informal economy depends on intimate connections between agency and identity. For participants – small-scale traders, sellers, motorcycle drivers, etc. -- traffic to, from, and within the zone is dictated by distinctions of identity, including ethnicity and nationality on a transnational scale and gender and class on an intranational scale. While government and local police authorities attempt to regulate official flows of goods and people, ethnographic research reveals that they also produce, tolerate, and even require these underground mobilities. According to participants in the informal economy of Moc Bai market, decades ago the border offered new opportunities for upward mobility. Although government officials continue to tout the continued growth of the Moc Bai SEZ, for informal economic actors, opportunities are more largely by internalized markers of identity than by larger economic regulation, thus limiting or even preventing lateral and vertical mobility. While the Moc Bai SEZ seems somewhat effective for larger corporations, agency for the market's informal participants proves to be inseparably tied to one's success in navigating identities. This research thus contributes to studies of how specially regulated government spaces, such as SEZs, tend to develop environments where individual capacities for economic mobility are shaped under the auspices of external corporate-governmental agendas and internal self-regulatory practices.

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

## Poster 87

### “Forced Upon Us:” Economic Desires and the Crisis of Identity in Rhodesia

*D. King and M. Munochiveyi*

*Department of History, College of the Holy Cross*

European infatuation with the land known as Zimbabwe today, and indeed all land in Africa was well underway by the turn of the 20th century. The introduction and expansion of white settlers into Southern Africa was motivated primarily by the prospect of easy economic gains in the form of untapped minerals, cheap labor, and vast expanses of farmland. The promise of doing less work for more wealth was an attractive offer for the lower and middle classes of the United Kingdom, as they began to flock in droves to Rhodesia. This drove up white immigration, increasing the population and forming a cultural basis for a new group of people who would call themselves Rhodesians. Rhodesians, being white Europeans, could not accept majority rule, since it threatened their economically privileged status. In 1965 settler leadership decided to declare independence as a republic. This action was not a revolution but merely a conservative reaction aimed at maintaining white economic control. Rhodesia's culture was entirely manufactured as a result of this push for independence. The culture of Rhodesia was born out of the white settlers singular aim: wealth at the cheapest cost. Movements in the arts, academia and literature helped to maintain the narrative that Rhodesians were no longer European but rather a distinct ethnic group that need to be at the reigns of Rhodesia. Although it created settler state in Rhodesia, and a Rhodesian culture that exists in diaspora to this day, the Unilateral Declaration of Independence of 1965 effectively destroyed any hope of continued white settler dominance. The need for Rhodesian culture and nationhood cut off Rhodesia from its markets globally due to sanctions, and created helped to spark a civil war, both of which lead to economic uncertainty and the collapse of white rule.

## Poster 88

### Silica Coating and Bioconjugation on Gold Nanoparticles

*T. Holland, C. L. Bayer, and S. Emelianov*

*Department of Biomedical Engineering, University of Texas at Austin*

Gold nanoparticles paired with the use of photoacoustic imaging have the justified potential to become an integral part of the breast cancer diagnosis process. Gold nanoparticles can be conjugated to antibodies that target specific biological specimen, such as the cell receptors of a tumor. Photoacoustic imaging involves a pulsating laser light that heats the nanoparticles. This light is converted to a thermoacoustic signal that is identified by an ultrasound transducer that in turn, formulates an image. Silica is grown on the exterior of the nanoparticle to protect and stabilize its shape and to add an amine functional group that is necessary for bioconjugation. In previous studies, silica-coated gold nanorods have had increased photothermal stability and the ability to maintain its optical quality after undergoing strong external influences. This gives silica-coated gold nanorods the potential to act as an exceptional therapeutic nanoagent for photoacoustic imaging. Our goal is that silica-coated gold nanorods bound with antibodies to the epidermal growth factor receptor, anti-EGFR, will bind with a high affinity to cancerous cells, thereby increasing the quality of photoacoustic images for diagnosis.

## Poster 89

### Acute Hind Limb Ischemia Reperfusion in the Recombinant Polygenic Type 2 Diabetic Mouse

*T. Uong, H. Albadawi, R. Oklu, J. D. Milner, H.-J. Yoo, and M. T. Watkins*

*Department of Vascular and Endovascular Surgery, Massachusetts General Hospital*

