9-9-2011

Program

COLLEGE OF THE HOLY CROSS

Eighteenth Annual Undergraduate
Summer Research Symposium

September 9, 2011

Hogan Ballroom

Dear Members of the Holy Cross Community,

Welcome to the 2011 Undergraduate Summer Research Symposium. Now in its eighteenth 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 2011. It also provides an opportunity for students to witness the breadth of research possibilities both on and off campus and to open a dialogue with a faculty member about conducting research during the upcoming year and summer. We hope you enjoy the impressive collection of research on display today.

Pr. Sara Mitchell, Department of Biology
Pr. Brian Linton, Department of Chemistry
Pr. Daniel Bitran, Science Coordinator
2011 USRS Organizing Committee

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

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The summer research program was organized by Pr. Daniel Bitran, the College Science Coordinator, by Pr. Daniel Klinghard, the Coordinator of the Summer Research Program in Humanities, Social Sciences and Arts, and by Pr. Bryan Engelhardt, the Coordinator of the Summer Research Program in Economics. Additional financial support for the summer research program was provided by the Offices of the President, Provost, and Dean, and the Office of Grants and Corporate and Foundation Giving.

Table of Contents

(Note: Presenter names are underlined.)

21. **The Group Cook-Off: Actual Versus Virtual Therapy.** *Sam K. Yohannan, Kim H. Hill, Stephanie Freudenberger, Hope Hunter, Roger W. Yurt, and Charles Jakubik. New York-Presbyterian/Weill Cornell Medical Center Department of Rehabilitation Medicine, William Randolph Hears Burn Center.*

22. **Rural Adolescent Involvement in School-Based Extracurricular Activities and Psychosocial Outcomes over Time.** *Allison Shepard and Pr. Alison Bryant Ludden. Department of Psychology, College of the Holy Cross.*

23. **Age-related Changes in the Factorial Structure of Religious Orientation.** *Priscilla Lam and Andrew Futterman. Department of Psychology, College of the Holy Cross.*

24. **Equivalent Maintenance of Alignment Throughout Healing of Bicondylar Tibial Plateau Fractures: Variable vs. Fixed Angle Locked Plating.** *Joshua Olson; Peter A. Cole, M.D.; Ryan E. Will M.D. Department of Orthopaedic Surgery, University of Minnesota.*

25. **Investigation of Hydrogen Bonding in Peptides.** *Benjamin D. Brink and Professor Brian Linton. Department of Chemistry, College of the Holy Cross.*

26. **Sequencing of the *Chlamydomonas reinhardtii* gene FAP 172.** *Matt Wicker and Dr. Mary Porter. Department of Genetics, Cell Biology and Development, University of Minnesota.*

27. **The Day to Day Lives of Caregivers of Alzheimer's Disease Patients.** *Frances Hamilton and Renee Beard, PhD. Department of Sociology, College of the Holy Cross.*

28. **African American Caregivers for those with Alzheimer's Disease.** *Adair Bender and Renee Beard, PhD. Department of Sociology, College of the Holy Cross.*

29. **Examining Hydrogen Bond Strength in Glutamine Derived Peptides.** *Meg Hanly and Professor Brian Linton. Department of Chemistry, College of the Holy Cross.*

30. **CINEGLOS: Developing a Web-based Interactive Spanish Film Glossary.** *Sheila Coursey, Kelsey Smith and Prof. Bridget Franco. Department of Spanish and Latin-American Studies, College of the Holy Cross.*

31. **Using Mannich Condensations to Model the Structure and Function of Metallo-enzyme Active Sites.** *P. R. Renehan and J. Farrell. Department of Chemistry, College of the Holy Cross.*

32. **Intralesional Hemorrhage in Patients with Metastatic Melanoma Treated by Gamma Knife Radiosurgery.** *T. J. Klein[1], F. J. Barbiero[2], J. E. Bond[1], J. P. Knisely[1], V. L. Chiang[1], J. B. Yu[1], [1]Yale School of Medicine, [2]College of the Holy Cross.*

33. **Efforts Toward the Synthesis of the C1-15 Segment of (+)-Sorangicin A.** *Christopher S. Jacques, Michael C. Mandrioli and Kevin J. Quinn, Department of Chemistry, College of the Holy Cross.*

34. **Efforts Towards the Synthesis of (+)-Sorangicin-A.** *Maria C. DiPoto, Colin O. Hayes, and Kevin J. Quinn, Department of Chemistry, College of the Holy Cross.*

35. **Investigating Stereoselective Organocatalysis.** *Justin R. DeFrancisco and Brian R. Linton. Department of Chemistry, College of the Holy Cross.*

36. **Using Alignable Images to Facilitate Learning in Structural Geology.** *C. Desharnais and B. Jee. Department of Psychology, College of the Holy Cross.*

37. **Early Adolescents' Sleep and Perceived Health Assessment.** *Michaela Johnson, Elizabeth Harkins, and Amy R. Wolfson. Department of Psychology, College of the Holy Cross.*

38. **Child Health Concerns In Ha-Makuya District: Disparities In Nutritional Knowledge And Diet, And A High Prevalence Of Bilharzia.** *C. Gordon, Davidson College; H. Mamadisa, University of the Western Cape; E. McManus, College of the Holy Cross; B. Pelham-Webb, Princeton University; A. Yeung, Duke University, A. Müller, University of Cape Town, Organization for Tropical Studies, Duke University.*

39. **The Choice of Child-Care Type and Its Impact.** *Pr. Joshua Congdon-Hohman, and Christopher Kalpin, Department of Economics, College of the Holy Cross.*

40. **Sonic or Ionic? Investigating the Mechanism of Laser Plasma Formation.** *S. Craig and J. Kelley*, *Department of Chemistry, College of the Holy Cross.*

41. **The Effect of Oxidizing Conditions on Splicing of *Trichodesmium erythraeum* Proteins.** *Laura M. Urbanski, Julie N. Reitter, and Kenneth V. Mills, Department of Chemistry, College of the Holy Cross.*

42. **Mapping the Energy Landscape of a Model Peptide Using Infrared Spectroscopy.** *B. Deane and S. Petty, Department of Chemistry, College of the Holy Cross.*

43. **Components of a Magneto-Optical Trap for Rubidium Cooling.** *Kevin Moran, Mike DeFeo, Andrew Novicki, and Timothy Roach*, *Department of Physics, College of the Holy Cross.*

44. **The Bearing of Gender and Health on Widowers' Bereavement and Widowerhood.** *Julia Bandini and Edward H. Thompson. Department of Sociology, College of the Holy Cross.*

45. **Effect of the Conserved Serine 166 Residue on *Pyrococcus abyssi* PolII Intein Splicing.** *Kathryn M. Colelli, Jennie E. Williams, Michelle D. Marieni, Julie N. Reitter, and Kenneth V. Mills. Department of Chemistry, College of the Holy Cross.*

46. **The Synthesis of "Caged" Phosphates.** *Joseph Todaro and Prof. Bianca Sculimbrene. Department of Chemistry, College of the Holy Cross.*

47. **Investigating the Mechanisms of Reduced Fertility Due to High Glucose Exposure in *Caenorhabditis elegans.*** *Amanda K. Engstrom and Dr. Michelle A. Mondoux, Department of Biology, College of the Holy Cross.*

48. **Effect of Conserved Resides on Splicing of the *Pyrococcus abyssi* DNA Polymerase II Intein.** *Jennie E. Williams, Kathryn M. Colelli, Michelle D. Marieni, Julie N. Reitter, and Kenneth V. Mills. College of the Holy Cross.*

49. **Modeling the Immune Reconstitution of HIV-1 on HAART.** *Leah DeCoste and David B. Damiano, Department of Mathematics, College of the Holy Cross.*

50. **Central Configurations in the Planar 7-Body Problem.** *Rebecca Moran and Gareth Roberts, Department of Mathematics and Computer Science, College of the Holy Cross.*

51. **Stabilization of a Diode Laser for Laser Cooling of Rubidium.** *M. DeFeo, A. Novicki, K. Moran, T. Roach. Department of Physics, College of the Holy Cross.*

52. **Combined Liver-Kidney Transplantation: Indications, Outcome Analysis, and the Hartford Hospital Transplant Program Experience.** *Andrew J. Polio, College of the Holy Cross and David Hull, MD, Hartford Hospital.*

53. **Ion and Atom Detection Systems, Design Simulations.** *Matthew Davis and Prof. Paul Oxley. Department of Physics, College of the Holy Cross.*

54. **How Does Reappraising Stress Arousal Affect Physiological and Affective Symptoms of Social Anxiety?** *E. Sophis[1], Dr. J. Jamieson[2], & Dr. M. Nock[2]. [1]Department of Psychology, College of the Holy Cross, [2]Department of Psychology, Harvard University.*

55. **Computer Modeled Laser Investigations & CCD Camera Synchronization.** *A. Novicki, M. DeFeo, K. Moran, T. Roach. Department of Physics, College of the Holy Cross.*

56. **New Tetrahydrosalen Derivatives as Potential Metallopolymer Monomers.** *P. Burns and J.R. Farrell. Department of Chemistry, College of the Holy Cross.*

57. **Evolutionary divergence of subspecies *Scaphinotus petersi.*** *Craig Connolly and Karen Ober. Department of Biology, College of the Holy Cross.*

58. **HateBook.** *Prof. Scott Malia, Danielle Santos and Patrick Simas. Department of Theatre, College of the Holy Cross.*

59. **Social Interactions in the colonial Mygalomorph *Heterothele villosella*.** *Jennifer Bosco and Brian Moskalik, Department of Biology, College of the Holy Cross.*

60. **Assessing and Responding to Autism in Underserved Populations.** *Meghan M. McCloat*, *Autism Speaks, College of the Holy Cross.*

61. **Understanding the relationship between nutrient stress and reduced fertility and mating in *Caenorhabditis elegans.*** *Marjorie R. Liggett and Dr. Michelle A. Mondoux. Department of Biology, College of the Holy Cross.*

62. **Measuring Physiological Markers of Arousal and Drug Craving in Opioid Users.** *Sean Gillespie and Dr. Gregory DiGirolamo*, *Department of Psychology, College of the Holy Cross.*

63. **Alcohol Use in Emerging Adult Light Smokers.** *Jennifer Daffron and Dr. Gregory DiGirolamo, Department of Psychology, College of the Holy Cross.*

64. **Historical Net Discount Rates: Corrected Data, Refined Calculations, and Revised Results.** *Andrew Kraynak and David Schap, Department of Economics, College of the Holy Cross.*

65. **An Ion Source for Plasma Physics Collision Studies.** *Patrick Collins and Prof. Paul Oxley. Department of Physics, College of the Holy Cross.*

66. **Morphometric Analysis of the Mandible in the Avian Suborder *Lari.*** *Ariana Masi and Pr. Leon Claessens, Department of Biology, College of the Holy Cross.*

67. **Detecting Rebound in PARP Activity After a Period of Inhibition in Human Aortic Smooth Muscle Cells.** *R. S. Nomoto, H. Albadawi MD, M. T. Watkins MD. Vascular Research Lab, Massachusetts General Hospital.*

68. **Laser-induced Breakdown Spectroscopy (LIBS) Analysis of Air.** *Kara Brownell and Jude Kelley**. Department of Chemistry, College of the Holy Cross.*

69. **Minocycline Treatment Reduces SIV and Alters Macrophage Immunophenotype in the GI of SIV-infected Rhesus.** *K.Broderick[1], Joanna Morel[2], S. Westmoreland[3] , [1]College of the Holy Cross; [2]Tufts University School of Veterinary Medicine; [3]Division of Comparative Pathology, NEPRC, Harvard Medical School.*

70. **The Role of Attention in Primacy Effects in Memory.** *Nathan Guevremont, Sean Gillespie, and Dr. Gregory DiGirolamo**. Department of Psychology, College of the Holy Cross.*

71. **Physics of Baseball: On the Nature of Spin.** *R. Eslinger, D. Barrett, N. Solman, and Pr. Matthew Koss. Department of Physics, College of the Holy Cross.*

72. **A Geometric Morphometric Analysis of Tarsometatarsal Ecomorphology in Birds.** *Maggie Johnson, Andrew Biedlingmaier, Jennifer Leavitt, Ariana Masi, and Pr. Leon Claessens. Department of Biology, College of the Holy Cross.*

73. **The Use of LIBS to Detect Heavy Metal Pollution in Blackstone River Sediments.** *K. Tracy and J. Kelley**, Department of Chemistry, College of the Holy Cross.*

74. **Locomotion & Habitat Effects on Avian Hind Limb Morphology.** *Jennifer Leavitt and Pr. Leon Claessens, Department of Biology, College of the Holy Cross.*

75. **Digitizing the Dodo: Creating a 3D model of a unique, articulated skeleton in Mauritius, Africa.** *Andrew Biedlingmaier, Jennifer Leavitt, and Pr. Leon Claessens. Department of Biology, College of the Holy Cross.*

76. ***Drosophila synaptotagmin I* and *IV* interact in a genetic assay.** *Thomas O'Brien, Christopher Lally, and Sarah Webster**. Department of Biology, College of the Holy Cross.*

77. **Recognition of a single nucleotide polymorphism in *TAS2R38* by *Hae*III can be used to predict bitter tasting ability.** *Christopher Lally, Thomas O'Brien, and Sarah Webster. Department of Biology, College of the Holy Cross.*

78. **Latitudinal variation in glacial cirque altitudes.** *E. Humphries and S. Mitchell. Department of Biology, College of the Holy Cross*

79. **Effect of Abstract Reasoning Activities on Mathematical Competency in Preschoolers at a Low-Income School.** *Professor Danuta Bukatko, A. Risley, and C. Shea. Department of Psychology, College of the Holy Cross.*

80. **Protein Splicing: Reactivity of Specific Inteins.** *Michael Nicastri, Julie Reitter, and Kenneth Mills. Department of Chemistry, College of the Holy Cross.*

81. **Characterization of the Anti-HIV Protein APOBEC3G.** *Sarah DiNapoli and Ann Sheehy, Department of Biology, College of the Holy Cross.*

82. **Pathogenesis of Uropathogenic E. Coli and Evaluation of Routes of Vaccination for Urinary Tract Infections.** *A. Schaeffer, D. Klumpp, V. Pavlov, S. Connolly. Northwestern University, Department of Urology.*

83. **Skin Equivalent: An Indispensable Tool in Skin Research.** *Myung Jin Lee. Chanel Inc. Skin Cell Biology Laboratory.*

84. **Development of a Lean Strategy for Residual Solvent Testing in Pharmaceutical Ingredients.** *S. Chin, D. Dykema, and K. J. Dennis, SLS & AST Department, Pfizer in Groton, Ct.*

85. **Investigating Novel Targets on APOBEC3G (A3G) Domains as Areas for Anti-HIV Therapy.** *Thomas Gallant and Pr. Ann Sheehy, Department of Biology, College of the Holy Cross.*

86. **Behind the Constitution.** *D. Gish, D. Klinghard, S. Rocci, J. Staley, and M. Neal, Department of Political Science, College of the Holy Cross.*

87. **Implicit Chaining with Equated Elements in Cotton-top Tamarins.** *B. Medeiros, E. Carter, M. Fox, and Pr. C. Locurto. Department of Psychology, College of the Holy Cross.*

88. **New Tridentate Aminoalcohol Ligands.** *S. Palilla and J. Farrell. Department of Chemistry, College of the Holy Cross*

89. **PARP's Involvement in Ischemia Reperfusion *In Vivo*.** *A. Cox, H. Albadawi, J. Yoo, M.T. Watkins. Division of Vascular and Endovascular Surgery, Department of Surgery, Massachusetts General Hospital, Harvard Medical School.*

90. **The Association Between Executive Compensation and Audit Fees.** *Pr. Karen Teitel, and Lauren Fitzgerald. Department of Economics and Accounting, College of the Holy Cross.*

91. **The Effect of Academy Award Competition on Market Share.** *M. Boyle, V. Matheson, L. Chiou[1], and M. Quinn. Department of Economics, College of the Holy Cross and [1]Department of Economics, Occidental College.*

92. **Laws Affecting Forensic Economic Calculations: Discounting, Interest, Income Taxes and Inflation.** *Pr. David Schap and Elizabeth Sundheim, Department of Economics, College of the Holy Cross.*

93. **Public Security Versus Student Privacy.** *Pr. Scott Sandstrom and Casandra Medeiros, Department of Economics, College of the Holy Cross.*

94. **The Effect of Separations and Hires on Crime Crime.** *Robert Baumann, Bryan Engelhardt, and Gregory Goding. Department of Economics, College of the Holy Cross.*

95. **How Reasonable Is It To Assume Full Information Between Buyer And Seller In The Housing Market?** *Pr. Katherine Kiel and Stacey Hochkins, Department of Economics, College of the Holy Cross.*

96. **What's Left Behind is What's Ahead: Using Fiction to Find Truth.** *D. Cotrone and S. Reents. Department of English, College of the Holy Cross.*

97. **Lakota Perspectives: An Oral History of the 20th Century Rosebud Reservation.** *Adam Logan and Pr. Gwenn Miller, Department of History, College of the Holy Cross.*

98. **The Catholic Church's Role in the Development of International Law: A Neglected Tradition.** *Pr. Ward Thomas and Travis LaCouter, Department of Political Science, College of the Holy Cross.*

99. **Labeling Women as 'Mad' in Nineteenth-Century America.** *E Kaplan and S. E. Sweeney, Department of English, College of the Hol Cross.*

100. **Male Paternity Via The Manipulation of Female Behavior.** *Mega Piacquadio and Pr. Brian Moskalik, Department of Biology, College o the Holy Cross.*

101. Palladium–Catalyzed Propargylation of Aromatic Imidates. *J. Pilloni and S. Waetzig, Department of Chemistry, College of the Holy Cross.*

102. La donna e i suoi rapporti sociali by Anna Maria Mozzoni: An English translation. *Susan Amatangelo, Francesca Bruzzese, and Alexandra Bruzzese, Department of Modern Languages & Literatures, College of the Holy Cross*

Poster 1

Eye Movement Constraints on Entrainment to an Environmental Rhythm

Colleen Bucci and R. C. Schmidt
Department of Psychology, College of the Holy Cross

Past research has found that limb movements become spontaneously entrained to a rhythmic environmental stimulus when the eyes track the moving stimulus with pursuit eye movements. Alternatively, when the eyes are stationary, limb movements become entrained to the moving stimulus, but less strongly. The current experiment investigates whether saccadic rhythmic eye movement cause spontaneous entrainment in both horizontal and vertical planes. Participants swung a hand-held pendulum at a comfort tempo and read letters that appeared on the screen while a stimulus oscillated horizontally across the screen. Results of eye tracking in the horizontal plane revealed that limb movements became strongly spontaneously entrained when the eyes tracked the stimulus saccadically. These results suggest that saccadic rhythmic eye movement at the same tempo of a moving stimulus enhance the spontaneous entrainment of limb movements to that stimulus just as pursuit movements do. Of interest is whether the same results occur when the eyes moved rhythmically in the vertical plane orthogonal to a horizontally moving stimulus. The question is whether any type of rhythmic eye movement at the same tempo of the moving stimulus would enhance the spontaneous entrainment of the limb movements to that stimulus.

