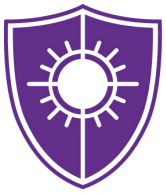

COLLEGE OF THE
Holy Cross

Twenty-Sixth Annual Symposium

Dr. Charles S. Weiss Summer Research Program

September 6, 2019
Hogan Ballroom

Dear Members of the Holy Cross Community,

Welcome to the 2019 Dr. Charles S. Weiss Summer Research Symposium. Now in its 26th year, the symposium is a college-wide event, bringing together faculty and students from all disciplines at Holy Cross and providing an opportunity to celebrate their accomplishments over the summer of 2019. It also affords an occasion for students to witness the breadth of research possibilities both on and off campus, and to open a dialogue with members of the faculty about conducting research during the upcoming academic year and summer.

The program and symposium are named after Charles "Chick" Weiss who joined the psychology faculty in 1975 with a Ph.D. in neurobiology and physiology from Ohio University. An esteemed professor, mentor and scholar, Weiss served as the chair of the psychology department from 1984 to 1989. He also served the College as Coordinator of Grants and Research (1989-95), the Director of the Office of Grants and Corporate and Foundation Giving (1995-2003), and the Director of Strategic Initiatives and Corporate and Foundation Relations from 2003 until his retirement in 2016. Weiss was integral to bringing major projects to life, most notably the College's Integrated Science Complex, Brooks Concert Hall and the Summer Research Program.

We hope you enjoy the impressive collection of scholarship on display today.

Daniel Bitran, College Science Coordinator, Director Summer Research in Natural Sciences and Mathematics
Anthony Cashman, Director Summer Research in Humanities, Social Sciences, and Arts
Joshua Congdon-Hohman, Director Summer Research in Economics.

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

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Institute of Education Sciences grant to Pr. F. Anggoro, Department of Psychology, College of the Holy Cross, and Pr. B. Jee, Department of Psychology, Worcester State University

Henry Dreyfus Teacher-Scholar Award to Pr. K. Mills, Department of Chemistry, College of the Holy Cross.

Massachusetts General Hospital, Division of Vascular and Endovascular Surgery

National Institutes of Health grant to Pr. R. Herrick, Department of Chemistry, College of the Holy Cross.

National Institutes of Health grant to Pr. K. Mills, Department of Chemistry, College of the Holy Cross.

National Institutes of Health grant, Dana-Farber Cancer Institute

National Institutes of Health grant, Department of Mucosal Immunology and Biology, Massachusetts General Hospital

National Institutes of Health grant, Department of Neurosurgery, Massachusetts General Hospital

National Institute of Health grant, Attachment and Biobehavioral Catch-Up Lab, University of Delaware

National Institutes of Health grant, Department of Biology, University of Vermont.

National Science Foundation grant to Pr. G. Findlay, Department of Biology, College of the Holy Cross

National Science Foundation grant to Pr. K. Mills, Department of Chemistry, College of the Holy Cross.

National Science Foundation grant, Department of Biology, University of Vermont.

National Science Foundation REU at the University of Massachusetts, Amherst

R. K. Mellon Family Foundation and Morton E. Goulder Research Endowment Fund, Lahey Hospital and Medical Center

Science Undergraduate Laboratory Internships Program, U.S. Department of Energy

Shoals Marine Laboratory

Sydney Scholarship Foundation at the University of Illinois Urbana-Champaign

Presenting Authors / Abstract Number

Presenting Authors / Abstract Number

Faculty Mentors / Abstract Number

Faculty Mentors / Abstract Number

Table of Contents

(Note: Presenter names are underlined.)