The polygenic mouse model of diabetes is believed to better simulate the human adult type-2 diabetes compared to the monogenic models (i.e. db/db or Ob/Ob). The aim of this study was to assess acute skeletal muscle injury in the polygenic mouse model of diabetes following hind limb ischemia reperfusion (IR). There was no significant difference in the degree of muscle fiber injury between the diabetic vs. non-diabetic mice ( $15 \pm 2$  vs.  $16 \pm 2$  average injured fiber per high power field,  $p=0.6$ ). The accumulation of Ly6G<sup>+</sup> ( $41 \pm 10$  vs.  $48 \pm 15$  average positive cells per field,  $p=0.7$ ) and Mac3<sup>+</sup> ( $42 \pm 6$  vs.  $33 \pm 5$  average positive cells per field,  $p=0.7$ ) cells in skeletal muscle following IR was similar in the diabetic vs. non-diabetic mice. Furthermore, levels of muscle KC ( $17 \pm 2$  vs.  $14 \pm 2$  pg/mg protein,  $p=0.2$ ) and serum KC ( $103 \pm 6$  vs.  $73 \pm 15$  pg/ml,  $p=0.09$ ) were also not statistically different between the two groups. The pattern of acute skeletal muscle IR in the polygenic diabetic mouse does not appear to be worse than that of the non-diabetic mouse following 1.5 hours of ischemia. Further studies in these polygenic diabetic mice subjected to severe periods of ischemia (i.e.  $\geq 3$  hours) and characterization of the regenerative phase (i.e. healing) in the limb muscle is warranted.

We thank the Department of Vascular and Endovascular Surgery at Massachusetts General Hospital for financial support.

## Poster 90

### Using 3D Models to Estimate Mass of the Dodo

*A. Kimelblatt, A. Randall, and L. Claessens*  
*Department of Biology, College of the Holy Cross*

The dodo (*Raphus cucullatus*) was a large, flightless bird that was endemic to the island of Mauritius and went extinct in the late 17th century, less than a century after the arrival of humans to the island. Knowledge of the dodo's appearance is limited because few accurate historical drawings exist, and these are outnumbered by a multitude of inaccurate drawings that were not based on any actual observation of the living bird. There are only two complete dodo skeletons in existence, which have both remained unstudied until this point. We've constructed a digital dodo in order to estimate the animal's mass and center of mass. Previous students in the lab traveled to Mauritius to 3D scan the most complete of the two skeletons, which we used in addition to the few reliable drawings of the bird as a foundation to create our digital dodo model. We created digital body outline models using Autodesk Maya, a 3D animation program, to reconstruct a body outline on top of the skeleton. We created three separate models representing a range of masses: minimum, average, and maximum. We exported our models into Geomagic Design X to determine total body volume. We modeled an esophagus and set of lungs to subtract air space from the body volume. We used a relative density of  $840 \text{ kg m}^{-3}$  to calculate the mass of each bird model, which ranged from 10- 20kg. Our data indicate that the dodo was not as light as recent studies have suggested, nor was it as heavy as some historical accounts have indicated. An accurate understanding of body mass and center of mass is integral to our future studies of the paleobiology of the dodo, including an examination of how the bird walked.

We thank Anne E. and John Kirby Bray '79, P10 and the Alumni/Parents Summer Research Scholarship Fund for their financial support.

## Poster 91

### On Globally Defined Solutions of the Generalized CLM Equation

*G. Yalla, S. Davies<sup>1</sup>, I. Alevy<sup>2</sup>, and J. Guzman<sup>2</sup>*

*Department of Mathematics, Carnegie Mellon University<sup>1</sup>*

*Division of Applied Mathematics, Brown University<sup>2</sup>*

We consider a generalized one dimensional model of the three dimensional vorticity equation, proposed by Constantin, Lax, and Majda. Results for the one dimensional model may provide insight to the behavior of solutions of the Navier Stokes equation. Specifically, we studied the effect the parameter that controls the amplification of the convection term has on solutions to this equation. Cordoba and Okamoto showed that nonpositive parameter values lead to singularities in finite time. While the behavior of solutions for positive values of the parameter are unknown, it is conjectured by Okamoto *et al.* that the solutions undergo a bifurcation from blow up to global existence for some parameter value between 0 and 1. Several different numerical and analytic methods, including the Finite Difference Method, Fefferman-Stein Decomposition and Pseudo Spectral Method, are utilized to analyze whether or not solutions form singularities in finite time.

We thank the National Security Agency and the Leadership Alliance Program for financial support.

## Poster 92

### Rhodiola Crenulata Inhibits WNT Signaling in the MDA-MB-231 Triple Negative Breast Cancer Cell Line

*E. Amaro Gonzalez, L. Mateo Bassa, X. Williams, and S. Smith Schneider*

*Pioneer Valley Life Sciences Institute*

Breast cancer is the second leading cause of cancer death in women, second to lung cancer. Triple Negative breast cancer (TNBC) tumors are the most aggressive form of breast cancer that does not express Her2/Neu receptor, estrogen and progesterone receptors. The Wnt pathway is a signaling pathway that is essential in normal cell development and has been implicated in breast cancer where it plays a role in cell invasion and cancer stem cell maintenance. *Rhodiola crenulata* (RC) is a Tibetan mountainous plant, commonly used in eastern alternative medicine as an adaptogen. Previously we have shown that RC inhibits migration and invasive behaviors of TNBC cell lines and increases cell death. In this study, we demonstrate the inhibition of WNT target gene activation in MDA-MB-231 cells upon treatment with RC. We performed a  $\beta$ -catenin reporter luciferase assay and qPCR for WNT target genes. Our results demonstrate an inhibition of  $\beta$ -catenin transcriptional activation as well as a decreased expression of canonical WNT target gene expression. This data suggests that RC inhibits WNT signaling in this triple negative breast cancer cell line and hints to a possible mechanism for how Rhodiola provides protective effects on triple negative breast cancer subtypes.