We thank Mr. Domenic J. Dinardo and Mrs. Catherine Eagen Dinardo of the Holy Cross Alumni/Parent Summer Scholarship Fund, the National Science Foundation (BCS-0750187) and the Agence Nationale de la Recherche (ANR-09-BLAN-0405-03) for financial support.

Poster 2

Creating an Astrometry Algorithm for 1-Dimensional X-Ray Data and Statistically Modeling Accretion Processes: A Twofold Study

R. Nazarian and T. Narita
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Using the Chandra X-Ray Observatory, we conduct a comparative study of 4U1630-472, Cygnus X-3, and X1743, all of which are observed using the 1-dimensional Continuous Clocking (CC) mode. While each of these data sets suffers a loss of one dimension of data due to the faster readout times, we developed an algorithm to use Chandra positioning technology to determine the various source locations. Especially important is the satellite's roll angle, which we take advantage of to derive the position of the source in two dimensions and, coupled with existing data sets, use to greatly increase the precision and accuracy of existing astrometry. Additionally, a spectral analysis of the 4U 1630-472 data suggests that the source is modeled by various components including absorption from interstellar gases and blackbody radiation from a hot gaseous disk surrounding the source. There is a marginal detection of and Fe absorption line (1.6σ), which indicates the presence of a corona. We do not, however, observe a stronger Fe absorption line as previous literature (Suzaku 2006) suggests. Had the same iron absorption line appeared in our data, we argue that we would have observed it approximately 50 - 90% of the time.

We thank Mr. and Mrs. Gerard P. and Clare Richer, contributors of the Holy Cross Alumni/Parents Summer Research Scholarships for their support.

Poster 3

Study of $Re(CO)_3^+$-Protein and $Re(CO)_3^+L$: Protein Complexes

Kathryn Kennedy and Richard S. Herrick
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Prior experiments on rhenium tricarbonyl compounds suggest that new $Re(CO)_3L$ compounds have significant, practical applications in bioorganometallic chemistry. The study of this chemistry is facilitated by the ready availability of $[Re(CO)_3(H_2O)_3]Br$, which is prepared from refluxing aqueous $Re(CO)_5Br$. The $Re(CO)_3(H_2O)_3^+$ cation is stable in water and air and undergoes substitution of the water ligands at a rapid rate, which makes experimenting with its bonding reasonable. It is an attractive way to search for promising radiopharmaceutical candidates, due to the similarity of Re to ^{99m}Tc, which is widely used in nuclear medicine. Also, target-specific rhenium compounds, prepared with 186- or 188-rhenium, could be used for therapy. Attaching different ligands to the rhenium tricarbonyl cation leads to compounds that target different areas of the body. The binding of $Re(CO)_3(H_2O)_3^+$ with proteins is also important to the study of the biological processing of Tc/Re imaging agents and the interactions of organometallic compounds with proteins. Lysozyme crystals were grown to continue research started by the Herrick/Zeigler collaboration.[1] Current work attempts to grow crystals with rhenium bound to ferritin, and future work will attempt to use myoglobin and glucose isomerase. Success with these proteins will lead to the exploration of more ambitious targets.

S. L. Binkley, C. J. Ziegler, R. S. Herrick, R. S. Rowlett, *Chem. Comm. (Cambridge, U. K.)* **2010**, *46*, 1203; b)S. Lindskog, *Pharmacol Ther* **1997**, *74*, 1.

Thanks to the Arnold and Mae Beckman Foundation for sponsoring this research.

Poster 4

Editing the Oldest Complete Manuscript of the *Iliad*

T. Arralde, S. Lindeborg, C. Roughan, M. Ebbott and N. Smith
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The 10th-century AD manuscript known as the Venetus A preserves our oldest complete text of Homer's *Iliad*, an epic originating in a 2nd millennium BC oral tradition. The manuscript also contains ancient commentaries ("scholia") dating back as far as the 3rd century BC Alexandrian scholars. Our edition of Book 1 publishes all of the scholia for the first time, and therefore includes 50% more of these scholia than the most recent scholarly edition does. Our goal as part of the Homer Multitext project is to decipher the material in the manuscript and encode it in our own digital edition. As a result, we can make the wealth of information immediately accessible, and can better interpret the manuscript. Working from high resolution digital photography, we have created the first complete edition of the text and accompanying scholia of Book 1. We have annotated the location of each scholion so that the visual evidence can be automatically retrieved. We have translated select scholia into English—none have ever been published before. We have compiled inventories across all 24 books of the *Iliad* of other features not systematically published or studied before. These features range from colorful red marks classifying types of scholia to marginal numbers indexing similes in the main text. Our edition sparks numerous questions. Why do the red marks vanish after the first few pages? Do the epic simile numerals refer to a lost text that the scribe assumed his reader would have? With the publication of our edition within the Homer Multitext, we and other scholars will be able to investigate these matters in new ways. Our work thus provides a foundation for future scholarship on the Book 1 scholia, and has established procedures for continuing work. The team-oriented model we developed for our work will be used for editing the rest of the Venetus A.

We thank the Alumni / Parent Summer Research Scholarship: Stephen P. Skinner '77 and Nancy Savage Skinner '79, and Deborah C. and Timothy W. Diggins '80, and the Andrew W. Mellon Foundation for financial support of this project.

Poster 5

Novel Rhenium Diimine Compounds

Calvin Luu and Richard S. Herrick
Department of Chemistry, College of the Holy Cross

Diimines have shown to be good ligands for Re d6 compounds. Some of the most common examples of diimines serving as strong ligands are: 2,2'-bipyridine, pyridine-2-carbaldehyde imine, and diazabutadiene. Recently, we have made less commonly used diimines, such as, 2,2'-biimidazole, and have found them to be excellent ligands. New synthetic paths were employed to create a unique set of Re(CO)3(diimine)X compounds. The focal point of these new paths was to bind different ligands to the Re(CO)3+ center. While working with various compounds containing rhenium and the biimidazole ligand, new crystal structures of Re(CO)3(biim)X were resolved from products of these reactions (biim = 2,2'-biimidazole; X = Cl, Br, I). Throughout this process different experimental procedures were used to improve yields. Future work in this area will comprise of improving experimental methods and solving crystal structures of Re(CO)3L+ compounds. Attaching different side chains, such as amino acids, to the ligand will be another future goal. This research will help provide further understanding of rhenium and organometallic chemistry.

We would like to thank an anonymous donor to the Alumni/Parents Summer Research Scholarship for their financial support.

Poster 6

Studying the Aggregation of Glutamine and Alanine-Based Tripeptides Using Infrared Spectroscopy

K. Gilmore and S. Petty
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Huntington's disease is a neurological disorder associated with an extension of the glutamine repeats at the N-terminus of the Huntingtin protein which leads to a change in the protein's structure. Similarly, the Prion diseases are caused by a structural change in the Prion protein that appears to be nucleated by β-sheet formation in residues 113-120, AGAAAAGA. When these proteins form β-sheets, which then aggregate to form amyloid fibrils, the proteins are unable to function resulting in a diseased state. In this study, we analyzed which features of glutamine and alanine-based tripeptides lead to the formation of stable β-sheets. Previous work has shown that the peptides Ac-QQA-ND_2 and Ac-AAA-ND_2 are able to form stable β-sheets. We have synthesized a number of tripeptides in which one of the alanine residues in these peptides has been replaced by another small amino acid. This has allowed us to investigate whether the size or the hydrophobic nature of the alanine side chain is the dominating factor in β-sheet formation in these tripeptides. We have also synthesized a number of tripeptides containing ^{13}C labeled alanines in order to determine whether these β-sheets align in a parallel or antiparallel orientation. Future work will include replacing the glutamine residues with asparagines to investigate the nature and importance of the hydrogen bonding interactions of the glutamine side chains in β-sheet formation.

The authors thank the Richard B. Fisher Summer Research Fellowship for funding this project.

Poster 7

An Explanation for Neural Tuning to Spiral Optic Flow Patterns

M. Pettinati and C. Royden
Department of Math & Computer Science, College of the Holy Cross

When an observer is in motion, the scene surrounding him or her projects an image that moves across his or her retina. Items within this image create a flow pattern, which can vary in complexity depending on the observer's movement. An observer moving in a straight line will generate a radial pattern with the center of the pattern corresponding to the direction of motion ("heading") of the observer. Certain cells in the medial superior temporal (MST) area of the brain respond strongly to (or are tuned to) these radial patterns of motion. These cells are believed to be responsible for processing information about the observer's heading. A computer model based on these cells has been developed to compute heading; it makes use of template cells that are each tuned to a radial pattern corresponding to a unique heading (Royden, *J. Optical Society of America A*, 1997). One electrophysiological study suggests certain cells in MST are tuned to spiral patterns rather than radial patterns (Graziano, Andersen, & Snowden, *J. Neuroscience* 1994). However, the data from the model created by Royden suggest that under certain conditions the responses by the cells tuned to radial patterns may resemble spiral tuning. We have determined that this apparent spiral tuning is due to a threshold nonlinearity. To further substantiate this idea, we created mathematical model to show that given a certain threshold, the input patterns (patterns of contributing cells) were predictable. In the mathematical model, the contributing cells (input cells whose response was within the calculated threshold of the template pattern) were consistent with the cells that contributed in the computational model. So, even though the cells are tuned to a radial pattern with a certain heading, they can appear to be tuned to a spiral pattern.

Supported by NSF grant IOS-0818286 to Professor Royden

Poster 8

Detecting Moving Objects: A Stereoscopic Approach

Sean Sannicandro and Constance Royden
Department of Math & Computer Science, College of the Holy Cross

When humans move, the images of the objects in the environment move across the retina, creating what is called an optic flow pattern. If the person is moving in a straight line through an area with no moving objects, the optic flow forms a radial pattern, the center of which is the observer's direction of motion. However, when the person changes direction, or rotates their head, the optic flow pattern becomes skewed. The presence of a moving object also affects the layout of the optic flow pattern. From previous research, we have developed a computational model to recreate the way the brain interprets these optic flow patterns for information. More specifically, how does a human pick out a moving object from the environment? Previous research shows that object speed and angle contribute greatly to this endeavor. However, speed can be misleading due to a phenomenon known as motion parallax; if a stationary object is closer to you than other objects, it moves faster. Thus, how do we tell if an object is moving or if it merely closer to you? To address this question, we added stereo vision, or depth perception, to the computational model in order to use a combination of both binocular disparity and velocity to pick out a moving object from the environment. Results show that there is an approximately linear relationship between the velocity difference and the disparity difference at the edges of a stationary object as the object distance from the observer is changed. Thus, if an object's disparity to velocity ratio does not match this linear relationship at the edges of the object, then the object is moving. We then used this relationship in the model to determine whether objects in the scene were moving relative to the observer.

Supported by NSF Grant IOS-0818286 to Professor Royden.

Poster 9

The Structure and Aggregation of Glutamine and Alanine Based Tetra-peptides

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Polyglutamine diseases are a family of neurodegenerative conditions such as spinobulbar muscular atrophy, dentatorubral-pallidoluysian atrophy, and Huntington disease. These conditions are associated with a CAG codon expansion in certain genes. As a result, proteins are formed that have long chains of glutamines at the N-terminus, which may cause the proteins to misfold and become toxic to cells. Protein misfolding is often associated with increased β-sheet structure. One way to understand polyglutamine diseases, is to study the relationship between glutamine based peptides and β-sheets formation. We have synthesized various tetra-peptides consisting of different combinations of glutamine and alanine residues and analyzed these peptides using infrared spectrometry. It was observed that while tetra-alanine and tetra-glutamine are both capable of forming β-sheets, glutamine tetra-peptides containing one, two, or three alanines do not always form β-sheets. The position of the alanines in the sequence disrupts interactions and affects whether or not the peptide forms β-sheets. Future work will include replacing the alanines with ^{13}C labeled alanines in order to obtain residue specific structural information and to learn about β-sheet orientation in our tetra-peptides.

The Authors thank the College of the Holy Cross Alumni/Parents Summer Research Scholarship - specifically, Mr. and Mrs. Paul S. and Kathy Stuka.

Poster 10

Using Chandra X-Ray Observatory to Study Absorption Line Variability In XB 1916-053 and GX 13+1

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Using the Chandra X-Ray Observatory, we investigate the nature of the absorption line features present in XB1916-053 and GX 13+1 in order to understand the geometry of the accretion structure surrounding these binary systems. Our analysis is conducted using NASA's CIAO data processing software. We specifically look at the "gaussian" model of each source, which in our case indicates the presence of highly ionized absorption lines originating from the gaseous accretion disk corona. The more prominent absorption features, measured by the gaussian normalizations, were plotted with respect to the orbital phase of each source. We find that the absorption line features remain relatively constant throughout our observations. Our results lead us to believe that the accretion disk corona has a cylindrical geometry. Further study of absorption line variability in other sources could classify a cylindrical corona geometry as a common characteristic of binary systems.

We thank the Massachusetts Space Grant Consortium for their financial support.

Poster 11

Fat Mediated Modulation of Reproductive and Endocrine Function in Young Athletes

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As many as 25 % of adolescent and young adult endurance athletes (track, gymnastics, ballet, swimming) develop amenorrhea. Hormonal changes the differentiate amenorrheic athletes (AA) from eumenorrheic athletes (EA) and non-athletic controls (NAC) have not been well characterized. Preliminary data indicate marked differences in fat mass and related hormones (such as ghrelin and leptin) in normal weight adolescent AA, when compared with EA and NAC. This study examines LH, ghrelin and leptin pulsatility in AA, EA, and NAC, and associations of LH with ghrelin and leptin in an adolescent and young adult population. We aimed to examine LH pulsatility patterns in AA versus EA and NAC, as well as examine associations of pulsatility patterns of ghrelin and leptin with pulsatility patterns of LH. We hypothesized that LH secretion (basal and pulsatile) is lower in AA when compared with EA and NAC. We also believed LH is associated positively with leptin and inversely with ghrelin. Nocturnal q 10' frequent sampling for 8 hours was performed for LH, and q 20' for leptin and ghrelin. A deconvolution analysis was performed to determine secretory characteristics (mean pulse height, mean pulse mass, total basal secretion, total pulsatile secretion, and total secretion) of LH, ghrelin and leptin. A correlation analysis was used to determine whether leptin and ghrelin secretion predict LH secretion. It was found that AAs have decreased LH and leptin and an increased ghrelin when compared to EA and NAC. It was also seen that LH correlates positively with leptin and negatively with ghrelin.

We thank the National Institute of Health and the MGH Clinical Research Center for financial support.

Poster 12

Characterizing a Novel Cell Line Derived from Mammary Tumor Epithelial Cells

Jonathan Ye, Professor Rob Bellin
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While using M28 mouse mammary tumor epithelial cells in an experimental model of breast cancer, our lab noticed that some of the cells in our dishes began showing fibroblastic features. We named these cells MFKD28 and began to explore the possibility that the M28 cells that have undergone epithelial-mesenchymal transition (EMT). EMT is a change many tumor cells undergo which allows the cells to more easily migrate from one site to another. Typical traits of EMT cells include reduced intercellular adhesion, increased migratory rates, increased invasion rates, increased proliferation rates, and decreased keratin expression. Previous staining for two cell-cell junction proteins, syndecan-1 and E-cadherin, shows that MFKD28 cells have a lower recruitment of these proteins to cell boarders compared to M28 cells. This summer, we have expanded the comparison of M28 and MFKD28 cells. Using Platypus Technology's cell migration assay, we have shown that the MFKD28 cells migrate faster than M28 cells. Additionally, a proliferation assay shows that the MFKD28 cells divide at a faster rate than M28 cells. Finally, through immunofluorescence staining, we showed that MFKD28 cells express lower levels of keratin. These results support our hypothesis that the MFKD28 cell line is the result of M28 cells which have undergone EMT.

We would like to thank an anonymous donor to the Holy Cross Alumni and Parents Summer Research Fellowships that made this summer possible.

Poster 13

The Isolation and Characterization of the Syndecan-4 Adhesome

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Focal adhesion complexes (FACs) are large assemblies of proteins that aggregate at the cell membrane in response to cell attachment. They exist as strong mechanical linkages that extend from the cytoskeleton of the cell into the extracellular matrix (ECM). Currently, much of the literature regarding cell adhesion maintains that FAC formation is initiated due to integrin protein binding to the ECM. However, our lab has recently shown that the trans-membrane protein syndecan-4 is capable of independently recruiting proteins to form FACs, thereby reinforcing the attachment of cells to specific sites. By isolating the adhesion complexes formed by syndecan-4 attachments to the ECM and using a proteomics approach, the goal of our study is to identify all of the proteins involved. To ensure that only syndecan-4-dependent adhesion proteins were collected, magnetic micro-beads were coated with anti-syndecan-4 antibodies. These beads were then dropped onto NIH 3T3 fibroblast cells and a chemical cross linker was added to covalently bind and stabilize any adjacent components of the FAC. After cell lysis, the beads, with the complex attached, were recovered with a magnet. A reducing agent was applied to break the disulfide bridges that hold the cross linker together, liberating the individual proteins. These samples were then analyzed via Western blots to determine which proteins were bound in the FAC. In our initial studies, no specific proteins could be recovered reproducibly. Current efforts focus on optimizing the conjugation of the antibodies to the beads in order to help enhance the recovery of the FAC.

We thank the BD Corporation for financial support.

Poster 14

Substrate Flexibility in Stereoselectively Catalyzed Michael Reactions

Christopher Shugrue and Brian Linton
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Analysis has previously been done on the Michael addition of nitro-ketone enolates to alpha-beta unsaturated carbonyls. It is possible to create three stereocenters in this reaction, both on the nitronate position and on the carbons alpha and beta to the Michael acceptor's carbonyl. Preliminary results seem to indicate that it is possible to control the stereochemistry of these stereocenters through the use of catalytic peptides. These peptides are believed to bind to the substrates, promoting facial selectivity of the nitronate attack and the final protonation of the Michael acceptor's alpha position. Substrates with different sizes and functional groups will bind differently to the peptides and hence affect the peptides' ability to stereoselectively catalyze reactions. Extensive work has been done this summer in synthesizing a variety of new substrates to test with the peptides. The nitro, carbonyl, and olefin groups of the substrates have been replaced with other withdrawing groups, such as sulfones, nitriles, and carboxylic acid derivatives. Screening these substrates with the peptides will yield information on the peptides' effectiveness and flexibility with different reactants.

We thank the Camille and Henry Dreyfus Foundation and the National Science Foundation under CHE-0852232 for financial support.