19. **Networks and the Gender Wage Gap: Evidence from College Football Performance.** *K. P. Irvine and M. H. Carney. Department of Economics and Accounting, College of the Holy Cross*

20. **Analysis of 1-Dodecyne Self-Assembled Monolayers on Flat Gold over Varying Reaction Times.** *S. G. Hull, E. C. Landis, and G. L. Avila-Bront. Department of Chemistry, College of the Holy Cross*

21. **Non-Sports Events for Sports Stadiums.** *A. Wu, R. Baumann, and V. Matheson. Department of Economics and Accounting, College of the Holy Cross*

22. **C-H Bond Functionalization Approach to Chromanones.** *J. Y. Dillon, J. L. Holmgren, and K. J. Quinn. Department of Chemistry, College of the Holy Cross*

23. **Copper-Catalyzed Reactivity of Ketenimines.** *L. Y. Ryan, K. P. Elaba, and A. K. Isaacs. Department of Chemistry, College of the Holy Cross*

24. **Financial Industry Regulatory Authority (FINRA) Dispute Resolution.** *W. Grimes and D. Schap. Department of Economics and Accounting, College of the Holy Cross*

25. **Static Solutions of Dirac Stars.** *E. Daka, N. Phan, and B. Kain. Department of Physics, College of the Holy Cross*

26. **Dynamic Solutions of Dirac Stars.** *N. Phan, E. Daka, and B. Kain. Department of Physics, College of the Holy Cross*

27. **"Privacy Comes at a Cost:" Criminal Procedure and the Constitution in the 21st Century.** *N. DeCoste and S. Sandstrom. Hon. Joseph F. Greene Moot Court Program, College of the Holy Cross*

28. **Jesus, Mary, and Joseph! Religiosity and Baby Names.** *J. Bucci, J. Congdon-Hohman, and J. Svec. Department of Economics and Accounting, College of the Holy Cross*

29. **How valuable are wetlands?** *J. Gasbarre and K. Kiel. Department of Economics and Accounting, College of the Holy Cross*

30. **WikiMap.** *S. Appleton and J. Svec. Department of Economics and Accounting, College of the Holy Cross*

31. **The Impact of the Minimum Wage on Workplace Safety.** *W. LaFiandra and D. Schwab. Department of Economics and Accounting, College of the Holy Cross*

32. **Predicting Success in the NBA.** *M. Bevilacqua and E. Ruggieri. Department of Mathematics and Computer Science, College of the Holy Cross*

33. **Blocking Effect of Conductive Alkyne Derived Nitrobenzene on Nanoporous Gold.** *Y. Chen and E. Landis. Department of Chemistry, College of the Holy Cross*

34. **Optimization of a Mass Spectrometry Method for the Analysis of Targeted Drug Delivery via Gold Nanoparticles.** *A. Bucknam and R. W. Vachet. Department of Chemistry, University of Massachusetts Amherst*

35. **Getting old stinks: Aging is associated with reduced regeneration in *Hofstenia miamia*.** *A. Guggenheim, S. Look-Why, R. Pabón, and J. Paxson. Department of Biology, College of the Holy Cross*

36. **Testing a Beam Profile Monitor System.** *P. Carpanedo, O. Marran, and P. Oxley. Department of Physics, College of the Holy Cross*

37. **Methyl-4-ethynyl benzoate and 4-ethynyl benzoic acid attachment to nanoporous gold in an oxygen depleted environment.** *J. Veras and E. C. Landis. Department of Chemistry, College of the Holy Cross*

38. **Investigating the Mechanisms that Decrease Fertility of *C. elegans* on a High-Glucose Diet.** *C. Davis, C. Dressel, and M. A. Mondoux. Department of Biology, College of the Holy Cross*

39. **Investigating the Effects of miRNA on Clear-Cell Renal Cancer**. *L. Pettengill, T. Kalantzakos, T. Sullivan, and K. Rieger-Christ. Translational Research Department, Lahey Hospital & Medical Center*

40. **Simulating the Board Game "Risk."** *Xu Ding and E. Ruggieri. Department of Mathematics and Computer Science. College of the Holy Cross*

41. **Tertiary C-H Hydroxylation with Mn(PDP) Catalyst.** *C. Morrison, R. Chambers, and M. C. White. Department of Chemistry, University of Illinois Urbana-Champaign*