We thank the Rays of Hope Foundation for financial support.

## Poster 93

### Staff Attitudes Regarding the Impact of an Animal Assisted Therapy Program on Military Behavioral Health Patients

*S. Brisson and A. Dekker*  
*Fort Belvoir Community Hospital*

Animal assisted therapy (AAT) is designed to promote improvement in human physical, social, emotional, and/or cognitive function. The first report of AAT occurred in 1792 when the Quakers documented the therapeutic use of animals in a mental health institution. Since that time the popularity of AAT in Behavioral Health has markedly increased. However, there is scant research regarding the impact of AAT programs on military Behavioral Health patients. The purpose of this study is to determine the attitudes of staff members regarding the impact of an AAT program on military Behavioral Health patients. In June of 2012 a highly trained service dog was introduced into a Behavioral Health therapy program at a military hospital. The dog participated in both individual and group counseling sessions. An anonymous survey was utilized to determine the staff attitudes regarding the impact of the AAT program on patients. 29 staff members were available for the survey. Results of the survey demonstrated that 86% (n=25) of Behavioral Health staff members identified a positive impact of the AAT program on patients. When observing an AAT program on patients, 72% (n=21) of staff members identified improved patient mood; 69% (n=20) identified patients as more relaxed; 66% (n=19) identified improved patient attitude towards their therapy; 55% (n=16) identified increased social interactions among patients. However, 6% (n=2) observed patients avoiding or ignoring the dog; 3% (n=1) observed patients as more tense or uncomfortable around the dog. Interestingly, 100% (n=29) of the Behavioral Health staff members reported a desire to continue the AAT program at the military hospital. In conclusion, staff attitudes regarding the impact of an AAT program on military Behavioral Health patients are overwhelming positive. The staff unanimously supports the continuation of the program.

## Poster 94

### What is Water?

*C. May, N. LaRovere, D. Sorkin, and D. Bitran*  
*Department of Psychology, College of the Holy Cross*

Inspired by David Foster Wallace's 2005 Commencement speech at Kenyon College, the name of this project alludes to the metaphor that Mr. Wallace uses at the beginning of his speech: an older fish asks two young fish, "How's the water?" The two young fish respond, "What the hell is water?" Mr. Wallace's metaphor is not conveying that humanity should be more thankful for air, water, and food because these elements are literally essential to keeping us alive, but rather it is a criticism of most people's lack of teleological understanding of themselves. The research specifically focuses on the factors that individuals consider when evaluating their own success. I explore objective and subjective understandings of success and the relationship between a successful life and a successful career, social comparison theory, the different implications of understanding work as a job, career, or a calling, evolutionary theory's impact on society's understanding of success, and alternative conceptualizations of career success. We conducted a pilot study that involved 35 interviews. We provided an opportunity for people of varying socio-economic backgrounds, ethnicities, religions, careers, and education to be engaged to reflect on one question: "What is success?" We believed people would understand success as a materialistically driven evaluation. The study found that no one believed materialistic gain is the key to success. Contrary to our hypothesis, answers often followed a qualitative analysis of success involving key ideas such as *autonomy* and *pursuing what I love*.

## Poster 95

### **A Longitudinal Assessment of HIV-Related Stigma and its Detrimental Effects on Psychological, Behavioral, and Physical Health Outcomes Among People Living with HIV/AIDS**

*E. Richards and S. Chaudoir*

*Department of Psychology, College of the Holy Cross*

HIV stigma—a social phenomenon wherein people living with HIV/AIDS are devalued or discredited—is a significant barrier to HIV prevention and treatment efforts in the U.S. Previous research indicates that HIV stigma is associated with suboptimal psychological, behavioral, and physical health outcomes among people living with HIV/AIDS. However, previous studies have often conflated multiple distinct forms of stigma, obscuring the precise relationships between stigma manifestations and their concomitant outcomes. The present study examines the effect of anticipated, enacted, and internalized stigma on changes in depression, sexual risk behaviors, and physical health symptoms among 233 adults living with HIV/AIDS in the U.S. Our findings indicate that anticipated stigma predicts lower depression, enacted stigma predicts greater HIV physical illness symptoms, and internalized stigma predicts greater depression but lower safer sex self-efficacy. By differentiating between these distinct forms of HIV stigma, researchers can better understand how to promote the health and well-being of people living with HIV/AIDS.

We thank the National Science Foundation for financial support.