Poster 15

Serotonin 2A Receptor Agonist Potentiates Amphetamine's Disruption of Prepulse Inhibition in Mice

Bethany Charron, Anna Whelan, and Dr. Daniel Bitran
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Prepulse inhibition (PPI), a reduced startle response to an acoustic stimulus when it is preceded by a lower intensity stimulus, is disrupted in schizophrenia. Increasing dopamine (DA) neurotransmission with amphetamine administration disrupts PPI. This is consistent with the DA hypothesis of schizophrenia. Recently, however, it has been found that low doses of amphetamine *increase* PPI. Interestingly, activation of 5-HT_{2A} receptors on dopamine nerve terminals decreases the release of DA. The current study tested the 5-HT/DA interaction in its modulation of PPI. Male mice were injected with 0, 0.5, 1, 2, or 4 mg/kg of amphetamine, a dose response curve reported by others to yield facilitative effects on PPI; disruptive effects of amphetamine are typically seen at higher doses. We did not find any facilitative effect of amphetamine on PPI, though 4 mg/kg did profoundly disrupt PPI. The next experiment tested the hypothesis that 5-HT_{2A} receptor stimulation ought to decreased the effects of amphetamine on PPI. Animals received an injection of 1 mg/kg of TCB-2, a 5-HT_{2A} receptor agonist, prior to the amphetamine treatment. We found that TCB-2 *potentiated* the disruptive effects of amphetamine; disruption of PPI was observed after 2 and 4 mg/kg. TCB-2 pretreatment alone had no effect on PPI. It is difficult to reconcile these data with the hypothesis that 5-HT_{2A} receptors decreased DA release. The data suggest that 5-HT_{2A} receptors may act independently of DA in affecting PPI. Further studies will continue to investigate the mechanisms involved in the regulation of PPI, helping to uncover pharmacotherapeutic interventions for schizophrenia.

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Poster 16

Imidazole $Re(CO)_3^+$ d^6 Compounds

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Recently, it has been discovered that two isotopes of Re, ^{188}Re and ^{186}Re, display β-emitting ability, making them of special interest in the medical field. Compounds of ^{99m}Tc have been used most recently as imaging agents to help detect certain types of cancer, as well as presenting the potential to treat it. This research is specifically focused on creating new compounds to assist in the development and application of imaging and therapy. Also, it has been seen that rhenium is a better contrast agent than the commonly used iodine, yielding brighter outcomes, since it is a better absorber of x-rays. Additionally, it is of interest to study ligands that can be attached to the $Re(CO)_3^+$ center that function as inhibitors to tumor receptor active sites to elucidate information concerning the biological function of Tc/Re imaging agents. New synthetic pathways were developed to form a new and diverse set of $Re(CO)_3X$ compounds with both expected and unexpected results. Over the duration of the summer, six new compounds in this series have been made and characterized. The focus was centered on attaching pyridine imidazole compounds to the aforementioned rhenium center, resulting in the formation and determination of new crystal structures. Future work on this project will include the attempt to elucidate more crystal structures for the compounds made as well as attaching additional functional groups to the pyridine imidazole ligand created this summer to bond to the $Re(CO)_3^+$ center.

$Re(CO)_3$(pyrim)Cl, Br, I series completed, $Re(CO)_3$(pybzim)Cl, Br, I series completed.
2-(2'-pyridine) imidazole ligand created with the possibility of attachment of organic compounds and functional groups.

We would like to thank the Camille and Henry Dreyfus Foundation for their financial support.

Poster 17

Synthetic Phosphorylation using P(V) Methodology

Sean Till and Prof. Bianca Sculimbrene
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Phosphates are unique molecules that have many biological and pharmaceutical applications. In biology, phosphates act as the primary components of cell membranes, structural components of both DNA and RNA, messengers between cells, and stable leaving groups to drive metabolic pathways. In pharmaceuticals, phosphates have been proven to increase the oral availability of intravenous medications, and are currently present in anti-tumor and anti-viral agents. The current method used to create these molecules is known as phosphorylation. This method utilizes a phosphorylating agent in the presence of an alcohol to form a protected phosphate. Once the protected phosphate has been created, its protecting groups can be removed to form the desired phosphate target. The purpose of these protecting groups is to prevent any undesired reactions from occurring at the phosphorus center. Current phosphorylation techniques employ a limited variety of protecting groups, which are often removed under harsh conditions. Therefore, we have sought to discover a new phosphorylation method which allows for a wider range of protecting groups to be used under catalytic conditions. The combination of a lewis acid catalyst and a pyrophosphate were used to create a library of protected phosphate targets from a variety of alcohols: 2-dodecanol, 4-phenyl-2-butynol, cyclohexanol, 1-phenylethanol and 4-phenyl-1-butynol in conversions up to 95% and isolated yields up to 88%. In the future, we hope to optimize catalytic conditions as well as develop other pyrophosphates with orthogonal protecting groups.

We would like to thank the Becton Dickinson Corporation for their financial support.

Poster 18

The Role of the Protein Merlin in Neurofibromatosis Type 2

Catherine Flynn and Robert Bellin
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Neurofibromatosis Type 2 (NF2) is a dominantly-inherited tumor-prone disorder affecting roughly 1 in 60,000 people. The most common symptom of NF2 is bilateral schwannomas along the superior vestibular branch of the 8th cranial nerve, which connects the brain to the ear. These vestibular schwannomas often cause imbalance, tinnitus, and hearing loss. This disorder arises from mutation of the Nf2 gene, which codes for the tumor suppressor protein, merlin. At high cell density, merlin sequesters epidermal growth factor receptor (EGFR) preventing it from signaling for further cell proliferation. Because merlin is not a transmembrane protein, it is likely through an interaction with another protein that merlin is able to localize near the membrane and hold EGFR there. We propose that this transmembrane protein is syndecan-1. A heparan sulfate proteoglycan, syndecan-1 interacts with both intracellular and extracellular proteins. Based on previously published work, syndecans likely interact with the FERM domain in the N-terminal region of merlin. We used site-directed mutagenesis to design point mutations (based on the NF2 Patient Database) in merlin's FERM domain to see if these mutations render merlin unable to link to syndecan-1. The mutants have been transfected into Nf2 -/- glioma cells so that the only merlin expressed in the cell are those with mutations. Initial confocal microscopy experiments display a range of merlin localizations, including vesicularization within the cytoplasm and co-localization with syndecan-1 along cell-cell borders. Future experiments include comparing low and high cell growth density.

We thank the BD Corporation for financial support.

Poster 19

Protein Splicing Inteins from *Synechococcus sp. PCC 7002* and *Pyrococcus abyssi*

Kevin Karanja, Julie Reitter and Kenneth Mills
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Protein splicing is a four-step intramolecular reaction, in which an intein flanked by N- and C- exteins is removed, with ligation of the exteins. Protein splicing is not known to require exogenous cofactors or energy sources such as adenosine triphosphate or guanosine triphosphate. We plan to study intein from *Synechococcus sp. PCC 7002 (Ssp 7002)* and *Pyrococcus abyssi* Polymerase II *(Pab Pol II)*. Ssp 7002 and *Trichodesmium erythraeum (Tery)* are cyanobacteria which have the ability to carry out oxygenic photosynthesis. Part of our study is comparing the Ssp 7002 intein to the intein from *Trey*. The inteins are very similar, but they differ in the C-terminal residue. *Tery* and *Ssp 7002* inteins contain a glutamine (Gln) or asparagine (Asn) at that position, respectively. We would like to understand the influence of the difference. With the *Pab Pol II* intein, we have created a mutation that should prevent the intein from splicing. This will allow an in vitro analysis of whether different compounds such as methyl-imidazole can induce splicing.

We thank the National Science Foundation and the Dreyfus Foundation for financial support.

Poster 20

Catalytic P(V) Phosphorylation: Orthogonal Protecting Group

Emily Allen and Prof. Bianca Sculimbrene
Department of Chemistry, College of the Holy Cross

Phosphate is an important functional group within many organic molecules. Both DNA and RNA are composed of phosphate groups linked to sugars. Many diseases are the result of incorrectly phosphorylated proteins. Recently phosphates have been incorporated into pharmaceuticals, increasing the drugs aqueous solubility and thus increasing their effectiveness. Our goal is to develop a method to integrate phosphate into organic molecules (a reaction known as phosphorylation) allowing the synthesis of diverse phosphate compounds. Protecting groups are crucial to our method since they enable organic reactions to take place without hindering the functionality of the phosphate. Past phosphorylation techniques utilize protecting groups that are removed under harsh conditions and often negatively impact other aspects of the molecule. Our method seeks to incorporate a diverse range of protecting groups that can be removed under orthogonal conditions. This allows one to choose the conditions that are most suitable for the phosphate compound being synthesized. We have successfully used the Allyl protecting group in the synthesis of a phosphorylated alcohol. This was accomplished in three steps by first synthesizing diallyl phosphate in 54% yield. Diallyl phosphate was then converted to a pyrophosphate in 99% yield. A phosphorylation reaction between this pyrophosphate and a secondary alcohol yielded 2-Dodecanol diallyl phosphate with 86% conversion and 83% yield. We are currently investigating the sec-Phenyl and Methoxybenzyl protecting groups.

We thank the Camille and Henry Dreyfus Foundation for financial support.

Poster 21

The Group Cook-Off: Actual Versus Virtual Therapy

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Introduction: The purpose of this study was to explore the therapeutic efficacy and overall preference toward a cooking group (CG) versus a virtual cooking group (VCG) from burn survivors' perspectives.

Methods:. The CG occurred in a real kitchen with utensils and food while the VCG was administered using Nintendo® Wii™ and software entitled, "Cooking Mama's Cook-Off" with virtual equipment and ingredients. Physical tasks in both groups included chopping, cutting, stirring and cooking on a stove. An identical questionnaire for both groups was developed, with areas of interest including distraction from their burns, socializing with other burn survivors, movement/standing tolerance, return to activity and reduced anxiety in the kitchen.

Results: Forty participants completed the study and had comparably favorable responses to the activities in the areas of interest during both the CG and VCG ($p > 0.05$). Although no statistically significant differences were noted for preference, trends indicated a predilection towards the VCG (55%), greater for kitchen burns ($n = 17$, 59%).

Conclusion: Virtual simulations of daily tasks may be used as an unconventional, alternative and cost-effective approach to therapeutic group activity. As a supplement to actual cooking, VCG may be useful as a transition for patients who sustained burns while in the kitchen and are hesitant to resume cooking activities.

We thank the New York Firefighters Burn Center Foundation for their ongoing support and generosity.

Poster 22

Rural Adolescent Involvement in School-Based Extracurricular Activities and Psychosocial Outcomes over Time

Allison Shepard and Pr. Alison Bryant Ludden
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Youth participation in extracurricular activities is an essential part of positive youth development in rural America. Rural communities are faced with challenges such as increased poverty and substance use, as well as limited school resources, but the setting of small rural schools allows for strong community ties. Organized activities establish supportive social networks for peers and adults, and they allow adolescents to experience and deal with challenges. In the current research, rural adolescents' ($n = 670$) involvement in school extracurriculars in the eighth and ninth grade was examined across eight psychosocial outcomes. Longitudinal data was collected for a subsample ($n = 238$) one year later. Using a series of hierarchical linear regressions, we examined how involvement in the five different types of activities was associated with depressive symptoms, stress about schoolwork, academic self-efficacy, academic self-concept, alcohol use, marijuana use, friends' substance use, and friends' positive school experiences. Cross-sectional results revealed that those involved in school arts reported more depressive symptoms, and those involved in school sports reported fewer symptoms. Longitudinal data also indicated that adolescents who were involved in school sports a year later reported less depressive symptoms and were more likely to have friends who use substances. Findings are similar to previous research involving urban and suburban youth and indicate that activities are key points for socialization during adolescence.

This research was funded by the generous contribution of Mr. James F. Mooney III and Mrs. Lisa Reed Mooney to the Parents / Alumni Summer Research Scholarship fund.

Poster 23

Age-related Changes in the Factorial Structure of Religious Orientation

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Since Allport and Ross (1967) researchers have refined measures of religious orientation. Measures of three distinct religious orientations have emerged – religion as an end in itself, religion as a means to other ends, and religion as a quest for meaning. While religious orientation, like other aspects of personality, cognition, and coping are thought to change with age (e.g., Fowler), few researchers have attempted to 1) systematically validate ends, means, and quest religiousness in later life, or 2) assess changes in religious orientation in later life. The current study examines the factorial structure, convergent validity, and age-related changes in the three-factor-ends-means-quest model of religious orientation using a random sample of 352 community-dwelling adults in Worcester, MA. The sample was median split into two age groups – late middle-aged (60-74) and older adult (74 and older). The ends-means-quest model was confirmed in the late middle-aged sample, then cross-validated in the older adult sample. Standard measures of religious orientation load predictably on ends, means, and quest factors in both older adult samples. Results indicate that relationships among ends, means, and quest factors differ from those typically reported in younger samples. Ends and quest religiousness are not associated in younger adults (correlations between -.10 and .10), while among middle-aged and older adults in our sample the correlation was .24 and -.27, respectively. This shift in the relationship between ends and quest is discussed in light of changes in religiousness predicted by normal development and age-related changes in stress and coping.

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

Poster 24

Equivalent Maintenance of Alignment Throughout Healing of Bicondylar Tibial Plateau Fractures: Variable vs. Fixed Angle Locked Plating

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This study was designed to assess which construct was superior in the prevention of genu varus formation following open reduction internal fixation of bicondylar tibial plateau fractures. A review was conducted of 62 consecutive patients operatively treated for bicondylar tibial plateau fractures with 1 of the 4 constructs: (1) a fixed angle locked plating system applied to the lateral border, (2) a fixed angle locked plating system applied to the lateral border with an additional medial buttress plate, (3) a variable angled locked plating system applied to the lateral border, and (4) a variable angled locked plating system applied to the lateral border with an additional medial buttress plate. Possible progressive genus varus was determined by measuring knee alignment on immediate postop and all subsequent follow up x-rays. Our Results show that neither the variable nor the fixed angle locked plating system was associated with significant varus collapse, as the difference in collapse rates over the time intervals between the two groups was just 0.0085 degrees. Additionally, neither the lateral nor the dual plating systems presented significant varus collapse rates, as the difference in collapse rates over the time intervals between the two groups was just 0.0688 degrees. Therefore, in the maintenance of coronal plane alignment in the tibial plateau postoperatively, there was neither an advantage to using fixed versus variable angle locked plating, nor lateral versus dual plating.

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Poster 25

Investigation of Hydrogen Bonding in Peptides

Benjamin D. Brink and Professor Brian Linton
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Hydrogen bonding plays an important role in nature and biotechnology. It is involved in protein folding, regenerative medicine, drug development, and certain ailments including Alzheimer's disease. Understanding hydrogen bonding and how to manipulate it can have significant effects in developing new cures. Several peptides have been created that can mimic small β-sheets and can be used to understand the correlation between the number of hydrogen bonds and conformation stability and how beta sheet pre-organization affects aggregation.

We thank the National Science Foundation for financial support.

Poster 26

Sequencing of the *Chlamydomonas reinhardtii* Gene FAP 172

Matt Wicker and Dr. Mary Porter
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The human coiled-coil domain containing protein (CCDC40) has very important functions in the creation of cilia. Mutations in this gene early on in development can lead to a disease called Primary ciliary dyskinesia (PCD). Side effects of this disease lead to the misplacement of organs in the body and chronic respiratory problems. By genetic mapping, an analog of this gene was found in the green algae *Chlamydomonas reinhardtii,* called Flagella Associated Protein 172 (FAP 172). In order to better understand how genetic mutations affect the product of the human gene, we can study this analog. I used various techniques, such as polymerase chain reaction (PCR), and computer programs to try and fill the gaps of unknown DNA sequence in the FAP 172 gene. While the genomic version of the gene proved to be difficult to fill the gaps, I was able to almost fully sequence the transcript sequence of this gene that directly codes for the protein. Future steps would be to finish sequencing the FAP 172 transcript sequence and move on to the genomic sequence.

This research was support by a grant from the National Institutes of Health to M. Porter.

Poster 27

The Day-to-Day Lives of Caregivers of Alzheimer's Disease Patients

Frances Hamilton and Renee Beard, PhD
Department of Sociology, College of the Holy Cross

Since most seniors who live with dementia are cared for by family members in their homes, the increasing number of people diagnosed with Alzheimer's disease (AD) has resulted in a corresponding rise in informal, unpaid caregivers. Most often, caregiving becomes the main priority and/or career for the family members of people diagnosed with AD. This paper focuses on the perspectives of 86 caregivers and their experiences in the times prior to, during, and after the diagnosis of AD. Grounded theory methods were used to collect, code and analyze data into common themes. The data revealed discussion about what symptoms were demonstrated that led to a diagnosis, the day to day life of these families subsequent to diagnosis, and changes in the relationships between caregivers and patients. Experiences varied based on the age of person diagnosed with AD and the relationship between caregiver and patient (both the type of relationship, such as spousal, parent/child, and the closeness of the relationship); these narratives demonstrated that caregiving can be both frustrating and rewarding. Through various coping mechanisms, including both practical changes, such as writing notes, and emotional coping, like support groups, support persons were able to navigate the changes in their lives since the diagnosis. This research presents various perspectives of caregiving, while also drawing attention to the needs of those caring for loved ones diagnosed with Alzheimer's disease. Such findings have implications not only for helping others dealing with AD, but also medical practice and community-based services.

We would like to thank the Greisch Family Summer Research Fellowship Fund for Students in Sociology for funding our work.

Poster 28

African American Caregivers for those with Alzheimer's Disease

Adair Bender and Renee Beard, PhD
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Alzheimer's (AD) is a disease that not only affects those diagnosed, but it also influences their loved ones. Being a caregiver shapes how one runs his or her everyday life. Through comprehensive qualitative interviews with 39 respondents, we are able to explore the thoughts, emotions and experiences of African American caregivers. These narratives focus on their relationships, their outlooks and how they handle their given situation. AD is most commonly viewed as a normal part of aging amongst African Americans. These narratives demonstrate spouses, children and siblings developing a parental role over their loved one with AD. Unfortunately, this role commonly leads to frustration. In order to cope with this role change, African American caregivers tend to turn to their faith. Meditation and prayer help to ease aggravation as well as remind caregivers of the larger picture. Every caregiver reported dramatic transformations in their lives since their family member was diagnosed. These changes can be emotional, physical and/or social. Almost all interviewed communicated that improvement in resources, such as community programs, nursing homes, extra help to stay living at home or the availability of information, could help alleviate some of the stress associated with the profound changes they experienced. These findings can be used to improve health policies, community services and doctor-caregiver interactions.

We thank the Mellon Summer Research Program for financial support of this work.