42. **Hans Urs von Balthasar and Adrienne von Speyr's Theology of Vocation and Discernment.** *J. Rosenwinkel and J. Gavin, SJ. Department of Religious Studies, College of the Holy Cross*

43. **Effects of helminth-induced bacterial metabolites (SCFAs) on mouse adipocytes.** *N. Steudel, C. Wen Su, and H. Shi. Department of Mucosal Immunology and Biology, Massachusetts General Hospital*

44. **Improving High Resolution Spectrometer for Observation of Finely-Spaced Laser Modes.** *K. Jaramillo and T. M. Roach. Department of Physics, College of the Holy Cross*

45. **Interference Patterns Observed in Cooled Rb Atoms.** *W. Alfaro Castro and T. M. Roach. Department of Physics, College of the Holy Cross*

46. **Effects of Early Adversity on Attention and Behavioral Regulation for High-Risk Children.** *O. Baldi, M. Dozier, and M. Garnett. Attachment and Biobehavioral Catch-Up Lab, University of Delaware*

47. **Dialogue Found in Worcester Food Pantries.** *M. Hawke and D. Harvey. Department of Sociology and Anthropology, College of the Holy Cross*

48. **Combat Psychiatry in Times of War.** *N. Chouairi and L. Attreed. Department of History, College of the Holy Cross*

49. **The General, the Czar, and the Yeoman: Cooperative Federalism in the Reagan Justice Department's War on Drugs.** *G. Smith and A. Hindman. Department of Political Science, College of the Holy Cross*

50. **Efforts towards the Synthesis of Indolizine.** *V. E. Shay, A. T. Palaia, and A. K. Isaacs. Department of Chemistry, College of the Holy Cross*

51. **Barium-141 Gamma Ray Spectroscopy and Influence on Antineutrino Spectra.** *C. McCormack and E. McCutcha. National Nuclear Data Center, Brookhaven National Laboratory*

52. **Terminal Alkyne Attachment on Platinum.** *M. Brush and E. Landis. Department of Chemistry, College of the Holy Cross*

53. ***Drosophila* DEG/ENaC ion channel *ppk29* is expressed in neuronal and glial cell types.** *N. Folan and A. S. Hill. Department of Biology, College of the Holy Cross*

54. **Investigating ERG Channel-Encoding Gene *Seizure's* Role in *Drosophila* Development and Stress Resistance.** *A. Dermady and A. S. Hill. Department of Biology, College of the Holy Cross*

55. **Enkurin Antibody Development for *Drosophila melanogaster.*** *R. Barrett, F. Busser, P. Patel, and G. Findlay. Department of Biology, College of the Holy Cross*

56. **Characterization of *atlas*, a putative *de novo* evolved gene essential for *Drosophila* male fertility.** *A. Ludwig, E. Rivard, P. Patel, and G. Findlay. Department of Biology, College of the Holy Cross*

57. **Investigation of *atlas* and *juno*, two *de novo* evolved genes necessary for full fertility in male *Drosophila*.** *S. E. Arnold, E. L. Rivard, G. C. Mascha, P. H. Patel and G. D. Findlay. Department of Biology, College of the Holy Cross*

58. **Effects of NAMPT Inhibition on PD-L1 Expression in Glioblastoma.** *Z. Tirmizi, M. Li, and H. Wakimoto. Department of Neurosurgery, Massachusetts General Hospital*

59. **Understanding Behavioral Synchrony: Differences in Behavioral Synchrony in Adolescents with Autism Spectrum Disorder using Functional EEG Networks.** *E. Devine, D. Damiano[1], and R. Schmidt[2]. [1]Department of Mathematics and Computer Science, [2]Department of Psychology, College of the Holy Cross*

60. **The Effects of Doxorubicin on the Immune Response to Cancer.** *K. A. Larkin, A. Najibi, and D. J. Mooney. John A. Paulson School of Engineering and Applied Sciences, and Wyss Institute for Biologically Inspired Engineering, Harvard University*