## Poster 96

### **The Probabilistic Change Point Algorithm**

*M. Antonellis and E. Ruggieri*

*Department of Mathematics and Computer Science*

*College of the Holy Cross*

While data sets have often been approximated through the usage of linear models, it is often inappropriate to use just a single line segment, especially when the data is expected to vary over time. Often a piecewise function of multiple line segments is the proper solution, however deciding where to break up the model poses its own set of challenges. Possible solutions grow exponentially with the size of the data set and this makes finding the “right” change point very difficult. The analysis of these “change points” in a Bayesian setting was the intention of this study. A probabilistic model was developed for accurately predicting the location of change points. Using Bayes’ rule suitable model parameters could be found and from that probabilities could be assigned to the suspected change point. Then a stochastic back trace was used to identify the index of the change points. Subsequently a graph could be produced including the data and the distribution of change points. Data points were sampled from the posterior distribution and this allowed us to calculate a model and plot the distribution of change points. These methods were all tested on temperature data sets provided by the NOAA on departures from long standing temperature averages the years 1880 to 2012. These data provide for a good source to start diagnostics of global temperatures against a reference value. With this data set we have compared our results to what previous analysis has been done of the temperature data set. The probabilistic model that has been developed can be used to search for change points in a wide variety of data sets. Thank you to the NOAA for providing the data at: <http://www.ncdc.noaa.gov/monitoring-references/faq/anomalies.php>

## Poster 97

### A Historical Performance of Frescobaldi's *Fiori Musicali*

*A. Ross and J. D. Christie*

*Department of Music, College of the Holy Cross*

*Fiori Musicali* of Italian baroque composer Girolamo Frescobaldi represents one of the most important and exquisite works of its time. Today, the means for performing such music as it might have been in 17<sup>th</sup> century Italy is neither well known nor practiced. This project sought to discern the methods for preparing this music in a historically accurate fashion for a final performance of *Messa della Madonna* in its originally intended liturgical context. Research began with ten days of study in Italy under Francesco Cera, renowned organist and expert in the repertoire. I gathered information from lessons and practice on period instruments in the Rome and Latium regions, visits to churches where Frescobaldi taught and played, and archival work in the Biblioteca Catanese. Study continued in the U.S. with examination of manuscripts and treatises and visits to historical model instruments. Much of the research centered on discerning how to organize the movements within a mass in today's post-Vatican II church. I conducted a search for the Gregorian chants of the mass that Frescobaldi would have known in his time. With regard to the organ versets, it becomes clear that many of these pieces would be played on a 16-foot registration or *all'ottava alta* (the higher octave of the instrument), producing ample contrast between the different pieces. These discoveries yielded an engaging, informed, and contextually appropriate performance. I will doubtlessly utilize the work of this project in my further studies.

We thank the Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts for financial support.

## Poster 98

### Morphological Variation in the Calling Structures of a Ground Cricket, *Eunemobius carolinus*

*K. Morsch and K. N. Prestwich*

*Department of Biology, College of the Holy Cross*

Acoustic signals are often central features of systems used by males to attract females and by females to evaluate the condition of males. *Eunemobius carolinus* is a small (5mm long, 30 mg), ground cricket. Males produce a quiet (~63 dB SPL<sub>re20.Pa</sub> at 0.3m) trilling sound that is omnipresent on campus in the fall. Sound is produced by closing the forewings while pushing a "pick-like" structure on one wing (plectrum) against teeth on the lower surface of a wing vein (the file) on the other wing. Each time the plectrum is gathered and released by a tooth, a sound wave is generated by the in-phase buckling of specialized wing cells (harps) on each wing; about 35 waves are produced per wing closure. The pitch of the call (~5.7kHz) must be in the female's narrow auditory range and is determined by the tooth strike rate and the sound pulse-silence (pulse) rate is central to species recognition (50-70/s). Passive and active female choice models both predict that females will prefer males that make the loudest calls and whose pitch and pulse rates match the preferences of her nervous system. We investigated the morphological variation in file structure (related to pitch and loudness) and harps (related to loudness) using scanning electron microscopy. We found a high degree of file asymmetry with the left file probably being non-functional. On right wing, tooth separation increased in the direction of plectrum movement; this helps explain the decrease in frequency during a sound pulse; tooth depth also increased, helping to explain increased loudness during a pulse. The harps are too small to radiate sound at maximum efficiency.

We thank Dr. Robin Vannote for his generous support of student research in ecology and evolution.

## Poster 99

### Automation and Stability Assessment of a Laser Spectrometer

*J. Golemi, T. Krueger, and T. Roach.*

*Department of Physics, College of the Holy Cross*

Spectrometers are widely used instruments designed to analyze different frequencies of light. Our spectrometer, built by a physics student last year is being used to study the behavior of an extended cavity diode laser (ECDL) system. The spectrometer consists of two lenses, a diffraction grating and a camera sensor that captures the image of a laser spot. One goal of this project was to stabilize the spectrometer by replacing the mountings of each optical component. The new mountings are one rigid piece of stainless steel (replacing three pieces of aluminum and steel) and are thicker and shorter, making the components less prone to any movement therefore more stable. Another goal was to automate the spectrometer via a computer in order to take faster and more reliable data. I wrote programs in LabView for this: at the push of a button the spectrometer will collect as many as 20 laser images, make a line profile of each, fit it into a Gaussian function and tell us both the mean position (frequency) and the width. The faster data collection allowed us to better study the spectrometer characteristics. We were able to focus the diffracted light into a much smaller spot, improving the precision by a factor of 3, down to 0.16picometer, or 0.09 GHz. We examined the long-term stability by repeatedly calibrating the spectrometer with another instrument, a laser wavemeter. In particular, we investigated the effect that both the air temperature and barometric pressure have on the spectrometer readings. Our experiment data on the effects matches up well with predictions of our theoretical models. Because of this we will be able to calculate (and correct for) with precision how much shift there is if the temperature or barometric pressure changes over time.