Poster 29

Examining Hydrogen Bond Strength in Glutamine Derived Peptides

Meg Hanly and Professor Brian Linton
Department of Chemistry, College of the Holy Cross

Hydrogen bonding plays a vital role in determining protein structure. Quantifying the strength of hydrogen bond acceptor abilities of different functional groups will allow for better understanding of the strength of hydrogen bonding in proteins, such as beta sheets. At the moment, following the behavior of a molecule at different concentrations is the most common method used to study hydrogen bonding behavior. A more specific account of the strength of a functional group's hydrogen bonding can be obtained through hydrogen/deuterium exchange. We have been synthesizing a series of molecules with different functional groups and using both these methods to show the advantages of hydrogen/deuterium exchange. More specifically, we are interested in hydrogen bonding in glutamine derived peptides, which have been shown to play an important role in Huntington's Disease. We have specifically been focusing on synthesizing a glutamine with a thiocarbonyl, which permits distinction of similar functional groups. In doing so, we have explored various methods for synthesizing primary thioamides, a functional group that is tricky to work with in organic solvents. Selectively thiolating a specific carbonyl is important in creating thioamides and would greatly contribute to developing an efficient synthetic technique for synthesizing such primary thioamides.

We thank the National Science Foundation for financial support.

Poster 30

CINEGLOS: Developing a Web-based Interactive Spanish Film Glossary

Sheila Coursey, Kelsey Smith and Prof. Bridget Franco
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College of the Holy Cross

In the growing field of Hispanic Studies, film provides an important medium for cultural, linguistic and artistic analysis. However, Spanish and Latin American film studies are currently hindered on two fronts: academic resources are predominantly published in English, rather than the target language, and researchers overwhelmingly rely on the written word to describe and refer to complicated cinematographic techniques. As a result, the visual language of film is often lost in translation. To address these issues, our research team used Lexique Pro software to generate a database of Spanish film terms which was then exported and adapted to create CINEGLOS, a unique interactive cinematographic web glossary. Over 150 film terms are defined in Spanish, cross-referenced, organized categorically and alphabetically, and linked to one or more video clips. We selected, edited and annotated each clip to highlight clear and meaningful examples of cinematographic techniques from over 50 critically acclaimed Spanish and Latin American films. CINEGLOS provides an essential pedagogical resource for students, professors and all those interested in Hispanic film that will continue to evolve and expand with the incorporation of new cinematographic terms and clips from future Spanish-language film productions.

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

Poster 31

Using Mannich Condensations to Model the Structure and Function of Metallo-enzyme Active Sites

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Department of Chemistry, College of the Holy Cross

Many biological processes rely on interactions between metal ions and organic compounds, including catalysis, blood transport, and brain physiology. We are developing an inexpensive strategy to rapidly prepare a library of metal-binding ligands. The objectives of this research include: (1) building a library of tetrahydrosalen, aminophenol ligands, (2) studying the ability of these ligands to bind Fe^{3+} ions in a five-coordinate geometry as opposed to the conventional six-coordinate geometry, and (3) studying the reactivity of the metal complexes and comparing them to both natural enzymes and previous ligands.

We thank the Arnold and Mabel Beckman Foundation for financial support.

Poster 32

Intralesional Hemorrhage in Patients with Metastatic Melanoma Treated by Gamma Knife Radiosurgery

T. J. Klein[1], F. J. Barbiero[2], J. E. Bond[1], J. P. Knisely[1], V. L. Chiang[1], J. B. Yu[1], [1]Yale School of Medicine, [2]College of the Holy Cross

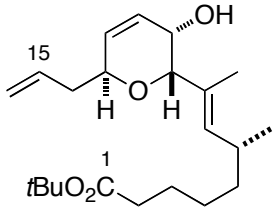
Gamma Knife Radiosurgery (GKRS) improves survival in patients with intracranial metastases from malignant melanoma. Intralesional hemorrhage, however, is a known risk after GKRS and the incidence of hemorrhage is elevated in certain histologic subtypes, including malignant melanoma. In this study, we performed a retrospective review of 158 patients treated with GKRS for intracranial metastases from malignant melanoma at Yale-New Haven Hospital between August 1998 and January 2011. Imaging studies done pre- and post-GKRS were reviewed to identify those patients with a radiographically significant increase in intralesional hemorrhage. Of the 158 patients reviewed, 58 had no follow-up imaging available and were thus excluded from radiographic analysis. Of the remaining 100 patients included for further analysis, 65 percent (n=65) were male and median age at the time of GKRS was 60.9 years (range 20.8 - 83.9 years). Thirty-one percent of patients (n=31) had a radiographic increase in hemorrhage as seen on MRI or CT scan. Median time to radiographic evidence of intratumoral hemorrhage post-GKRS was 42 days (range 3 - 175 days). Age and sex had no significant effect on intratumoral hemorrhage ($p = 0.08$ and 0.15, respectively). The presence of intratumoral hemorrhage prior to GKRS had no significant effect on the development of increased intratumoral hemorrhage post-GKRS, with 28% percent of patients who developed delayed intratumoral hemorrhage showing signs of pre-GKRS bleeding versus 21% of those who did not. GKRS is a safe tool in the treatment of intracranial metastases from malignant melanoma. Although the risk of increased intratumoral hemorrhage after GKRS is concerning at a rate of 31%, this risk does not appear to be significantly elevated from the baseline risk of hemorrhage due to intracranial metastases from malignant melanoma. Thus, although it is important to inform patients of their risk of bleeding after GKRS, this risk of bleeding does not appear to be significantly increased by the treatment itself.

Poster 33

Efforts Toward the Synthesis of the C1-15 Segment of (+)-Sorangicin A

Christopher S. Jacques, Michael C. Mandrioli and Kevin J. Quinn,
Department of Chemistry, College of the Holy Cross

Sorangicin A is a highly oxygenated macrolide isolated from the myxobacterium *Sorangium cellulosum* with high activity against both Gram-positive and Gram-negative bacteria. The structural complexity of sorangicin A necessitates the use of a convergent strategy in which subunits are synthesized individually and coupled to one another in order to complete an efficient total synthesis. In this poster, we will present our progress on the synthesis of the C1-C15 portion of sorangicin A. This fragment is comprised of a core dihydropyran ring with three substituents, including an alkenyl C1-C8 chain with a stereogenic center at C6.



Our approach involves independent synthesis of the dihydropyran core and subsequent coupling with the C1-C8 side chain. An immediate precursor to the side chain has been prepared in good yield using Meyers' asymmetric alkylation of a pseudoephedrine-derived amide to install the C6 stereocenter with a high degree of stereoselectivity. Synthesis of the dihydropyran ring has been achieved by Achmatowicz rearrangement of a readily available furan followed by reduction for installation of the C11 hydroxyl in a stereoselective manner. We will present the optimization of our routes these subtargets and our proposed strategy for completion of the C1-C15 segment.

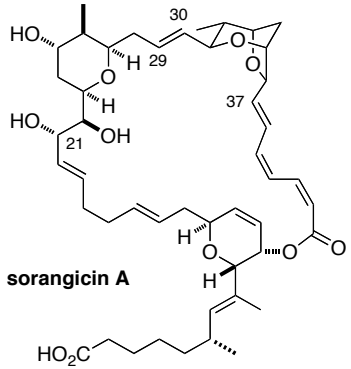
We gratefully acknowledge the financial support of the National Science Foundation and the generous donation of Dr. George A., Jr. and Mrs. Jackie Paletta to the Alumni/Parent Summer Research Scholarship Fund.

Poster 34

Efforts Towards the Synthesis of (+)-Sorangicin-A

Maria C. DiPoto, Colin O. Hayes, and Kevin J. Quinn,
Department of Chemistry, College of the Holy Cross

Sorangicin A is a broad-spectrum antibiotic natural product isolated from the myxobacterium *Sorangium cellulosum*. We have been investigating a convergent approach to this macrolide that require the synthesis and union of three key subunits of similar complexity. In this poster, we will present our progress towards the syntheses of the C21-C29 and C30-C37 fragments.



sorangicin A

The C21-C29 fragment consists of a highly substituted tetrahydropyran ring that is expected to arise from ring-closing metathesis and subsequent functionalization of the resulting endocyclic double bond. Our strategy for and our efforts toward the preparation of the substrate for this key step will be presented. The C30-C37 segment, containing an unique bicylic ether, is the greatest synthetic challenge present in the natural product. We have developed an approach to this substructure using a size-selective ring-closing metathesis/alkene isomerization/oxy-conjugate addition sequence. Our progress toward these fragments and proposed approach for their coupling will be presented.

We gratefully acknowledge the National Science Foundation and the generous donation of the Stransky Family Summer Research Scholarship for financial support of this research.

Poster 35

Investigating Stereoselective Organocatalysis

Justin R. DeFrancisco and Brian R. Linton
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An important characteristic of a molecule is its three-dimensional structure, or "handedness." Like the way a pair of hands are mirror images of each other, but cannot be superimposed on each other, chemicals can come in pairs that differ sharply in function because of their three-dimensional arrangement. Differently handed molecules react with other handed molecules in unique ways, much like how a right hand can only effectively shake a right hand, and not the left. Thus, we may prefer the right-handed molecule instead of the left. However, a chemical reaction will generally show no preference in forming one hand over another. One way to create a preference is through organocatalysis. Catalysts can act to not only stabilize intermediates to speed reaction times, as is often seen, but also bring together two reactants in a specific orientation relative to each other. This orientation will be reflected in the final product's defined three-dimensionality. Our research focused on this idea of influencing the three-dimensional structure of our products. Specifically, we have looked into asymmetric nitro Michael additions and stereoselective acylations of alcohols. We have developed receptors to be used as catalysts in these reactions. We have also been developing methods on a High Performance Liquid Chromatograph in order to separate these handed molecules.

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

Poster 36

Using Alignable Images to Facilitate Learning in Structural Geology

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Geological forces shape the earth's crust. *Normal faults*, for example, form when extensional forces pull blocks of rock apart along a plane, whereas *reverse faults* are formed by compression. Geologists classify faults to retrace the forces that have acted on an area; however, normal and reverse faults are visually similar. In this study we investigated whether viewing superficially similar (highly alignable) images of a normal and reverse fault would help people learn to distinguish the two categories. Highly alignable examples highlight *alignable differences*—in this case, spatial relations that distinguish normal from reverse faults (e.g., Gentner & Markman, 1994). Participants were presented with pairs of normal and reverse fault images embedded in an instructional text about structural geology. The pairs were either high or low in alignability. Participants then completed a 22-item fault classification test. Across a series of experiments, participants who saw highly alignable images in the instructions classified faults more accurately at test. However, participants had difficulty classifying faults that had different slope angles from the images in the instructions. Future work will focus on eliminating this limitation in learning.

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

Poster 37

Early Adolescents' Sleep and Perceived Health Assessment

Michaela Johnson, Elizabeth Harkins, and Amy R. Wolfson
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Sleep is a vital part of a healthy lifestyle, as important as diet and exercise. Previous research has demonstrated positive correlations between perceived health and both sleep duration and sleep efficiency, while daytime sleepiness was associated with negative outcomes in perceived health for adolescents. Seventh graders from two urban schools were randomly assigned to an 8-session Sleep-Smart (SS) Program (n=70) or a comparison group (n=73). The preventive-intervention program focused on educating students on healthier sleep habits and patterns. Participants competed self-report measures concerning their sleep habits, internal and externalizing behaviors, and general health at baseline and following the intervention. Sleep patterns were estimated utilizing actigraphy. Controlling for pubertal status, BMI, gender, and income, repeated measures multivariate analyses demonstrated positive Sleep-Smart Program effects on the early adolescents' sense of wellbeing such as global health, sufficient energy, ability to participate in activities, and family health.

We thank an anonymous donor to the Alumni / Parents Summer Research Scholarship fund for the financial support for M. Johnson, and NIH, NICHD, 5 R01 HD047928-06 for funding of the Young Adolescent Sleep-Smart Pacesetter Program.

Poster 38

Child Health Concerns In Ha-Makuya District: Disparities In Nutritional Knowledge And Diet, And A High Prevalence Of Bilharzia

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A. Müller, University of Cape Town
Organization for Tropical Studies, Duke University

The aim of this study was to look at several factors that contribute to the overall health of children in Ha-Makuya Village in the Vhembe district of Limpopo Province in South Africa. We studied the health of six children through a survey orally administered to one parent of each child. Firstly, the study examined the nutritional status of children in the region determined using the Z-scores based on weight and height. Secondly, the study investigated the diet of each child and the nutritional knowledge of each parent in order to examine the gap between what parents would like to feed their children and the foods the children actually eat. Lastly, the study focused on the prevalence of bilharzia, a common parasite found in the rivers of the region, and if parents knew about the dangers of river water. The results showed that the children studied had average Z-scores for their ages and that parents had knowledge of a healthy diet but were unable to provide this food to their children the majority of the time. Three of the six children had contact with the infected river water despite all parents reporting that they knew that river water was unsafe. Two of the six children studied had been previously diagnosed with bilharzia, and one child was awaiting test results. Based on the results, the children are in good nutritional standing but are still not eating an ideal diet. Bilharzia is a growing concern in children in the area, and although residents are aware of the potential danger, they still use the river water for both recreational and household use.

This research was made possible by the Organization for Tropical Studies, Duke University.

Poster 39

The Choice of Child-Care Type and Its Impact

Pr. Joshua Congdon-Hohman, and Christopher Kalpin,
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In our research we use the Bureau of Labor Statistics' NLSY79 data set to analyze the influences on a mother's decision to return to work and to use child care following the birth of her first child. While doing so we focus on the role health insurance plays in this decision, something that has yet to be accounted for in previous studies. Our preliminary results indicate that women whose employers offer some form of health insurance have a higher probability of returning to work in the year following the birth than those who do not. To yield our results, we first determine a mother's length of leave from working surrounding the birth of the child whether it be from a paid pregnancy leave, a gap in job tenure, or a spell of unemployment. After determining each mother's leave from work, we then use several probit models to test the statistical significance of pertinent variables. While other variables such as educational attainment and personal income are statistically significant for some models, we conclude that only health insurance was a consistent factor in all models. In future work, we plan to continue to provide our own unique analysis for some other questions in this field with a special focus on the effects of the choice of child care on the mother's labor outcomes. This research is important because if we can explain the effects of the choice of child care on a mother's career trajectory it could contribute to economic discussion regarding the wage gap between women and men.

We thank the May and Stanley Smith Charitable Trust for their support.

Poster 40

Sonic or Ionic? Investigating the Mechanism of Laser Plasma Formation

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Laser induced breakdown spectroscopy (LIBS) forms a superheated plasma when a highly focused laser beam collides with a sample. In gas samples, plasmas usually form at the focal point of the beam. This laboratory recently showed that by sending a beam coaxially through a tube, the position of the air plasma shifts. However, it was yet to be determined if the nature of this shift was due to residual ions or standing acoustic waves. A sonic shift would be caused by standing waves created in the tube. When air plasmas form, they create a "popping" noise from the air displaced by the plasma collapsing back upon itself. This would set up an acoustic standing wave in the tube, which has areas of high and low pressure. In areas of high pressure, a relatively focused beam would form an air plasma even though it has not yet reached its focal point. Residual ions left in the tube from previous plasmas could also shift the location of the formation of these air plasmas. When a laser pulse first creates an air plasma, it would send ions throughout the tube. When the next laser pulse comes down the tube, it would interact with the residual ions and form an air plasma away from the focal point. Through several experiments, isolating both the ionic and sonic effects, it was determined that standing acoustic waves caused this shift in the formation of the air plasmas. Future work will be done to determine the effects of the number of tubes used, the tube's diameter and tube length on the position of the air plasma.

We thank an anonymous donor's contribution to the Alumni / Parents Summer Research Scholarship for financial support.

Poster 41

The Effect of Oxidizing Conditions on Splicing of *Trichodesmium erythraeum* Proteins

Laura M. Urbanski, Julie N. Reitter, and Kenneth V. Mills
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Protein splicing is a post-translational event by which an intervening polypeptide, called an intein, facilitates its own excision from the flanking polypeptides, called the exteins, and the ligation of the exteins. A protein found in *Trichodesmium erythraeum* contain two inteins, Ndse1 and Ndse2, that are expected to splice. It was hypothesized that under oxidizing conditions the inteins would form disulfide bonds between cysteine residues which would prevent the first and third step in the splicing mechanism. Ndse1 and the full Tery gene were ligated into an *E. coli* expression vector. The two inteins were studied under different oxidative conditions through the use of *E.coli* BL21 and OrigamiDE3 cells. The Ndse1 intein is very similar to a protein found in *Synechococcus sp* 7002. An interesting difference between the inteins is the Tery intein contains a C-terminal glutamine and the Ssp 7002 contains a C-terminal asparagine. It is hypothesized that because of the Gln the Tery intein will splice much slower

This research was supported by a donation from an anonymous donor to the Alumni / Parents Summer Research Scholarship and by a grant from the National Science Foundation.

Poster 42

Mapping the Energy Landscape of a Model Peptide Using Infrared Spectroscopy

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The structure of a protein is vital in its ability to function correctly in the human body. Typically, it is assumed that the lowest energy conformation of a protein is its native structure *in vitro*, the structure which allows it to perform the necessary bodily functions. However, it has been seen that the misfolding of a protein can result in the formation of stable aggregates, which demonstrates that the protein folding pathway is much more complex than recently thought. These aggregates have been seen to contain increased amounts of β-sheet. In certain model peptides, such as Poly-L-lysine (PLL), the formation of β-sheets can be reversible. In this study, PLL was used to investigate the kinetics of the protein folding pathway at various pH and temperatures using infrared spectroscopy. It was observed that in all cases, the folding pathway that PLL underwent was α-helix→ β-sheet → random coil. As temperature was increased however, β-sheet structure was sustained for longer, with the amount of time it took to form random structure increasing. At lower pH (11.3), PLL remained α-helical at higher temperatures than at higher pH (12.3). As PLL was further heated at both pH values, stable β-sheets were able to form, and on cooling random coil was formed. Further work will include exploring the kinetics of PLL at lower pH, in order to investigate the effect of side chain charge on the folding mechanism.

The authors would like to thank Dr. Edward A. Meyers for his generous contribution to the College of the Holy Cross Alumni/Parents Summer Research Scholarship.

Poster 43

Components of a Magneto-Optical Trap for Rubidium Cooling

Kevin Moran, Mike DeFeo, Andrew Novicki, and Timothy Roach
Department of Physics, College of the Holy Cross

A Magneto-Optical Trap (MOT) can trap atoms and cool them to nearly absolute zero. The primary force used in these experiments is the recoil momentum that results from scattering a photon of light. Cooling is achieved by making this force velocity dependent, using the Doppler Effect and magnetic sublevel shifts. By arranging the laser light incident on the atoms from several directions with appropriate polarization, an "optical molasses" is created that slows and cools the atoms. However, atoms will still diffuse out the trapping region if there is no position dependence to the optical force. We introduce this by applying an inhomogeneous magnetic field to the trapping region. The end goal of this experiment will be to observe what occurs when a cloud of laser-cooled Rubidium atoms scatters off a magnetic surface. There are several different components, which I worked on and analyzed, that are necessary for a successful MOT. These include Acousto-Optic Modulators (AOM), Quadrupole and Nulling Magnetic Coils, and a Spatial Filter used to shape the laser beam incident to the trapping chamber. I performed detailed analysis of these components including laser beam profiling for different portions of the optical setup, as well as frequency and optical power tests for two AOM's. Results from this analysis and their role in our successful implementation of laser cooling will be presented.