We thank the Dean's Office for financial support.

## Poster 100

### Transit Systems and Algorithms: Enhancing the Use of Public Transportation

*M. Z. Dardas and B. Merolli*

*Department of Mathematics and Computer Science  
O'Callahan Science Library, College of the Holy Cross*

With the widespread availability of computers in the 21<sup>st</sup> century computers became a standard for individuals to interact with other individuals, businesses and organizations. Although the history of the internet and commercially available computers is relatively short, computers managed to invade virtually every field. Despite the abundance of computer and latest technology one area that appears unaffected by the growth and mainstreaming of computers is transportation. While different services (such as apps, websites, text, QR code trackers) exist to assist with public transportation, few are organized, accurate or simple, leaving uncertainties with using public transit and accessing local resources. In large cities, the power of computer based planning and interaction for transportation are demonstrated by recent transit providers such as Uber, Lyft and Kutsuplus. Bringing together a complex of Application Programmable Interfaces (API's), algorithms and research in sensors/hardware under a simple dashboard can assist riders in their future travels and excursions. The project is being piloted in Worcester, MA due to its demographics, population size and geographic location. The project involves a multistep process and currently is undergoing front-end development. Using the WRTA's, Google Maps and Weather Underground API's we plan to release a web-based application so that it will be cross-platform and available for all devices. Results are pending.

We thank the Mellon Grant for funding our research and support from the Summer Mellon and Science Research Programs at Holy Cross.

## Poster 101

### **The Dominican Republic and Haiti: Analyzing a Post-Earthquake Relationship**

*R. González and R. Carrasquillo*

*Department of History, College of the Holy Cross*

The Dominican Republic and Haiti are two remarkably different countries that coexist on one island. For years, cultural disparities between both nations have contributed to significant social, political, and economic disputes. Following the 2010 Haiti earthquake, however, the Dominican Republic launched a massive cross-border disaster relief mission, providing critical medical resources, logistical support, and humanitarian aid. Today, several scholars of international relations contend that the impressive solidarity demonstrated by the Dominican Republic in the aftermath of the Haiti earthquake has led to improved relations between the two countries. Despite these claims, the evolving relationship between the Dominican Republic and Haiti has received minimal academic examination. This investigation examined the development of the Dominican Republic's relationship with a post-earthquake Haiti. More specifically, the investigation analyzed how Dominican policies toward Haiti, with particular regard to migration, refugees, and visas, changed in wake of the 2010 earthquake.

We thank the Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts for financial support.

## Poster 102

### **Faith, Doubt, and Questioning in Later Life**

*M. Duddy, E. Hillis, S. Moroz, and A. Futterman*

*Department of Psychology, College of the Holy Cross*

Relationships between faith and doubt, e.g., between expressions of the depth of one's faith and one's questioning of the truth of doctrine, have been examined in younger and older adults. Whereas for younger adults, e.g., predominantly college students, faith and doubt seem to be unrelated, for older adults, faith and doubt seem to "go together". Given the association between faith and doubt observed in older compared to younger adults, we asked why older adults are more apt to question their faith? Two sets of studies may provide answers to this question: the literature on stress and aging, and the literature on cognitive changes with age. On the one hand, it may be that stress causes one to question the truth of religion, e.g., "How could God let this happen?". On the other hand, the ability to think relatively, e.g., to consider alternative views, and to see events in a larger life context, cognitive skills that develop markedly in later life, may prompt faith and doubt/questioning to coexist. This summer, we interviewed 110 older adults living in New England regarding their faith and doubt, and how their relationship between faith and doubt changed over time. These older adults ranged in age from 58 to 100 and lived in various home settings (e.g., their own homes, assisted living communities, etc.). In addition to these 110 interviews, 80 similar interviews completed previously, were also examined. Across these 190 interviews, we found that as our participants got older they were able to ask more questions and tolerate more doubt, while also maintaining their faith. In most cases, stressful life events resulted in a strengthening of faith, though much doubting and questioning was involved along the way.

We thank the Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts for financial support.