We thank the Massachusetts Space Grant Consortium, NASA, and the Richard B. Fisher Summer Research Grant for financial support.

Poster 44

The Bearing of Gender and Health on Widowers' Bereavement and Widowerhood

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Spousal loss has long been viewed and studied as a "women's issue," and very few studies have examined the meaning of widowerhood for men. This project sought to explore the distinctly gendered experiences of widowerhood among middle-aged men using longitudinal data from the 1960's Harvard Bereavement Study. The study contained interviews from 19 widowers under the age of 45, which were conducted within 3 weeks, 8 weeks, 13 months, and 2-4 years after the wife's death. The interviews were coded for themes of masculinity and health. The results indicate that masculinities are important in evaluating the ways in which men cope with grief. The loss of a spouse not only created a difficult situation for these widowers in that men had to cope with deep sadness and grief during this period, but becoming a widower also required the men to adapt to the loss of their wife in a "masculine way." Men faced the difficulties regarding whether or not to express their emotions, divulge their unspoken dependency and ask for help, and try to singlehandedly care for their children's needs. Some felt a need to "perform" masculinity in order to reaffirm their independence and strength during a period when their manhood was put to test. Coping strategies to deal with the stress of spousal bereavement reflected a masculine style, and included increased drinking and smoking, promptly returning to work, and remarriage in order to reassure others of their normative masculinity and ability to control chaos. Further research is needed in order to fully understand how masculinity and health challenges influence the bereavement outcomes among middle-aged widowers.

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

Poster 45

Effect of the Conserved Serine 166 Residue on *Pyrococcus abyssi* PolII Intein Splicing

Kathryn M. Colelli, Jennie E. Williams, Michelle D. Marieni, Julie N. Reitter, and Kenneth V. Mills
Department of Chemistry, College of the Holy Cross

Protein splicing is a self-catalyzed process in which an intervening polypeptide (intein) in a precursor protein is removed and the polypeptides on either side are ligated (N- and C- exteins). In the *P. abyssi* PolII intein the block F Serine 166 plays an important role in coordinating multiple steps in protein splicing. This residue has been analyzed in two contexts: one context promotes splicing and the other promotes N-terminal cleavage. Mutating Serine 166 inhibits splicing by disrupting the coordination of the steps. The PolII intein has also been ligated into the gene for kanamycin. This makes splicing necessary for cell survival. The PolII intein will be used as a positive control and a Q185N/C+1A mutant will be made to use as a negative control because it inhibits splicing. This construct will be used for genetic screening of mutations to find inteins with greater splicing efficiency.

This work was supported by the National Science Foundation, the Dreyfus Foundation, and the Arnold and Mae Beckman Foundation.

Poster 46

The Synthesis of "Caged" Phosphates

Joseph Todaro and Prof. Bianca Sculimbrene
Department of Chemistry, College of the Holy Cross

Phosphates are used in the formation and regulation of many intracellular compounds, including: enzymes, nucleic acids and phospholipids. In order to study these biological pathways, phosphates need to be released into cells at specific times. This can be accomplished by "caging" the phosphate with a protecting group that can be removed upon exposure to light. These protecting groups "hide" the chemical effects of the phosphate compound, letting it remain inactive within a biological system. The active phosphate can then be released by simply exposing the compound to a specific wavelength of light. This eliminates the need of harsh deprotecting reagents that may damage the cells. One major limitation to this process is the synthesis and purification of "caged" phosphates. Our research is focused on developing a simple method to synthesize and purify "caged" phosphates in high yields. Our synthesis begins with the formation of a phosphate containing *o*-nitrobenzyl protecting groups. This reaction has been accomplished in up to 76% yield. In a second step, this material is converted to a phosphorylating agent that provides the light sensitive protecting group in up to 99% conversion. This phosphorylating agent is then reacted with a secondary alcohol, 2-dodecanol, to form the "caged" phosphate in up to 92% conversion and 82% yield. We are currently seeking to further improve this reaction and explore the number of other compounds capable of being "caged."

We would like to thank the Richard B. Fisher Summer Research Fellowship for the financial support.

Poster 47

Investigating the Mechanisms of Reduced Fertility Due to High Glucose Exposure in *Caenorhabditis elegans*

Amanda K. Engstrom and Dr. Michelle A. Mondoux
Department of Biology, College of the Holy Cross

Diabetes is a chronic disease marked by insulin resistance and the body's inability to correctly respond to high levels of glucose. Diabetes currently affects 25.8 million people in the United States, and has been shown to lead to increased potential for birth defects, miscarriages, and infertility. The nematode *Caenorhabditis elegans* is an ideal organism for studying the effects of high glucose on fertility because of its conserved insulin-signaling pathway. In previous studies, high glucose exposure in *C. elegans* led to reduced fertility as well as a delay in reproductive development. Here, we investigated the mechanisms leading to reduced fertility and delays in development under excess glucose conditions. By exposing worms to high glucose during either development or the adult stage, and then studying their reproductive profile and brood size, we found that the developmental delay is separable from the decrease in fertility. Feeding high glucose only during development led to a two-day reproductive delay, while glucose exposure in adulthood did not. The decrease in fertility, however, requires adult exposure because there was no decrease with only developmental exposure. We assayed post-fertilization phenotypes under high glucose conditions and saw no change in external or internal hatching. We are now investigating increased apoptosis or defects in the adult germline as possible causes for the fertility decrease.

This summer research project was generously funded by Dr. Edward M. Meyers, M.D. via the Alumni/Parents Summer Research Scholarship.

Poster 48

Effect of Conserved Resides on Splicing of the *Pyrococcus abyssi* DNA Polymerase II Intein

Jennie E. Williams, Kathryn M. Colelli, Michelle D. Marieni, Julie N. Reitter, and Kenneth V. Mills
Department of Chemistry, College of the Holy Cross

Protein splicing is a post-translational event by which an intervening polypeptide, the intein, facilitates its own excision from the flanking polypeptides, the exteins, and the ligation of the exteins. Splicing of the Pyrococcus abyssi DNA Polymerase II intein is initiated by an increase in temperature. The reaction rate may then be analyzed. The rate of the first step of splicing has been analyzed using mutants of the Pab PolII intein, specifically at the Aspartic Acid 74 and the Serine 166 residues. The mutations of the former residue have no effect on splicing but mutations of the latter to Threonine increase splicing rates. The Pyrococcus horikoshii DNA Polymerase II intein is being cloned into an E. coli expression vector for future comparison to the Pab PolII intein splicing rates due to the high level of conservation between the sequences of the inteins.

This work was supported by the National Science Foundation and the Camille and Henry Dreyfus Foundation.

Poster 49

Modeling the Immune Reconstitution of HIV-1 on HAART

Leah DeCoste and David B. Damiano
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During the chronic stage of HIV infection, patients usually have heightened activation of their CD4+ (helper cells which are the primary target of HIV) and CD8+ (killer) T cells. Their blood cell counts show a decrease in the CD4+ cell count and an increase in the CD8+ cell count over time. Once patients initiate highly active anti-retroviral therapy (HAART), their CD4+ and CD8+ counts and activation levels typically return to normal within two years. However, for other patients, the return to normal occurs more slowly and occasionally appears to plateau before reaching the normal range. The goal of our project is to develop a multi-compartment ordinary differential equations model representing immune system cell counts of patients on HAART that can be used to identify aspects of the immune reconstitution that might account for the slow or limited recovery of cell counts to normal values. We will compare model values to patient data and adjust parameters to obtain best fits of the patient data. Patient data comes from an ongoing retrospective study of patient data at the HIV/AIDS clinic at the University of Massachusetts Medical School. In particular, we have identified a cohort of 40 patients on HAART that are both virological responders (HIV counts drop to undetectable levels with minimal viral blips to less than 1000 cells/mL) and that have at least 6 years of data on therapy. These patients represent a range of immunological responses. We are beginning with differential equation models produced by Dr. Denise Kirschner and her co-workers. These models contain cellular compartments of interest to us. We plan to use these models and parameter values as a baseline for future work.

This is a joint project with Dr. Richard Ellison, Dr. Jennifer Daly, Dr. Thomas Greenough, and Reagan Savas from UMass Medical Center. We thank the generous contribution of an anonymous donor to the Alumni/Parents Summer Research Scholarship for financial support.

Poster 50

Central Configurations in the Planar 7-Body Problem

Rebecca Moran and Gareth Roberts
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College of the Holy Cross

The Newtonian n-body problem has puzzled scientists for centuries. The gravitational force on n bodies is assumed to depend solely on their positions and masses. Therefore, the n-body problem essentially studies the motion of celestial bodies in the solar system and the universe. While the 2-body problem, the Kepler problem, is challenging, it is well understood. However, for larger n, the problem is much more complex and it is difficult to find analytic (non-numerical) solutions. One way to find solutions is by looking for *central configurations*. A set of positions forms a central configuration if it satisfies a certain algebraic equation. This special arrangement of masses leads to actual analytic solutions of the n-body problem. An equilateral triangle formation of any three masses is a central configuration in the 3-body problem. This example occurs with the Sun, Jupiter and Trojan asteroids, as well as with the recently discovered asteroid forming an equilateral triangle between the Earth, itself and the Sun. We looked for central configurations in the 7-body problem with bodies set up in a double rhombus formation. We found examples of central configurations that had a subset which formed an equilateral triangle. Because of the relatively large number of bodies, there has not been much study of the 7-body problem. However, we were able to use symmetry to simplify the problem and make substantial progress.

We thank Dr. Dan Kennedy for his generous support of the Alumni / Parents Summer Research Scholarship. This research was also funded by the National Science Foundation.

Poster 51

Stabilization of a Diode Laser for Laser Cooling of Rubidium

M. DeFeo, A. Novicki, K. Moran, T. Roach
Department of Physics, College of the Holy Cross

We developed a system for the laser cooling of rubidium. We used a Gallium Arsenide diode laser in a Littrow configuration for external cavity feedback. The laser was also stabilized by precise temperature control and an active feedback system. This active feedback system used the absorption of light through a cell of rubidium as a reference for the desired frequency at which the laser should operate. An error signal was created from this reference and fed back to the laser system via current control and piezoelectric transducers. This system keeps the laser output "locked" at the desired frequency for laser cooling, even if they system experiences thermal expansion or mechanical vibrations. We also modulate the input current to the laser chip in order to generate additional frequencies of light ("sidebands"), at slightly higher and lower frequencies relative to the primary frequency of operation. The higher frequency sideband is used to return the atoms of rubidium into the hyperfine state necessary for the laser cooling process to work.

We thank Mr. and Mrs. John Kirby and Anne Brae for their generous support of the Alumni/Parents Summer Scholarship fund.

Poster 52

Combined Liver-Kidney Transplantation: Indications, Outcome Analysis, and the Hartford Hospital Transplant Program Experience

Andrew J. Polio, College of the Holy Cross and David Hull, MD, Hartford Hospital

The Model for End-Stage Liver Disease (MELD) scoring system has resulted in a substantial increase in the number of combined liver-kidney transplantations (CLKTx) performed since its implementation in 2002. The burden CLKTx place on the already limited number of renal grafts available for renal transplantation has prompted inquiry into the indications and survival rates of CLKTx in an attempt to determine appropriateness as well as understanding of irreversible renal disease associated with liver failure. This study analyzed 357 patients at the Hartford Hospital Transplant Program (HHTP), who had undergone liver transplantation from 1988-2011, to evaluate proposed indications of CLKTx, determine outcomes of CLKTx at this center, and comment on the MELD scoring system as a means of organ allocation. It was determined that stricter listing protocols are needed, CLKTx patients experience shorter survival time periods post-transplantation than liver transplant patients alone with SCr $\geq$ 2.0 mg/dL, and the MELD scoring system of liver and kidney allocation should included indicators that accurately predict post-transplantation outcomes.

This project was funded by the Medical Education Department of Hartford Hospital.

Poster 53

Ion and Atom Detection Systems, Design Simulations

Matthew Davis and Prof. Paul Oxley
Department of Physics, College of the Holy Cross

The ultimate goal of our research is to investigate charge transfer collisions between atoms and ions. Our research results will improve physicists' understanding of the role that such collisions play in determining the physical properties of plasmas. This poster describes two projects relevant to future experiments in which lithium atoms are collided with protons (hydrogen ions). The first project was to design an ion detection system that would extract lithium ions which result from a charge transfer collision. Using SIMION, a sophisticated computer software program, we were able to complete the design of an apparatus that uses electric fields to guide lithium ions from a collision site to an ion detector called a Channel Electron Multiplier (CEM). We completed a design that will allow us to detect lithium ions with speeds $\leq$ 3300 m/s, enabling us to detect 96% of the collisions that occur. For the second project we designed two Faraday cups, each with a unique purpose, and constructed one of the two cups. The first cup was designed to detect fast-moving ions (speeds ~105 m/s), while the other was designed to detect fast atoms. The charged particle Faraday cup was successfully built and used to collect valuable data from a Colutron ion source that will be used in our future collision experiments (see accompanying presentation by Patrick Collins 12'). The second Faraday cup, which detects neutral atoms, will be built in the future.

We are very grateful for the financial support received from a Massachusetts Space Grant, to the Richard B. Fischer Summer Research Fund, to Dick Miller for machining expertise, to Tony Sacovitch for his assistance with equipment, and to Prof. Kelley for use of SIMION.

Poster 54

How Does Reappraising Stress Arousal Affect Physiological and Affective Symptoms of Social Anxiety?

E. Sophis[1], Dr. J. Jamieson[2], & Dr. M. Nock[2]
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This research examined the benefits of interpreting one's physiological and affective reactions to social stress as normal, adaptive responses instead of as harmful maladaptive ones in a stressful situation. Socially anxious individuals and healthy controls participated in the Trier Social Stress Test. Participants assigned to the reappraisal intervention read articles stating that physiological arousal is evolutionarily adaptive in stressful situations and that they should interpret their body's reaction as such. Those assigned to the control intervention did not read any articles. We collected readings [cardiac output (CO), total peripheral resistance (TPR), PANAS, and Stroop] before and after the Trier task. Participants in the reappraisal intervention experienced an increase in CO and decrease in TPR. However, only socially anxious participants in the reappraisal condition made the least amount of errors (on average) on the Stroop threat list. This same group was the only group to experience an increase in positive affect after the Trier task was completed. These findings show that reappraisal improves physiological responses to stressful situation in both socially anxious and healthy control individuals but seems to only help socially anxious participants in test of attentional bias and affect.

We thank the National Institute for Child and Human Development for financial support.

Poster 55

Computer Modeled Laser Investigations & CCD Camera Synchronization

A. Novicki, M. DeFeo, K. Moran, T. Roach
Department of Physics, College of the Holy Cross

We investigated the behavior of an external cavity laser system in which an external diffraction grating is used to reflect light back to the diode in order to have superior control of the frequency of the laser light. To do so, we developed a model that predicts the operating frequency of the laser based on the amount of current going into the laser, and the physical specifications of the laser system. Specifically, we looked at how patterns in the current tuning are related to diode facet reflectivity, external cavity length, grating reflectivity, and grating angle. In doing so we were able to discern how these system parameters contribute to the overall behavior of the laser. We found our model behavior agrees well with the measured tuning behavior of our custom-built external cavity laser, and should allow us to more easily optimize the laser tuning and stability. We also developed a way to synchronize the exposure of our charged coupled device (CCD) camera with a pulse from the laser so that we can take data during our experiments on cold rubidium atoms. The synchronization is important because the laser pulse illuminates the cloud of atoms as it evolves under the influence of gravitational and magnetic forces.

We thank the Mr. John F. Power and Mrs. Mary Figge Power for their generous contribution to the Alumni/Parent Summer Research Scholarship fund.

Poster 56

New Tetrahydrosalen Derivatives as Potential Metallopolymer Monomers

P. Burns and J.R. Farrell
Department of Chemistry, College of the Holy Cross

Polyelectrochromic materials change color as one varies an applied voltage. These materials have applications as displays, sensors, and as dynamic camouflage. We are preparing a series of hybrid phenol/thiophene complexes that will allow us to bind transition metals and then polymerize them into thin films. Progress in preparing and characterizing these molecules along with their condensation into multi-dentate ligands will be reported.

We thank Mr. David M. and Mrs. Michele Joy for their generous contribution to the Alumni/Parents Summer Research Scholarship Fund.

Poster 57

Evolutionary divergence of subspecies *Scaphinotus petersi*

Craig Connolly and Karen Ober
Department of Biology, College of the Holy Cross

The extravagant molecular and morphological diversity in insects offers good models to study evolution and adaptation. Beetles' evolutionary success and diversification makes them particularly well-suited for examining patterns and processes of morphological change. The Sky Islands mountain range in Tucson, Arizona is subject to the two main bioregional convergences of temperate and subtropical climates, as well as cold and hot adapted deserts. This creates a unique model of evolutionary divergence and ecological diversity. Because of these significant differences in climate, we hypothesized that the indigenous beetle subspecies *Scaphinotus petersi* underwent speciation and diverged into one or more new species. To determine whether the *S. petersi* subspecies are actually unique species, we assessed differences in size between the six subspecies of *S. petersi*. Femur length, tibia length, total leg length, head width, total body length, and other measurements were taken. We found consistent evidence suggesting females of all six subspecies are larger than males. Based on our measurements, we determined that *p. biedermani* was the largest, followed by *p. kathleenae, p. catalinae, p. corvus, p. grahami,* and *p. petersi*. Our study shows that female beetle morphology is larger than male morphology and that there is a significant size difference between the subspecies *p. biedermani* and *p. petersi*. This suggests that these beetle subspecies may indeed be two separate species that have diverged over time. Analyzing genetic differences, geographical differences, and mating complementarity will provide valuable insight to support this conclusion.

Poster 58

HateBook

Prof. Scott Malia, Danielle Santos and Patrick Simas
Department of Theatre, College of the Holy Cross

In this digital realm, bullying and teasing has migrated from our classrooms and playgrounds, and taken residence on our computers and phones. As technology continues to advance, more people fall victim to cyber bullying. Since teenagers spend a majority of their time on the Internet, they are most at risk for this potent and dangerous form of harassment. Even more at risk are LGBT teenagers. A number of factors including lack of social support and hopelessness have contributed to higher suicide rate among this group. Statistics show that they are 2-6 times more likely to commit suicide compared to heterosexual teens and yet this proves to be a highly controversial issue, sparking arguments from all sides as to how this issue should be dealt. After investigating various media forms and collecting data, we developed a research based, three act play, which began as a series of improvisational exercises, and were later fine tuned and scripted. We explored a multitude of dramatic conventions and genres to create a piece that displayed a truthful representation of our subject from multiple vantage points.

We thank the Mellon Summer Research Grant for financial support.