## Poster 103

### **The Impact of Faith Experiences on Families of Those with Autism**

*M. Bassaly, S. Schuetz, and S. Crawford Sullivan*

*Department of Sociology and Anthropology, College of the Holy Cross*

As each year passes, statistics show that Autism Spectrum Disorder (ASD) has become more prevalent, now impacting 1 in 68 children (CDC 2014) in the U.S. Researchers study the potential causes of ASD as well as the physical and psychological impacts on parents. However, research regarding faith communities, in terms of their support or lack of support for families of those with autism, has not been as avidly investigated. Faith communities can be a main (or only) source of support for many families of ASD. Our research aims to discover how families experience – or do not experience -- support from their faith communities. This summer, we interviewed parents, siblings, religious educators, doctors, and autism resource specialists to gain more information about religion and autism support. We also began to explore these issues cross-culturally, investigating them in the Hispanic community around Worcester, as well as in India. Of those who are involved in religion, some families have had wonderful experiences in their church, experiencing support from clergy and congregation. Others have felt unwelcome to the point of switching congregations or leaving organized religion altogether. Our data suggest that a supportive clergy (or religious leader) can lead to a more accepting worship community. Families call for education for pastors and congregations in order to provide more accepting and supportive congregations for all who desire them.

We thank the Andrew W. Mellon Foundation Fund for Summer Research in Humanities, Social Sciences, and Arts for financial support.

## Poster 104

### **Love and the Kingdom**

*K. Manansala and P. J. Fritz*

*Department of Religious Studies, College of the Holy Cross*

Love is at the nexus of nearly all theological discussion. From a Christian perspective, we are commanded to love our neighbor and in knowing love, so too shall we know God. Yet, the task of knowing love itself is vastly complicated. As others share their notions with us, we might realize that something has ineluctably been lost in translation. Even our own ideas germane to personal experiences of love seem tremendously difficult, if not impossible, to convey. This project seeks to determine what constrains us as we toil to understand and explain our particular experiences of love as well as to affirm the eschatological value and necessity of these constraints. We begin with the contention that love is a religious experience revealed to us in the form of supersensory intuitions. Using 20<sup>th</sup> century European phenomenology, we indicate that time and subjectivity are at the core of our inability to absolutely transmit these intuitions to someone who is radically Other to us. This will point ultimately to the incomprehensibility of our relationship to our Other—an incomprehensibility that has further implications for love as a feeling, the meaningfulness of love, and the eventual direction of love toward the coming Kingdom of God.

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

## Poster 105

### What Works in Ending Female Genital Cutting: Lessons from Egypt, Kenya, and Senegal

*M. Casey and V. Langohr*

*Department of Political Science, College of the Holy Cross*

The United Nations Children's Fund estimates that over 125 million girls have undergone female genital cutting (FGC), which the World Health Organization defines as "all procedures that involve partial or total removal of the external female genitalia, or other injury to the female genital organs for non-medical reasons." Given the psychological and physical harm that can result from the practice, recent decades have shown women's rights activists, international organizations, and governments trying a variety of eradication initiatives. Our research aimed to answer the following, specifically focusing on case studies of Egypt, Kenya, and Senegal: What types of anti-FGC efforts have been the most successful, and why? Through an extensive review of literature, we examined methods including legislation, public declarations, human rights approaches, alternative rites of passage, media efforts, safe houses, and more. We believe that the most effective method is a community-based human rights approach that includes a supplemental focus on life challenges outside of FGC, such as hygiene skills and literacy, and that is tailored to individual cultural or religious groups. However, this micro-focus also presents a challenge in that no comprehensive overlying program exists to connect global efforts and to move successes from smaller pockets of girls to the millions who are affected. Moving forward, efforts against FGC seem to be gaining support as international discourse shifts to a "soft development" agenda. Some obstacles to consider include circumcision of infants to avoid legal persecution, belief in FGC as a religious requirement by many Muslim leaders, fierce social pressure, and law enforcement.

We thank the Andrew W. Mellon Foundation for financial support throughout this process.

## Poster 106

### Construction of a Portable Cosmic Ray Telescope

*M. Wasser and T. Narita*

*Department of Physics, College of the Holy Cross*

Cosmic rays were among the first high-energy particles ever detected and have various environmental and technological impacts. Existing cosmic ray detectors are often not portable, reliant on a desktop computer and AC power, and provide only a basic sense of the directionality of the cosmic rays. We have designed and constructed a compact, battery operated telescope, along with a BASIC stamp microcontroller to record data over a long period of time. We have successfully collected and analyzed data with this telescope, and have begun constructing a second telescope.

We thank the Patricia McGovern Hill '82 and Peter J. Hill '82 Family Summer Research Scholarship for funding this project.