Poster 59

Social Interactions in the colonial Mygalomorph *Heterothele villosella*

Jennifer Bosco and Brian Moskalik
Department of Biology, College of the Holy Cross

Spiders are normally solitary animals, infrequently engaging in contact with conspecifics. In rare circumstances, species abandon their solitary tendencies and remain in a group. However, there are many potential trade-offs. Extreme inbreeding, reduced genetic diversity, high colony turnover rates and high rates of extinction potentially account for the rarity of this phenomenon. A potentially great model to address the evolution of spider (Mygalomorph) sociality is the Ischnocolid tarantula species *Heterothele villosella*, a minority among spiders in the fact that they are colonial. The social lifestyle of this species is not unique among its congeners but not all of them have been documented for sociality. Herein, we aim to examine fundamental interactions under environmental conditions influence this species' sociality. As we begin to understand the structure of *H. villosella* communities, we will also examine how social and environmental factors impact mating and territorial behavior. This understanding will contribute to the growing body of knowledge pertaining to the evolution of spider sociality and how the assembly of these communities affects the evolution of competition and social living in an otherwise solitary animal. Initially, we observe increase incidences of contact and cannibalism. After a few days of being undisturbed, individuals were observed to establish individual retreats. During this period, we observed social tolerance among individuals living in adjacent retreats. From these initial observations, we can assume that after a period of dispersal and adjustment, the increased rate of contact is the reason for increased incidences of cannibalism. After the establishment period, the observed social behavior can be attributed to the colonial nature of the species.

We thank Dr. and Mrs. Robert A. and Rhonda Harrington for their generous contribution to the Alumni/Parents Summer Research Scholarship Fund, and the American Arachneological Society for additional financial support.

Poster 60

Assessing and Responding to Autism in Underserved Populations

Meghan M. McCloat
Autism Speaks, College of the Holy Cross

Global Autism Public Health Initiative (GAPH) is a program designed to strategically determine the unique needs of autism communities around the world, striving to better understand and develop approaches to addressing challenges in autism awareness, research, and services in communities around the world. As the reported prevalence of autism continues to rise around the globe, so does the demand for information about and services to treat the disorder. The aim of the current project is to make recommendations for GAPH based on the successful elements of existing health service programs in other disorders that can potentially inform the development of autism-specific programs and ultimately provide sustainable healthcare programs for underserved communities, both in developed and developing countries. Specifically, an extensive literature review on existing autism services research and, more broadly, services research in other health conditions including non-communicable diseases, mental health, and developmental disabilities was conducted to identifying successful and potentially transferable elements of these programs. The results of this project included the identification of common barriers prohibiting autism program development in underserved communities, including access issues, lack of education, cultural stigma and language barriers. Thus possible solutions to developing successful programs that reach underserved communities around the globe may include community-centered kiosks to improve screening, urban and rural healthcare partnerships between academic centers and primary care providers, community representatives and tracking databases. Additional recommendations include the alliance of local autism community stakeholders including government to prioritize, develop and support innovative solutions that successfully and sustainably increase access to autism specific programs among the underserved. This report will allow Autism Speaks to make strategic funding decisions in supporting programs that will be most effective and have the greatest reach globally.

Poster 61

Understanding the relationship between nutrient stress and reduced fertility and mating in *Caenorhabditis elegans*

Marjorie R. Liggett and Dr. Michelle A. Mondoux
Department of Biology, College of the Holy Cross

Diabetes currently affects 25.8 million people in the United States. This disease, along with obesity and many cardiovascular diseases, has been linked to the consumption of high sugar diets. *Caenorhabditis elegans* have a conserved insulin-signaling pathway, making them an ideal model organism for studying the effects of excess glucose. Previous studies show that exposing *C. elegans* to high glucose conditions decreases fertility, however the cause is still unknown. One model suggests that glucose affects male fertility. I tested this model by performing mating assays on high glucose and found that mating was reduced by 30%. A lifespan assay with males on high glucose also showed that male lifespan was unaffected by glucose. These results showed a uniquely male sensitivity to glucose since the concentrations used were too small to yield any fertility defect in hermaphrodites but, unlike hermaphrodites, males seem to live just as long when on glucose. To better understand the cause of the mating defect, I tested the males' ability to come into contact with hermaphrodites on glucose and for changes in the morphology of the tail, the main copulatory structure of the worm. I found that mating efficiency and tail morphology were both unaffected by high glucose. Other possible causes of this mating defect may be the ability of the male to properly insert his tail in the vulva of the hermaphrodite, decreased pheromone signaling, or decreased sperm transfer or quality when exposed to high glucose. Future studies will explore these possibilities as well as other potential contributors to this defect.

This project was generously funded by an anonymous donor to the Alumni/Parents Summer Research Scholarship fund.

Poster 62

Measuring Physiological Markers of Arousal and Drug Craving in Opioid Users

Sean Gillespie and Dr. Gregory DiGirolamo
Department of Psychology, College of the Holy Cross

The current study seeks to investigate the arousal effects of viewing opioid-related cues in a sample of opioid users and opioid-naïve controls. A subject's arousal level is easily measured by pupil reactivity in response to these cues. In this study, an EyeLink 1000 eyetracking machine measures subjects' pupils as they are presented with a series of opioid and non-opioid (neutral) cues, in two blocks. After viewing each cue, subjects were asked how that cue affected their subjective level of craving for drugs (1-9), on a visual analog scale. One participant in the opioid-use group and seven healthy controls completed the experiment. The opioid user averaged a greater pupil response to drug-related cues than neutral cues, as compared to the control group, across both blocks. The opioid user also rated the drug cues as inducing more craving (m=1.22) than the neutral cues (m=1.02), as well as higher than controls rated drug cues (m=1.1). Thus, viewing drugs cues can sufficiently produce both arousal and craving in drug users. We plan to follow up this experiment with a study involving mobile sensor technology to measure and index the physiological responses of drug users to drug stimuli in real world situations.

Special thanks to the Richard B. Fisher Summer Research Grant for financial support.

Poster 63

Alcohol Use in Emerging Adult Light Smokers

Jennifer Daffron and Dr. Gregory DiGirolamo
Department of Psychology, College of the Holy Cross

Despite the well-known adverse health effects of tobacco use, including heart disease, cancers of the lung, throat and mouth, and chronic obstructive pulmonary disease (Surgeon General's Report, 2004), people continue to smoke. These rates are significantly elevated among 18-25 year olds, with emerging adults having the highest rate of current use in the last month (41.4%) amongst all ages (Substance Abuse and Mental Health Services Administration, 2009). Within this age range, only half (48.1%) of these smokers were daily smokers. Low-rate and infrequent smoking is, thus, common among emerging adults. Co-use or co-dependence of tobacco and alcohol is particularly concerning in emerging adults as hazardous drinking may compound the health risks associated with tobacco use. Perhaps not surprisingly, daily smokers consume greater amounts of alcohol and drink more frequently than non-smokers. These data might lead one to believe that only daily smokers expose themselves to the largest risks with their dependency in one drug proportionally influencing their consumption habits of other drugs. Logically, light smokers would then fall somewhere between non-smokers and heavy smokers on the alcohol consumption scale. We analyzed the data from the National Epidemiological Survey on Alcohol Related Conditions (a survey of 43,000 18-25 year olds) looking at specific subset of smokers and their drinking habits. Our smoking spectrum ranged from “daily smokers” to “very heavy smokers” who smoke 5 to 6 days a week to “very light smokers” who smoke once a month or less. The results reveal very light smokers drink significantly more alcohol more frequently than daily smokers. The risks posed to light smokers of co-use of tobacco and its effects on alcohol consumption is particularly concerning because light smokers may be less likely to quit smoking or participate in traditional smoking interventions because they do not identify themselves as nicotine dependent smokers thus prolonging their dangerous habits.

Funding was provided by the Cognitive Neuroscience & Technology Initiative of the Veteran’s Administration National Center for Homeless Veterans.

Poster 64

Historical Net Discount Rates: Corrected Data, Refined Calculations, and Revised Results

Andrew Kraynak and David Schap
Department of Economics, College of the Holy Cross

When a court orders compensation, the award is normally made as a lump sum payment. The lump sum must be equal to sum of future losses accounting for growth in wages or costs, future inflation, and discounting to present value. Historical net discount rates combine past wage or cost growth rates, interest rates, and inflation rates to provide a benchmark rate for discounting future losses. Ireland and Ireland and Tucek published a series of tables that compute historical net discount rates using arithmetic means. Spizman (2007) and Spizman and Weinstein (2008) address the shortcomings of using arithmetic averaging and explain that the proper method for averaging rates over time uses geometric means. The motivation for our project was to correct the inaccuracies caused by the use of arithmetic rather than geometric averaging in the previously published net discount rates. Because of the yearly compounding, even a small difference in a net discount rate could result in a large difference in a lump sum award. Creating our own tables of historical net discount rates, we discovered several different sources of error in Ireland’s and Ireland and Tucek’s tables including data entry mistakes, the use of out-dated data, and the use of arithmetic means. The largest difference we found among the multi-year averages or net discount rates was in the amount of 27 basis points. This small difference (.0027) applied to a life care plan of $100,000 per year for 50 years results in a difference in estimates exceeding a quarter of a million dollars in a lump sum award.

Financial support from the May and Stanley Smith Charitable Trust is gratefully acknowledged.

Poster 65

An Ion Source for Plasma Physics Collision Studies

Patrick Collins and Prof. Paul Oxley
Department of Physics, College of the Holy Cross

This presentation details tests of a Colutron Research Corporation ion gun system to produce beams of several different types of ion. Our tests included the production of positive Hydrogen, Argon and Nitrogen ions, which along with water ions are seen all together in several spectra of ion beam currents located in our presentation. The Hydrogen ions are the most interesting to our work as they will be used in future collision experiments between protons and neutral atoms. The ion gun assembly includes an ion source, a focusing and accelerating system, and a velocity filter. The ion source portion of the ion gun ionizes an input gas creating the ions. The ions are then focused and accelerated towards a velocity filter, where crossed electric and magnetic fields separates different ion types based on their respective masses. It is in adjusting the voltages and currents supplied to this velocity filter that we were able to separate the different types of ions. Several tests were run to determine the characteristics of the ion beams with respect to various ion gun parameters. Proton (H^+) and Ar^+ beam currents of up to 200nA and 6μA, respectively, have been achieved. Multiple tests were completed in order to measure the diameters of both the proton beam and the Ar^+ beam which were found to be ~4mm and < 2mm, respectively. Other results in our presentation include the relationship between beam current and ion system parameters such as background gas pressure, anode voltage and current, filament voltage and current, input gas pressure, focus and steering voltages.

We are very grateful to the Massachusetts Space Grant and the Richard Fisher Summer Research Grant for their financial support, to Dick Miller for machining expertise, and to the Colutron Research Company for their technical assistance.

Poster 66

Morphometric Analysis of the Mandible in the Avian Suborder *Lari*

Ariana Masi and Pr. Leon Claessens
Department of Biology, College of the Holy Cross

The mechanics of bird feeding is diverse and includes, amongst others, surface feeding, plunge diving, pursuit diving, and scavenging. The lower jaw is often subject to significant forces during feeding, and likely shows adaptations associated with the specific stress-regime of feeding. This study explored mandibular shape variation within 17 species of the suborder *Lari* (*Charadriiformes*), which includes gulls, terns, skuas and skimmers. Morphometric analysis of 32 landmarks highlighting the lower mandible, the fenestra, and the length of the beak, shows that there is an axis of shape variation that separates the species within the suborder. The first three principal components captured variation in the length and width of the mandible, the length of the rostrum mandibulae, the position of the fenestra, and the curvature of the lower mandible in the region of the angulus mandibulae. A regression of shape on centroid size showed little to no correlation, indicating that much of the observed variation in mandible shape was not due to variation in size. Altogether the results suggest that three-dimensional shape analysis can help elucidate evolutionary patterns in skeletal form and function. During the academic year, I plan to digitize associated skulls and mandibles in order to examine the kinematics of the quadrate bone during feeding and bill elevation.

We thank the National Science Foundation (ABI 0743327, to Professor L. Claessens) for funding this study.

Poster 67

Detecting Rebound in PARP Activity After a Period of Inhibition in Human Aortic Smooth Muscle Cells

R. S. Nomoto, H. Albadawi MD, M. T. Watkins MD
Vascular Research Lab, Massachusetts General Hospital

Intimal hyperplasia (IH) is an excessive growth of smooth muscle cells within the vascular wall after trauma and is a major cause of failure of endovascular and vascular reconstructions. Thus, effective therapeutic strategies to prevent or decrease its incidence have been explored. One of such targets is poly (ADP-ribose) polymerase (PARP), a nuclear enzyme that plays a critical role in many biological processes such as DNA repair and post-translational modification. PARP inhibition has been shown to prevent IH in a rat model of arterial injury. However, this research group saw an augmentation of IH in mice with arterial injury that received transient treatment of PJ34, a water-soluble PARP inhibitor. Our goal was to study whether the elimination of PJ34 after a period of PARP inhibition shows a rebound in PARP activity in human aortic smooth muscle cells (HASMC) stimulated with growth factors and hydrogen peroxide in vitro. No significant difference was observed in metabolic activity between HASMC that received continuous and transient treatment of PJ34 using the WST-1 Assay, but PARP inhibition increased proliferation of HASMC in vitro. Decrease in PAR level was observed by western blot in continuous exposure group, which suggest decrease in PARP activity. Based on these results, PARP inhibitors should be used with caution for treatment of intimal hyperplasia.

We thank the National Institutes of Health and Massachusetts Division of Vascular and Endovascular Surgery for their financial support.

Poster 68

Laser-induced Breakdown Spectroscopy (LIBS) Analysis of Air

Kara Brownell and Jude Kelley
Department of Chemistry, College of the Holy Cross

Laser-induced breakdown spectroscopy (LIBS) utilizes a laser focused on a sample to create plasma with an emission spectrum characteristic of that sample. A glass gas cell was constructed and used in conjunction with mass-flow controllers to obtain spectra of gases. Air and its major components were analyzed. The glass gas cell ensured that only the gas of interest was being excited by the laser. The mass-flow controllers allowed us to analyze the spectra of different gases, of a single gas at various flow rates, and mixtures of gases. Spectra of air and its major component gases, nitrogen, oxygen and argon were obtained with the gas cell. In order to identify the peaks in the air spectra, a peak analysis program in LabView was used. To improve our program's identification algorithm, a series of spectra of increasing amounts of air and decreasing amounts of nitrogen was taken. This served to better identify the peaks in the air spectra associated with oxygen and argon. A spectrum comprised of a linear combination of air's component spectra was made according to their relative percent abundances. The resultant theoretical air spectrum was then compared with an actual air spectrum showing that overall the two were very similar.

This research was supported by a generous contribution by Mr. and Mrs. Richard K. and Lindsay Watson to the Alumni / Parents Summer Research Scholarship fund.

Poster 69

Minocycline Treatment Reduces SIV and Alters Macrophage Immunophenotype in the GI of SIV-infected Rhesus

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HIV is a severe retroviral infection that is driven by immune dysregulation in the human body. Infected monocytes carry the virus into the CNS and induce a response in microglial cells, the resident macrophage in the brain. Once the microglia are activated, they begin to produce neurotoxic substances and viral products that cause neuronal injury and dysfunction. This can result in dementia or what is referred to as HIV-associated neurocognitive disorders (HAND). The GI tract is a site that fosters large amounts of viral replication, and it is thought that the level of immune activation in the GI tract may impact the level of immune activation in the brain. We hypothesized that the degree of neuronal injury would decrease if the viral load and subsequent immune activation in the GI tract could be controlled by minocycline. Minocycline is an antibiotic with anti-inflammatory properties that has demonstrated neuroprotective qualities in studies of other CNS diseases, such as Multiple Sclerosis and Parkinson's. Minocycline prevents T-cell migration into the CNS and suppresses the p38 mitogen-activated protein kinase cascade in microglial cells, thus inhibiting their activation. We analyzed tissues from CD8-depleted SIV infected rhesus macaques to determine the effects of minocycline virus and immune activation in the colon. Eight age-matched rhesus macaques were infected with SIV and CD8+ T-cell depleted using a monoclonal antibody. Four of these eight received oral minocycline (MN) while the other four received no treatment. Eight other age-matched uninfected macaques were used as controls. Four of these controls were CD8+ depleted while the remaining four were not. Immunohistochemistry (IHC) was performed on tissue sections of the small intestine (SI) and large intestine (LI) of these macaques. IHC was used to asses much information including: the overall level of tissue virus burden (SIVnef), the level of T-cell depletion (CD3/CD4), the degree of immune activation (CD68, CD163, CD16, CD206), and the rate of intestinal epithelial cell apoptosis (activated caspase 3). We sought to determine the ability of MN to reduce immune activation in the GI tract and how this may impact the brain.

Poster 70

The Role of Attention in Primacy Effects in Memory

Nathan Guevremont, Sean Gillespie, and Dr. Gregory DiGirolamo
Department of Psychology, College of the Holy Cross

Memory for an object is most influenced by the first representation of that object. Participants are more likely to report having seen only the first version of an object than subsequent altered presentations (DiGirolamo & Hintzman 1997). The present study explored whether that primacy effect is due to a difference in initial encoding of the first presentation of the object, altered perception of subsequent presentations of the object, or diminished retrieval processes at memory test for the two objects. Participants performed a visual memory task in which they were told to remember a series of visual objects where some objects appeared twice at either the same or different sizes. Their eye movements to these objects were recorded. They were then tested in a forced-choice task where they were presented with two versions of the same object, one big and one small, and asked to determine whether they had seen one, both, or neither of the objects. As expected, preliminary results indicate that participants are generally more likely to report having seen only the first version they had seen than the second version. Furthermore, although the actual size of their eye movements was not significantly impacted by the first presentation, the number of total eye movements was altered. That is, participants' attention to subsequent presentations are affected by earlier presentations of an object.

Funding for this research was provided by a generous contribution by an anonymous donor to the Alumni / Parents Summer Research Scholarship to Nathan Guevremont and a Richard B. Fisher Summer Research Fellowship to Sean Gillespie.

Poster 71

Physics of Baseball: On the Nature of Spin

R. Eslinger, D. Barrett, N. Solman, and Pr. Matthew Koss
Department of Physics, College of the Holy Cross

In the study of the physics of baseball, we have delved into the nature of the ball's spin, or angular velocity. This summer, we developed a rigorous method to calculate the angular velocity of a baseball in linear motion at a specific time interval. With the use of high-speed 1000 fps cameras we captured the ball's motion exiting one of our three pitching machines. We then selected a 20 – 30 frame spread of data, and, using image editing software, tracked a marked dot on the ball in terms of its pixel location. With those pixel locations, along with the ball's radius and midpoint (in pixels), we were able to determine the ball's angular velocity in that time interval with our equations. We then moved to create a large data set of initial angular velocities of our pitching machines at variable settings. At the close of the summer we began our field house testing, launching the ball in a parabolic arc with cameras capturing its initial and final angular velocities. With those two angular velocities and the time differential (Δt), we calculated the time constant (τ) of the assumed exponential decay during the ball's flight.

The research conducted by R. Eslinger and D. Barrett was funded by the generous contribution of an anonymous donor to the Alumni / Parents Summer Research Scholarship fund. Work conducted by N. Solman was funded by a Massachusetts Space grant and by funds from the Richard B. Fisher Summer Research grant.

Poster 72

A Geometric Morphometric Analysis of Tarsometatarsal Ecomorphology in Birds

Maggie Johnson, Andrew Biedlingmaier, Jennifer Leavitt, Ariana Masi, and Pr. Leon Claessens
Department of Biology, College of the Holy Cross

Birds exhibit a wide variety of locomotion and foraging behaviors. Using geometric morphometrics, we studied shape changes in the left tarsometatarsus, a bone that makes up one of the three major segments of the hindlimb, to examine phylogenetic and functional influences on shape change. We 3D scanned 69 specimens (covering 63 different species), and digitized 40 landmark points on each bone using the computer program Landmark. A Principal Component Analysis was performed to calculate the shape changes among specimens. The majority of variation (74.4%) was found in the first two principal components. The first principal component shows variation in the overall shape of the tarsometatarsi. The positive end reflects a short and wide shape, while the negative end represents a long and narrow bone. The second principal component reflects shape variation in the distal end of the tarsometatarsi. We classified specimens based on habitat, locomotion, and phylogenetic placement. At this point in our research, the data do not give any clear indication of a pattern between locomotion and principal component value, but classification by habitat type does show some promising preliminary groupings. Particular groups that show correlations in our preliminary analysis include the water birds, birds living in grasslands, and those occupying sparsely vegetated areas. We hope that with the addition more specimens to our analysis during the academic year, we will be able to demonstrate significant correlations between shape, function, and phylogeny. Water birds, Sparse, and grasslands.

We thank the National Science Foundation (NSF Aves 3D, L. Claessens) for funding this study.

Poster 73

The Use of LIBS to Detect Heavy Metal Pollution in Blackstone River Sediments

K. Tracy and J. Kelley
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Laser induced breakdown spectroscopy (LIBS) is a technique that uses a highly focused, pulsed laser beam to strike a sample and create a superheated plasma. This plasma emits light characteristic of the elements within the sample. The resulting spectrum is analyzed to determine what elements are present (qualitative information) as well as the amount of each element present (quantitative information). We are developing a LIBS methodology for a fast and inexpensive way of quantifying heavy metal pollution in river sediment. Last summer we compared the results we obtained from our LIBS instrument with the more traditionally used method of Atomic Absorption (AA) Spectroscopy. Over the course of this summer's research we worked on developing a better optical setup for acquiring LIBS spectra and quantifying heavy metal contamination on the Blackstone River. The previous LIBS set up used a long focus lens (400 nm) which required the laser to be operated at a high power. This had the disadvantage of shot to shot fluctuations in spectrum intensity and location, which caused a higher degree of error compared to other analytical techniques. We are experimenting with the use of a lens with a shorter focusing distance (100 nm) and a lower laser power to minimize sample ablation and achieve a more stable, localized plasma. We have also further developed methodology for analyzing experimental uncertainty.

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

Poster 74

Locomotion & Habitat Effects on Avian Hind Limb Morphology

Jennifer Leavitt and Pr. Leon Claessens
Department of Biology, College of the Holy Cross

The hypotarsus, a posterior-facing projection on the middle-foot bones of birds, serves as an attachment point for multiple tendons and ligaments involved in plantar flexion of the foot. We hypothesize that in birds who typically require powerful leg strokes, such as swimmers, it would be biomechanically advantageous to have a more pronounced hypotarsal projection on the tarsometatarsus. To test this hypothesis we photographed the long bones of the hind limb and digitally measured hypotarsus (HPT) depth, and length of the tarsometatarsus (TMT), tibiotarsus (TBT) and femur (F) of 60 bird species that span a diversity of locomotion and habitat specializations. Individual species were placed in one of six locomotion groups including ground, swimming, wading, aerial, tree, and birds of prey, as well as one of eleven habitat groups, such as forest, open landscapes, marshland, and ocean. Ternary plots of the HPT, TMT and TBT values were made. Early analysis of data indicates a correlation between morphology and functionality of the hind limb in several groups, including swimming birds and terrestrial taxa. By increasing our sample size and expanding our analysis with new analytical approaches, we hope to confirm the existence of statistically significant differences in the future, and increase the accuracy of our analyses. The ecomorphological framework established by this study may prove useful to interpret biomechanical behavior in fossil taxa in the future.

We thank the National Science Foundation (ABI 0743327, to Professor L. Claessens) for funding this study.

Poster 75

Digitizing the Dodo: Creating a 3D model of a unique, articulated skeleton in Mauritius, Africa

Andrew Biedlingmaier, Jennifer Leavitt, and Pr. Leon Claessens
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The much mythicized dodo (*Raphus cucullatus*) is an archetype of recently extinct species. Details of the bird's extinction remain cloudy, yet human settlement of its homeland of Mauritius has been associated with the dodo's demise. Much of our knowledge is derived from not always accurate artistic renditions of the bird and travel logs from Dutch expeditions to the island in the 17th Century, but surprisingly little is known of the dodo in a modern scientific context. Very little skeletal material has been preserved, and much of this was collected over a century ago with poor documentation. In August 2011, we traveled to Mauritius with our lab's 3D scanning equipment to create a detailed, three-dimensional model of what is likely the only complete dodo skeleton in the world. This articulated skeleton, housed at the Mauritius Natural History Museum, is unique because all of its components are from the same individual. However, the skeleton has never been described scientifically, and is difficult to access for scientific research. We also scanned rare skeletal elements excavated, under modern scientific conditions, at the Mare aux Songes marshland by the Mauritian – Dutch Dodo Research Programme. During the academic year, we will use the 3D models of the articulated skeleton in the first detailed study of hindlimb locomotion in this flightless bird.

We thank the National Science Foundation (NSF Aves 3D, L. Claessens) for funding this study.

Poster 76

Drosophila synaptotagmin I and *IV* interact in a genetic assay

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Synaptotagmin I and synaptotagmin IV both seem to promote peptidergic release in *Drosophila* neurons. However, the extent of their interaction in this process is unclear. *Synaptotagmin I* and *synaptotagmin IV* double mutants are lethal before adulthood and thus this interaction cannot be studied directly. Percent survival of larva at four days post egg laying was used to indirectly measure the genetic interaction between the two mutations. Previous studies showed that synaptotagmin I knockouts, synaptotagmin IV knockouts, double knockouts, heterozygous genotypes, and wild type controls survived at 57, 74, 0, 65, and 85 percent respectively. In order to complete the data of genetic combinations, flies were crossed to obtain larva combinations with genotypes that were homozygous at one synaptotagmin locus and heterozygous at the other synaptotagmin locus. Embryos with the proper genotype, marked by the absence of GFP, were selected and put into individual food wells. Each larva was identified three days later as either alive or dead to assess percent survival. We hypothesized based on the appearance of a genetic interaction between the two genes from the previous data that our new genotypes will survive at an intermediate value between the double knockouts and the single synaptotagmin knockouts. Our preliminary findings agree with this hypothesis and help support the larger prediction that the genetic interaction between the synaptotagmin I and IV genes involves each operating in parallel pathways.

We thank the BD Corporation, the Sherman Fairchild Foundation, and the Richard B. Fisher Summer Research Fellowship for financial support.

Poster 77

Recognition of a single nucleotide polymorphism in *TAS2R38* by *Hae*III can be used to predict bitter tasting ability

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The ability to taste the chemical phenylthiocarbamide (PTC) is a dominant trait determined by the *TAS2R38* gene, one of approximately thirty genes for bitter taste receptors in mammals. This gene is notable for three variable positions known as single nucleotide polymorphisms (SNPs). Differences in these SNPs decide PTC tasting ability. One of these SNPs is recognized by the restriction enzyme *Hae*III and through restriction fragment length polymorphism (RFLP) analysis, bitter tasting ability can be predicted. We modified a procedure from previously published techniques and tested its application as an introductory biology lab where students will become familiar with genetic mutations, resulting phenotypes and common biological procedures. DNA is isolated from a hair root cell and protein contamination inactivated with proteinase K. The genomic DNA region of interest was then amplified through PCR, digested with *Hae*IIII, and run through gel electrophoresis to be analyzed. After testing 13 undergraduate hair samples, we confirmed that PTC tasters display two bands of DNA fragments 177 and 44 base pairs long while nontasters are distinguishable for a single band at 221 base pairs. We created both a student manual and a TA preparation guide. We will test this laboratory exercise with an introductory biology class in Fall 2012.

We thank the BD Corporation, the Sherman Fairchild Foundation, and the Richard B. Fisher Summer Research Fellowship for financial support.

Poster 78

Latitudinal variation in glacial cirque altitudes

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Glacial erosion at the base of cirque headwalls and the creation of threshold slopes above cirque floors may have a role in the "glacial buzzsaw" in limiting the altitude of mountain peaks. Since glacial extent and therefore glacial erosion rate depends on the equilibrium line altitude (ELA) of a region, the altitude of cirque formation should be a function of the ELA. Regional studies have shown that cirques form at an altitude midway between the modern and last glacial maximum (LGM) ELAs in some mountain ranges, but a global correlation has not yet been demonstrated. We examined the correlation between cirque altitudes and global ELA trends by compiling existing data for cirque locations and altitude in several mountain ranges. We also used ArcGIS, 30 m to 100 m resolution digital elevation models, and geo-referenced 1:50,000 scale topographic maps to locate cirques and measure cirque altitude and relief in additional ranges. For each range we calculated the average cirque altitude, relief, and latitude and compared the altitudes to the East Pacific modern and LGM ELAs. For the ranges studied, the average cirque altitudes generally fall between the modern Eastern Pacific and LGM ELAs. In the northern hemisphere, cirque altitude gradually increases towards the north from the LGM ELA to the modern ELA. Average cirque altitudes in the southern hemisphere are midway between the LGM and modern ELA. This evidence supports the hypothesis that cirque formation is dependent upon the ELA, and that cirques likely form during average, rather than extreme, glacial conditions. There is also evidence suggesting that peak heights are restricted to < 600 m above the cirque basins. The correlation between cirque altitude and ELA, along with the restricted window of relief, implies that cirque formation is a factor in limiting peak altitude in ranges that rise above the ELA.

We thank Mr. and Mrs. Herman R. and Mary Charbonneau for their generous contribution to the Alumni / Parents Summer Research Scholarship fund.

Poster 79

Effect of Abstract Reasoning Activities on Mathematical Competency in Preschoolers at a Low-Income School

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Early mathematic interventions can enrich the development of young children's mathematical competence. Previous research has shown that math skills at the start of preschool are indicators of future academic performance. This study focused on encouraging more abstract reasoning with numbers among low-income preschoolers in order to promote broader numeracy skills. Preschool children with ages ranging from 3-5 years were randomly assigned to one of three groups: an interactive iPad number pattern game, in which the emphasis was on examining abstract relationships among numbers, a group which played a linear number-based board game presented on the iPad, and a control group. Results demonstrated that the students' performance on a standardized test of numerical competency improved significantly after only four 15-min intervention sessions, regardless of treatment condition. Future research should examine the key variables that contribute to such a dramatic intervention effect.

We thank Mr. and Mrs. Dean M. and Victoria Boylan and Mr. and Mrs. James and Jeanne Moye for their generous support of the Alumni / Parents Summer Research Scholarship fund.

Poster 80

Protein Splicing: Reactivity of Specific Inteins

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Inteins are polypeptides flanked by two polypeptides, all contained in a single protein. By a process known as protein splicing, the intein removes itself in a self-catalyzed reaction. The reaction begins as the peptide bond which links the N-terminal extein to the intein undergoes an amide to thioester rearrangement. In the inteins of both Methanoculles marisnigri (Memar) and Methanospirillium hungateii (Mhu), we see both inteins take two separate paths after the rearrangement. Each intein has been observed to splice or cleave their N-terminal extein. In a reductive environment we witness the reactions proceeding mostly to completion, but in a more oxidative environment we were able to halt the splicing and cleavage to a greater degree. Through the use of site directed mutagenesis we were able to change the amino acid sequence of the intein and increase its reactivity. Through studies of the intein in vitro we have been able to observe an effect on its reactivity in different redox conditions. Furthermore we have subcloned the Memar intein, the Mhu intein and the intein from the organism Halobacterium salinarium (Hsa) into a context where it is flanked by different exteins. From here we hope to further understand and alter its reactivity. We will then use site directed mutagenesis to make comparisons between different mutations within each intein, and also comparisons between the similar but different inteins of each organism.

This work was supported by the National Science Foundation, the Dreyfus Foundation and by an anonymous donor to the Alumni / Parents Summer Research Scholarship fund.

Poster 81

Characterization of the Anti-HIV Protein APOBEC3G

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The protein APOBEC3G (A3G) exhibits antiviral function against Human Immunodeficiency Virus (HIV) in human immune cells including T cells and macrophages. Currently, the antiviral function of A3G is primarily attributed to its DNA mutator capability. However, several studies have found indications that A3G exerts significant antiviral activity independent of its mutator function. To further identify and characterize the domains of A3G that contribute to its function as a restriction factor, our lab created a library of 135 mutant A3G constructs, 92 of which retain antiviral activity. The ability of the mutant A3G constructs to mutate DNA was examined in a bacteria-based assay. The assay relied the generation of antibiotic resistance mediated via A3G expression and exertion of its mutator effect. To verify the results of the assay, we qualitatively examine and compare expression levels of the A3G constructs via Western blotting. The results of the antibiotic resistance assay can delineate regions of A3G necessary for mutator activity as well as contribute to the understanding of A3G structure. Mutant A3G constructs that retain mutator activity identify regions of the protein that do not significantly influence the catalytic ability of A3G to mutate DNA. In contrast, mutant A3G constructs that exhibit a loss of mutator activity delineate regions of the protein that are important to the catalytic function. In addition, because we previously found that these mutants retain antiviral activity, these non-mutating constructs indicate antiviral function independent of DNA mutator activity. The non-mutating A3G constructs provide a new avenue of research for examining the antiviral function of A3G.

We thank an anonymous donor for his generous contribution to the Alumni / Parents Summer Research Scholarship fund.

Poster 82

Pathogenesis of Uropathogenic E. Coli and Evaluation of Routes of Vaccination for Urinary Tract Infections

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Urinary tract infections are extremely common infecting 40% of women and 12% of men at least once in their lifetime. Uropathogenic ecoli (UPEC) is the most common bacteria causing uncomplicated infections. The first project evaluated the host response to UPEC by comparing cytokine response. Previous experiments in mice have shown elevated levels of both IL-33 and IL-13 cytokines as a result of infection with UPEC. Analysis of human urine samples show that patients with bacterial colonization have higher levels of IL-33 and IL-13 cytokines compared to patients with no bacterial colonization. This data supports the existence of the Il-13 IL-33 axis in human patients with bacterial cystitis. In a second project, the ΔwaaL strain of E. Coli was evaluated as vaccine candidate. Different routes of instillation of the vaccine were compared as to the effectiveness of the vaccine in developing adaptive immunity against UTIs. The results showed that both nasal and subcutaneous routes of vaccination are sufficient for induction of adaptive immunity against UPEC in vivo.

Special thanks to the National Institutes of Health and the American Urological Association for financial support.

Poster 83

Skin Equivalent: An Indispensable Tool in Skin Research

Myung Jin Lee
Chanel Inc. Skin Cell Biology Laboratory

Skin protects internal organs from damage due to environmental stress, prevents water loss, aids in temperature regulation, and defends against microbial infection. This largest organ of the body is mainly composed of three layers: the epidermis, the dermis, and the hypodermis. Keratinocytes are the main cellular component of the epidermis; melanocytes reside in the lower epidermis at the junction with the dermis; and fibroblasts reside in the dermis. To better understand skin function, these cells may be studied separately, or together in a three dimensional skin equivalent (SE) model. This research focuses on the effect of UV irradiation or an active ingredient on SE structure. To prepare SE, a collagen solution containing normal human epidermal fibroblasts is prepared and solidified to mimic the dermis. Normal human epidermal keratinocytes are added on top as the epidermis. SEs are differentiated to form stratum corneum by exposing the epidermis to air. To study the effects of an active ingredient or UV irradiation, SEs are treated with an active or UV, then processed into paraffin blocks and further to slides for staining and imaged using microscopy. I observed differences in morphology of treated SEs, compared to untreated controls, which represent the influence of treatment. Changes include epidermal thickness and presence of sun-burn cells. Therefore, SE helps advance skin research by approximating the potential effect of a treatment on human skin without using animals, and allows scientists to better understand skin biology.

I sincerely thank the Chanel Skin Cell Lab: C. Lasserre, A. D'Arcangelis, E. Fedorova, J. Namkoong, and A. Leo for their guidance. I also thank the NY Leadership Council and Summer Internship Program for the stipend and support provided.

Poster 84

Development of a Lean Strategy for Residual Solvent Testing in Pharmaceutical Ingredients

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Pfizer's SLS Analytical Department routinely receives requests from companies to develop and validate residual solvent methods in response to regulatory queries or to support regulatory submissions in pharmaceutical ingredients. Since these methods must be provided under tight timelines, streamlining the process to reduce time for method development and validation will allow Pfizer to more rapidly provide reliable data and meet their customers' needs. The European Pharmacopoeia (EP) residual solvent method was assessed via headspace gas chromatography. A lean strategy was desired to screen residual solvents less than 10% of the International Confrence Harmonisation (ICH) limit so routine testing of active pharmaceutical ingredients can be avoided. Limitations of the EP method included DMSO and DMF blank interferences and DMF carryover; thus it may be in the company's best interest to avoid the EP method when possible.

We thank College of the Holy Cross Summer Internship Program, Pfizer's Scientific Laboratory and Services Analytical Department; AST in Groton, Ct, and Atrium for their support.

Poster 85

Investigating Novel Targets on APOBEC3G (A3G) Domains as Areas for Anti-HIV Therapy

Thomas Gallant and Pr. Ann Sheehy
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HIV is a retrovirus that attacks and kills cells of the human immune system, leaving the host vulnerable to decimating opportunistic infections. Recently, a natural defense against HIV was discovered. This defense is the APOBEC3G (A3G) protein. While this protein is most often subject to viral regulation, via a direct binding event involving the viral infectivity factor Vif, preliminary clinical data suggests that this interaction may be overcome. By characterizing the regions of the A3G protein that are critical for Vif-mediated regulation, we may be able to liberate A3G from viral control thereby enhancing host defenses. Using past studies, we scanned through a library of mutant A3G constructs for their ability to restrict a wild-type HIV infection. Our screen focused around mutation H248A, which has been previously discovered to break away from Vif regulation. This mutation was tested again with a new user and yielded the same results. Areas around amino acid 248 will continue to be tested in order to determine if the amino acids in this specific area are able to disengage from Vif regulation. This data suggests a novel site of Vif:A3G interaction which may serve as a unique target for future therapeutic intervention.

We thank BD Corporation for their financial support.