## Poster 107

### Philosophy and the Poetic Word

*T. Nowak, C. Dustin and J. Lawrence*

*Department of Philosophy, College of the Holy Cross*

Two major quarrels in the history of philosophy are worth pointing out – one old, one new: the quarrel between philosophy and poetry, and the quarrel between fundamental ontology and ethics. Of course, on the surface, these two have nothing to do with each other. But, what is at stake in both is nothing less than language itself. If Emmanuel Levinas sought to ground philosophy on a thinking that thinks more than it thinks, or does better than think, Martin Heidegger proclaimed that the thinkers are still not yet thinking. Recasting the differences between Levinas and Heidegger is not of interest here. But what is strange, calls for attention: What makes these two strangers declare that the project of true thinking is so difficult? The scandal borne of the “opposition” between these two thinkers is their possible union in the poetic word. This situation is doubly scandalous because the opposition between philosophy and poetry seems to be resolved in poetry, the forbidden, after all. What is listening to others without getting past the first step (Levinas) but standing before the impenetrability of the poetic word, yielding to the meaning of being’s other – in contact? What is the saying that really engages in saying (Heidegger) but speaking, again, the impenetrability of the poetic word – in truth? Poetry’s hermeneutical dexterity – which does not reduce the Other to the Same but holds both in tension – shows that philosophy might just be a veneer for the word yet unspoken. This adventure takes a third pair – the postwar poets Paul Celan and Czeslaw Milosz – the Jew and the Christian – to show that thinking *is* difficult: it consists of the word, the poetic word.

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

## Poster 108

### Identifying Essential Regions in the Anti-HIV Protein Apobec3G

*R. Casazza and A. Sheehy*

*Department of Biology, College of the Holy Cross*

Acquired Immunodeficiency Syndrome (AIDS) is caused by advanced HIV-1 disease and is characterized by the destruction of the immune system. Although several effective treatments exist HIV-1 acquires drug-resistant mutations as it replicates, often leading to the need for second- and third-line therapies. HIV-1 primarily infects CD4+ T-cells and macrophages, which naturally express an anti-viral protein Apobec3G (A3G). Unfortunately A3G is ineffective in combatting wildtype/naturally acquired HIV-1 infections, as HIV-1 encodes a viral protein, Viral Infectivity Factor (Vif), that counteracts A3G. Vif binds A3G and marks this protein for cellular degradation. Disrupting this critical Vif:A3G interaction could liberate A3G from viral regulation, making this interaction is an attractive chemotherapeutic target. Molecularly, A3G catalyzes G-to-A mutations in the viral genome during the essential process of reverse transcription, resulting in hypermutated DNA that leads to an aborted viral lifecycle. Recent research has suggested that A3G may also exert an additional mechanism for inhibiting virus replication. Previously the lab has generated a library of 135 different mutants of the A3G protein; 92 of these proteins retain their ability to function as antivirals. These functional mutants are currently being screened for catalytic function. Surprisingly, several mutants have been identified which exhibit a decreased ability to mutate DNA but retain viral restriction. These results suggest that A3G does in fact express an alternate antiviral function independent of its catalytic activity. These findings aid in understanding details of A3G’s antiviral mechanism, and may contribute to the identification of novel targets for chemotherapeutic intervention.

We thank Becton Dickinson Corp for financial support.

## Poster 109

### Lack of Carbohydrate Catabolite Repression in *Clostridium ljungdahlii*

*P. McNamara and M. Vargas*

*Department of Biology, College of the Holy Cross*

*Clostridium ljungdahlii* is a gram positive, anaerobic bacterium that can ferment fructose and a variety of sugars. It is an acetogen, capable of making acetate from carbon dioxide and hydrogen gas using the Wood–Ljungdahl pathway. Interest in *C. ljungdahlii* is focused on its potential to produce organic commodities via microbial electrosynthesis. In this process, *C. ljungdahlii* uses electrons from a solar panel or electrode as its energy source. When combined with CO<sub>2</sub> within the cell, organic compounds are released. To increase the efficiency of electrosynthesis, previous studies constructed a strain in which the gene *ccpA* was deleted. CcpA is a global regulatory protein responsible for carbon catabolite repression in gram-positive bacteria as well as regulation of biofilm production, gliding motility, type IV pili and hydrogenase production. This study shows that fructose does not inhibit *C. ljungdahlii* growth on xylose, indicating that carbohydrate catabolite repression does not occur. In addition, unlike *C. perfringens*, gliding motility was not inhibited by fructose. Interestingly, *C. ljungdahlii* *ccpA* mutant colonies displayed a dark red phenotype when grown on congo red agar plates that was different from wild type colonies. In other bacterial species, this phenotype is characteristic of excessive polysaccharide secretion or the abundance of amyloid pili (called curli), both important for biofilm production and adherence to surfaces. Thus, *ccpA* may negatively regulate polysaccharide secretion. Further experiments are needed to determine whether the *ccpA* deletion strain can colonize surfaces better than the wild type and thus increase yield of electrosynthesis by attaching in higher numbers to the electrode.

We thank Katherine L. and Paul S. Stuka '77 for their generous contribution to the Alumni/Parent Summer Research Scholarship fund.