Poster 86

Behind the Constitution

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The United States Constitutional Convention of 1787, after many compromises and debates, drafted the proposed federal constitution, which was sent to each of the thirteen states to ratify. Superficially, these compromises and debates can be delineated in fairly simplistic terms: Big State vs. Small State and North vs. South; however, when looking deeper at the state constitutions and the ratification debates, one can see that the arguments found in the these ratification debates are based on more underlying principles of government. The consistent debates that were discussed in each state convention, such as debates over whether or not to include a Bill of Rights, the nature of separation of powers, and whether "We the People" is an appropriate phrase, emphasize the underlying factors that tie the states together and to the federal constitution. The interdependent nature of the people, newspapers, and constitutions themselves illustrate that the split between opposing sides is not a superficial or a physical boundary. The boundary that details that major fission between opposing sides in the state ratifying convention originates within the deeper principles of government that the people adhere to and disagreements over how that should translate into a written constitution.

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Poster 87

Implicit Chaining with Equated Elements in Cotton-top Tamarins

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Implicit learning, a process in which humans learn without awareness, has been proposed to occur in infants as they gain the ability to use language without explicit instruction (Reber, 1967). In a previous study (Nissen and Bullemar, 1987), a serial reaction time task was administered in which subjects were asked to press a designated computer key that corresponded to spatial locations on a computer screen. One group was exposed to a repeating sequence of 10 spatial locations, and the other group was presented with randomly presented locations. It was found that subjects tended to have faster reaction times in response to patterned information compared to random information. Post-experimental questionnaires indicated that subjects in the repeating sequence group were not generally aware that they had received patterned information. This finding indicated that the subjects learned without awareness or explicit instructions. Our study sought to determine whether the ability to learn implicitly is present in non-human primates, specifically cotton top tamarins. Using a procedure similar to Nissen & Bullemar (1987), tamarins were presented with a five-element sequence of images arranged according to ABCDE sequence. Each element in the sequence corresponded to a location on a six-quadrant touch screen at which a stimulus was presented. Subjects were required to touch the image in order to advance in the sequence, and were reinforced randomly with a probability of .2 per element. Consistent with the Nissen and Bullemar study, the latencies in response time were compared during acquisition and random phases. The results of this study showed higher latencies during the random test than during training on the pattern. This finding indicates that the subjects learned at least some transitions between elements without contingent reinforcement for doing so.

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Poster 88

New Tridentate Aminoalcohol Ligands

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Phenol heteroligands, commonly synthesized though a Mannich Condensation, have been used to bind to metals, which in turn are used as catalysts in reactions that mimic those that commonly occur in the human body. In order to understand the effect of the phenol substitution on reactivity towards Mannich Condensations and the solubility and binding properties of the amino alcohol products, different conditions were tested to determine the optimal conditions for producing heteroligands. In conclusion, all heteroligands required different conditions since the different substituted phenols were either electron withdrawing or donating. All heteroligands that had the pure one-armed dichlorophenol as the amine contributor were able to be isolated, whether through a column, recrystalization, etc. Those that required the one armed dimethylphenol, ditbuylphenol or ditamylphenol as the amine contributor experienced difficulty due to the fact that the substituents on the phenol were all electron donating, making them weak electrophiles. With further research, we hope to isolate pure products of all six heteroligands, which can then in turn be used to bind to metals and then observe their effectiveness in catalysis reactions.

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

Poster 89

PARP's Involvement in Ischemia Reperfusion *In Vivo*

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The purpose was to define the activity of the enzyme, poly-ADP-ribose polymerase (PARP), in acute and regenerative phases of reperfusion injuries in various cellular components *in vivo*. Mitochondrial and nuclear extraction kits were used to isolate mitochondrial, nuclear, and cytosolic fractions from tissue harvested in the hind limb posterior compartment calf muscle of C57BL6 mice. BCA assays were performed to quantify the protein level in each sample. Western blotting was then used to qualitatively and quantitatively measure PARP activity. From densitometric analysis, the nuclear fractions were found to have the greatest PARP activity followed by mitochondrial and cytosolic fractions.

This research was funded by the Division of Vascular and Endovascular Surgery, Massachusetts General Hospital.

Poster 90

The Association Between Executive Compensation and Audit Fees

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Prior research documents a positive association between total CEO compensation and audit fees. This research investigates whether the association changes for the type of CEO compensation and/or the mix of audit fees. Furthermore, it examines whether the association is affected by the passage of the Sarbanes-Oxley Act 0f 2002, which significantly increased regulations surrounding the monitoring of financial statements. Executive compensation and audit fee information was collected for 54 large S&P listed firms from 2000-2009. The regression used by Wysocki (2010) was replicated for both total compensation and stock compensation. SOX interactions and non-audit fees were also added to the regression to see if the association varies across governance or with types of audit fees. Our preliminary results are similar to Wysocki (2010). We have a much smaller and more homogenous sample but find close to a significant positive association between executive compensation and audit fees, with a stronger association for stock compensation than total compensation. We also find that SOX reduces the association between stock compensation and audit fees but not total compensation. The passage of SOX changed the mix of compensation by reducing the amount of stock issued but did not change the total compensation. Non-audit fees do not seem to be associated with either type of compensation. Further research is necessary in order to expand the sample to include all S&P 500 listed firms and to address endogeneity problems.

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Poster 91

The Effect of Academy Award Competition on Market Share

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This paper investigates how the value of an Oscar nomination or win varies over time with the number of award categories and number of nominees per category. Over the past decade, the Academy of Motion Picture Arts has made two noteworthy changes impacting the race for best picture. First, in 2001, the Best Animated Feature category was introduced, recognizing up to five animated films in a separate award category. More recently, in 2009, the Academy increased the number of nominees in the Best Picture category from five to ten with a goal of increasing recognition for deserving films. Several prior studies have estimated the financial benefits associated with a Best Picture Oscar, finding that nominees and winners enjoy higher box office revenues, an increased market share of theaters, and a larger share of the rental market. This study investigates how these benefits differ as competition within and across award categories changes. Using a panel of weekly box office data for nominated and non-nominated films from 1999 to 2011, we test for changes in revenues and market share of nominees and winners as the number of nominees and categories increases over time. Preliminary results suggest that increasing the number of nominees in the best picture category negatively impacts box office revenues of nominated films in that category.

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Poster 92

Laws Affecting Forensic Economic Calculations: Discounting, Interest, Income Taxes and Inflation

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States differ in their statutory and case law requirements affecting how practicing forensic economists compute appraisals in cases involving lost income over time. Due to the fact that courts typically award damages in a lump-sum fashion rather than as structured payments over time, our legal research concentrated on four key characteristics in state law governing the practice of discounting by forensic economists in cases involving personal injury or wrongful death: (1) discount method, (2) pre- and post-judgment interest, (3) income taxes and (4) inflation. The results of our research are compiled into a color-coded table divided into 50 sections which include detailed findings cited in Bluebook citation format and categorized under the heading of one of the four characteristics. Color codes reference sources that include LexisNexis presentations of statutory and case law found via key word searches; extracts from the state series appearing in the journal affiliated with National Association of Forensic Economics (NAFE); excerpts from entries found at forensic economic websites; and cautionary notes found by, as a final step, Shepardizing at LexisNexis the case law material gathered from the aforementioned sources, to assure accurate up-to-date content. Due to the fact that the law constantly evolves, we intend to launch our results electronically and hope to do so at the NAFE website, inviting ongoing comment on each state entry as a blog, then periodically updating by rewriting the entries to take account of the blog commentary.

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Poster 93

Public Security Versus Student Privacy

Pr. Scott Sandstrom and Casandra Medeiros,
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College campuses are expected to be safe environments where students increase their capacity to think. However, with violent school attacks, like the Virginia Tech shooting, the pleasant perception of a college campus disappears. What then can schools do in order to avoid such tragedies from occurring? Unfortunately, with federal privacy acts, constitutional rights, and other legislation, a school is quite limited, as to how much prevention can take place. The Family Educational Rights and Privacy Act obscures schools' abilities to disclose information about a student's educational record, including mental health records and a student's disciplinary history. Federal funding may be lost if a student's information is inappropriately released. The Health Insurance Portability and Accountability Act, also protects students' medical information, impeding a school from knowing whether or not a concerning student has a mental disorder. Furthermore, the Americans with Disabilities Act prevents schools from mentally evaluating students as part of the college admission process. Finally, the First Amendment, the Second Amendment, and the Fourteenth Amendment, are all constitutional rights that schools must not violate when assessing a student who exhibits alarming behavior. The Department of Education and many other agencies have established safety guides so that schools can properly assess potentially dangerous students without violating students' rights, but still protecting the public. Nevertheless, we propose that: federal acts should be amended so that more information about incoming students is disclosed, requiring the mentally ill to continue treatment, and requiring all threats to be assessed by teams.

We thank the May and Stanley Smith Charitable Trust for their support.

Poster 94

The Effect of Separations and Hires on Crime Crime

Robert Baumann, Bryan Engelhardt, and Gregory Goding
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It has long been known that crime and unemployment are positively correlated meaning the higher the unemployment, the higher the crime rate. We wanted to take this idea one step further and determine whether crime is dependent on the hire and separation rates. That is, does the rate at which an individual is hired and fired from their job affect their propensity to commit crime? In our research, we first used state level to determine the effects of the hire and separation rates on property and violent crime. We then decided to determine the effect using individual level data obtained from the National Longitudinal Survey of Youth (NLSY). For the empirical results, we used the Uniform Crime Reports and the Job Openings and Labor Turnover Survey (JOLTS) at the state level. Our research found that when the sepration rate increases for workers, total crime increases. Employed workers commit less crime while unemployed workers tend to commit more crime. We also investigated the results for the hire rate and found that when the hire rate increases, the employed are more likely to commit crime while the unemployed are less likely. Finally, we did some empirical regressions and found that the hire rate, separation rate, quit rate, and percent black were all significant at a .10 level.

We thank the May and Stanley Smith Charitable Trust for financial support.

Poster 95

How Reasonable Is It To Assume Full Information Between Buyer And Seller In The Housing Market?

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Many environmental economists have utilized the house price hedonic model to estimate the price of environmental goods. The house price hedonic model in essence quantifies the contribution of an environmental good to the price of a house on the market. In order to put a price tag on an environmental good, you must assume that buyers purchase a home implicitly understanding that they are also buying the environmental factors that may effect the house. In order for this model to accurately capture the price of an environmental good, buyers and sellers must have full information of these environmental factors. Our research explores this assumption of full information by examining the environmental factors included in disclosure laws for all fifty U.S. states. We find that there are many inconsistencies with the number of disclosures between states. In addition, most required disclosures simply inquire about environmental externalities on the specific property. Only three states require that sellers disclose information on environmental externalities nearby. These states are Alaska, Colorado, and Rhode Island. With such discrepancies in disclosure laws, many hedonic studies that rely on the assumption of full information may have understated the price of environmental externalities.

We thank the May and Stanley Smith Charitable Trust for their support.

Poster 96

What's Left Behind is What's Ahead: Using Fiction to Find Truth

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We often describe fiction as an exercise in imagination and creative play. We have realized, however, while this is true, the genre is also a method of profound inquiry. For example, through writing, we are able to grapple with self-understanding, whether such understanding comes to us through emotions (grief, jealousy, joy, etc.), interactions with others, or internal struggle. Often, we comprehend our lives by sifting through memory, or by confronting the past; in doing, we must reckon with what we want to leave behind if we want to move forward. Specifically, we drafted stories that aim to consider the shortcomings and challenges of communication, the fickle nature of regret, and the complications of familial love, loss and recovery. To bolster our writing, we studied the work of contemporary writers such as Raymond Carver, Tobias Wolff, Amy Hempel, and Charles Baxter. In particular, we noted technique and style as a means to achieve not only a strand of compelling content, but also narrative success. We also explored topics such as pacing, character development, the effects of dialogue, and the role of language itself.

We thank the Mellon Foundation for financial support.

Poster 97

Lakota Perspectives: An Oral History of the 20th Century Rosebud Reservation

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Having volunteered on the Rosebud Reservation for the past five years, it has become apparent that the Lakota perspective has not been accurately represented in the mainstream American historical narrative. Primary sources are a basic element necessary in the preservation of a culture and increasing public understanding of these under-served communities. Oral history has emerged as an important tool in the documentation of Native American history, especially in the creation and archiving of these primary sources. I endeavored to create a primary source record of Lakota people living on the Rosebud Reservation in South Dakota by conducting and recording interviews, and subsequently transcribing them to create a document for archiving. This exercise was not only a research study of modern Lakota culture, but also an active education about the relatively new discipline of oral history. Living on the reservation for a month, and experiencing both problematic developments and research successes provided an invaluable experience that differed from my original expectations and was, as a result, more educational. In addition to gaining a new understanding about Lakota life on the reservation, I learned about the struggles oral historians face when entering a new culture. Upon returning I began transcribing the recorded interviews and compiling a written primary source of different Lakota experiences throughout the twentieth century.

We thank the Mellon Foundation for financial support of this project.

Poster 98

The Catholic Church's Role in the Development of International Law: A Neglected Tradition

Pr. Ward Thomas and Travis LaCouter
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For over a millennium, the Roman Catholic Church has led international discussions and diplomatic efforts regarding how to most effectively wage humanitarian warfare. Since Augustine's formulation of a rudimentary concept of the Just War in the early 5th century, Catholic thinkers have attempted to develop the moral boundaries of war. By articulating the need for a military strategy that acknowledges both political utility and moral restraint, the Church has maintained relevance in the field of international relations and has established itself as a player in the formal processes to develop and codify the rules of war. The Church has helped protect civilians during armed conflict by committing itself to the success of certain pieces of international law that limit the use of indiscriminate or disproportionate weapons in war. Through its efforts to limit cluster munitions, landmines, and chemical weapons, the Church has shown its willingness and ability to successfully advocate for a strong application of jus in bello. The current conception of the Just War tradition, as represented by the formal diplomatic organs of the Church, displays an inability or unwillingness to address the unique challenges of modern warfare – i.e. guerrilla tactics broadly, what have been called civilian-centric tactics, and targeted killing. This represents an abdication of responsibility and threatens to forfeit the Church's position as a realistic and useful interlocutor in international relations. If the Holy See were to become irrelevant to discussions of war and peace on a formal international level, noncombatant immunity would lose one of its most vocal defenders. The Church needs to pay attention to not just the specific weapons used in war, but the underlying tactics and logic of modern war in order to continue to be taken seriously.

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Poster 99

Labeling Women as 'Mad' in Nineteenth-Century America

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The nineteenth century saw an influx of first-person narratives published by women about their experiences inside insane asylums. Many had been committed by their husbands, who did not need a judge's consent to place their wives in such institutions. In novels like Charlotte Brontë's *Jane Eyre,* female characters suffered similar involuntary confinement at home or in asylums. Whether in painfully real accounts of their own experiences, or in imaginative tales, a number of nineteenth-century female authors described women's imprisonment in asylums and analyzed the reasons behind it. By juxtaposing Louisa May Alcott's gothic tale "A Whisper in the Dark" with cases of actual women who were diagnosed as mentally ill because they disobeyed their husbands or guardians, we were able to explore varying depictions of angry women as hysterical, irrational, or "mad" in the nineteenth century. We also considered the medical and legal procedures that facilitated their imprisonment, as well as the strategies that women used to resist or even escape it. In particular, we looked at Elizabeth Parsons Ware Packard, who, after being committed to an asylum by her husband and then confined by him inside their home after her release, not only successfully sued for her liberty but also went on to found the Anti-Insane Asylum Society, to publish several books about her ordeal, and to advocate for laws that would prevent husbands from committing their wives to asylums without a public hearing.

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Poster 100

Male Paternity Via The Manipulation of Female Behavior

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In *Schizacos ocreata*, females are monogamous. After the first successful reproductive event, female receptivity to mates alters, making females highly reluctant to mate again. The goal of our experiment was to determine the source of this change in receptivity. We hypothesized that the biochemical aspects of reproduction were responsible for the alteration in female behavior. In this experiment we used dimethylformamide, or DMF, to test our hypothesis. Dimethylformamide allows seminal products to be absorbed by the female, thus replicating the biochemical aspects of reproduction, not the physical. We know this technique is valid because it has been used in bee and other spider studies. We are extending the previous uses of DMF to examine the role of male seminal products in the modification of female behavior and receptivity, ensuring male paternity via manipulation of female behavior. In our experiment, female spiders were assigned to one of two experimental groups: a DMF positive group, or a DMF negative group. The DMF positive females received a mixture of DMF and seminal products, whereas the DMF negative females solely received DMF. We conducted two ten minute trials per female wolf spider, where females were exposed to random males. Female receptivity was documented when a male successfully mounted a female. In the trials conducted after twenty four hours after DMF application, there were no receptive DMF positive females and four receptive DMF negative females. This data would lead one to believe that the biochemical products of male seamen contributes, or even creates the change in female receptivity; however when repeating the trials forty eight hours after DMF application, DMF positive females were successfully mated. As a result, our methods must be amended in order to truly conclude whether the mechanical or biochemical aspects of reproductive change female receptivity.

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Poster 101

Palladium–Catalyzed Propargylation of Aromatic Imidates

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Heterocycles are important structures in many pharmaceuticals, making their synthesis of interest to organic chemists. New methods for the diversification of these species would be synthetically useful. Propargylation reactions of heterocyclic compounds have been explored using palladium reagents as catalysts to provide bis-electrophilic species. Initial studies on the propargylation of 2-hydroxypyridine were completed and alkylated hydroxypyridines were identified. Reaction conditions were optimized by testing different ligands and solvents. As 2-hydroxypyridine has two nucleophilic sites, attack can occur by either the nitrogen or oxygen. The regioselectivities observed in the reaction have provided insight to the mechanism, which will be discussed. To date, several compounds have been isolated and characterized. Future investigations will explore the mechanistic details and the synthesis of these biologically important building blocks en route to more elaborate precursors.

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Poster 102

La donna e i suoi rapporti sociali by Anna Maria Mozzoni: An English translation

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Though the Italian feminist Anna Maria Mozzoni is not widely known in the United States, she was an essential figure in the Italian Women's rights movements in the late 19th century. With the publication of the Italian Civil Code in 1865, women were treated as separate and subordinate in most matters; the grounds for marital separation were markedly unequal, and divorce was nonexistent. A husband could legally separate from his wife if she committed adultery, but he himself could not be challenged unless he flagrantly and publicly maintained a mistress for an extended period of time. Women who had formerly held the right to vote in local elections could not exercise administrative or national suffrage, hold governmental office, act as notaries, or serve as witnesses to civil acts. Mozzoni was an outspoken critic of the Civil Code, as evidenced by the publication of a series of essays entitled *La donna e i suoi rapporti sociali.* The essays that we translated this summer had never before been translated into English; an English language copy of the essays thus makes them available for a wider audience, as English is more commonly spoken and read than Italian. As a result, Mozzoni's beliefs, opinions, and solutions to problems facing Italian women can be accessed by scholars, academics, and those interested in women's studies. We hope to inform others about Mozzoni and her achievements through the translation of her key essays.

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