## Poster 110

### An Investigation of UNC-89 using Transgenic *C. elegans*

*K. Deehan, G. Benian, and H. Qadota*

*Department of Pathology, Emory University School of Medicine*

UNC-89 is a giant polypeptide of the sarcomere of striated muscle in *C. elegans*. Its human homolog is called “obscurin.” Loss of function *unc-89* mutants display reduced locomotion, disorganized myofibrils, and lack M-lines. The largest of the *unc-89* gene’s isoforms, UNC-89 B (~900,000 Da), consists of 53 Ig, 2 Fn, 2 protein kinase domains (PK1 and PK2), and a SH3, DH and PH domain. Two small isoforms consist of PK1, interkinase (IK), Ig, Fn, and PK2. It has been shown that all that is required for normal localization at the M-line is a fragment consisting of 1/3 IK, Ig, Fn, and PK2. We would like to mutagenize a line expressing this transgene and screen for genes that are required for this localization. Further, previously, we have shown that the SH3 domain of UNC-89 interacts with paramyosin, a thick filament core protein. In *unc-89* mutants that lack all UNC-89 isoforms containing the SH3 domain, paramyosin is mislocalized into aggregates. To obtain further evidence that UNC-89 and paramyosin interact in vivo, we wondered what would happen if the SH3 domain were overexpressed. Again, mutagenesis of a transgene was desired. Four transgenic lines expressing different fragments of UNC-89 were irradiated with UV light and the progeny was inspected for 100% transmission. We obtained two integrated lines: (1) A line that expressed 1/3 IK-Ig-Fn-PK2-EGFP from the muscle-specific promoter from the *myo-3* gene showed that the protein localized only to the M-line; however, the fluorescence levels were too faint and thus deemed unusable. Therefore, we plan on reattempting to integrate a line that has the EGFP tag at the N-terminus of IK-PK2. (2) A line that expressed SH3 artificially fused to 1/3 IK-Ig-Fn-PK2 with an HA tag and expressed by a heat shock promoter was successfully integrated. We conducted a time course experiment with the integrated transgene to determine a time after heat shock at which the protein was easily detected. Using this time point, we plan to observe the effect of overexpression of UNC-89’s SH3 domain on the organization of paramyosin.

We thank Emory’s Department of Pathology for supporting this work.

## Poster 111

### **Investigating the Use of Naturally Occurring Immunoglobulin M (nIgM) as a Preventative Therapy for Autoimmune Diabetes**

*K. Brayman, P. Chhabra, and M. Langman  
Department of Surgery, University of Virginia*

Naturally occurring immunoglobulin M was isolated from human serum through gel filtration on a column. An Elisa was then preformed in order to ensure purity and correct concentration for treatment. The nIgM was then used therapeutically to prevent the onset and progression of Autoimmune (Type 1) diabetes in non obese diabetic (NOD) mice. Abnormalities in nIgM has been closely associated with a tendency toward autoimmune diseases including Type 1 Diabetes. Approximately 15 NOD mice regularly received intraperitoneal injections of nIgM isolated from the serum of human subjects (200µl on first injection followed by 100 µl injections biweekly) until 18 weeks of age and were age matched with a control group. In previous study, nIgM was isolated from mouse serum for same species injection. 80% of control mice that received no treatment or a saline substitute became diabetic by 18-20 weeks of age. Of those that received the nIgM treatment none became diabetic over the treatment period. From this study it can be concluded that nIgM is a strong candidate for therapy with potential to prevent the onset and progression of autoimmune diabetes in other species as well. The new model in which human isolated nIgM was used as treatment across species with the NOD mice is ongoing. As of yet, no mice that have undergone treatment have become diabetic.

## Poster 112

### **Effect of B-type Natriuretic Peptide on Emergency Department Diagnosis of Congestive Heart Failure**

*N. Cormier, S. Oh, and H. Smithline  
Baystate Medical Center, Tufts Medical School*

Congestive Heart Failure (CHF) affects approximately 4.6 million patients in the United States and accounts for about 957,000 hospitalizations annually. CHF diagnosis depends on many complex and interrelated factors, but B-type Natriuretic Peptide (BNP) has provided increased diagnostic power in recent years. The purpose of our study is to evaluate how the introduction of BNP diagnostic testing has affected the accuracy of Emergency Department (ED) diagnosis of CHF nationally. The National Hospital Ambulatory Medical Care Survey (NHAMCS) is a nationwide registry containing data from patient visits to non-federal, short-stay hospital EDs. Using the NHAMCS database to evaluate the rate of mismatch between ED and final discharge diagnosis of CHF over the time period encapsulating BNP's introduction will enable us to evaluate its efficacy as a diagnostic tool. First, we defined CHF based on the classification system used in the NHAMCS database known as the International Classification of Disease (ICD-9) code. We established criteria to test the statistical reliability and specificity of proposed definitions. Second, we used cross tabulation of CHF diagnoses with hallmark clinical tests used in its diagnosis to validate the NHAMCS database and our definition of CHF. We will proceed with continued validation by cross tabulating CHF diagnosis with medications administered and chief complaint. After adjusting our operating definition of CHF accordingly, we will begin tests that more directly assess the effect of BNP diagnostic testing on the accuracy of ED diagnosis of CHF.

We thank the Baystate Medical Center Emergency Department and Tufts Medical School for financial support.

**NOTES**

**NOTES**

**NOTES**

**NOTES**