61. **Interrogating the role of MDM4 in metastatic prostate cancer.** *C. Richter, J. Hwang, H. Elmarakeby, E. Van Allen, and W. Hahn. Dana Farber Cancer Institute*

62. **Cameras in the Courtroom: Televised Proceedings and the Consequences of Increased Transparency on the United States Supreme Court.** *M. McNamara and E. Brooks. Department of Political Science, College of the Holy Cross*

63. **Analysis of Acoustic Waves During Simulation of Hydraulic Fracturing.** *T. Nsubuga and L. Pyrak-Nolte. Department of Physics and Astronomy, Purdue University.*

64. **Restaging Women's "Private" Lives: A Historical-Institutional Analysis of the Battered Women's Movement.** *K. Shortell and S. Gallo-Cruz. Department of Sociology and Anthropology, College of the Holy Cross*

65. **Generational Divides in U.S. Immigration Opinion? Millennials' Views in Comparison, 2004-2018.** *V. Nash, J. C. Dixon, and A. S. Fullerton[1]. Department of Sociology and Anthropology, College of the Holy Cross, [1]Department of Sociology, Oklahoma State University*

66. **Structural analysis of the force chains within communities of particles.** *P. Przewoznik and D. Damiano. Department of Mathematics and Computer Science. College of the Holy Cross*

67. **The Gospel of Anti-Judaism?** *X. Duan and T. B. Liew. Department of Religious Studies, College of the Holy Cross*

68. **The Effects of Revising the Preoperative Fasting Protocol in Arthoplasty Patients.** *E. Keleher, A. Abdeen, and J. Drew. Beth Israel Deaconess Medical Center*

69. **Documentation of Catholic Worker Thought: Conversations in Worcester & Hartford.** *H. Wyatt-Luth and D. O'Brien. Department of History, College of the Holy Cross*

70. **Procedural Approach Associated with Incidence of Long-Term Laparotomy Complications Post Open Abdominal Aortic Aneurysm Repair.** *C. Manxhari and C. DeCarlo. Division of Vascular and Endovascular Surgery, Massachusetts General Hospital*

71. **Capitalism and Ethics.** *C. Whiteside, J. Fisher, E. Liskov, and D. Brand. Department of Political Science, College of the Holy Cross*

72. **US funded HIV Interventions in Eswatini and Gender Equity.** *I. Kallassy and T. Masvawure. Center for Interdisciplinary Studies, College of the Holy Cross*

73. **Altering Institutional DNA: In Pursuit of the Eco-Campus.** *E. Dennehy and E. Jones. Department of Sociology and Anthropology, College of the Holy Cross*

74. **Nationwide Injunctions, Polarization, and Judicial Restraint.** *C. Piccione and G. Burnep. Department of Political Science, College of the Holy Cross*

75. **Law, Politics, and Human Nature: Harry Blackmun and the Separation of Powers.** *M. Cooper and E. Brooks. Department of Political Science, College of the Holy Cross*

76. **Dragon Ladies: Comic Depictions of Vietnamese Women as Metrics of American Memory of the Vietnam War.** *R. Grosskopf and J. Santos. Department of English, College of the Holy Cross*

77. **Investigating the Anti-Cancer Properties of *Withania Somnifera* in Colorectal Cancer Using Metagenomic Analysis of the Gut Microbiome.** *A N. Phan, M. K. Bhasin, and B. Thomas. Dana Farber, Harvard Cancer Center*

78. **Russia's Revamped Blood Libel Accusation: Indicative of a Return to Antisemitic, Monarchist Times?** *S. Baker and D. Dukhanova. Department of Modern Languages and Literature, Russian Program. College of the Holy Cross*

79. **Education, Advocacy, and Service: Documenting AIDS Project Worcester.** *N. Taliento and S. Yuhl. Department of History, College of the Holy Cross*

80. **Implementing Democracy.** *S. Javaid and V. Langohr. Department of Political Science, College of the Holy Cross*

81. **Disrupting the Summer Slide.** *S. Dwyer, J. Ertle, K. O'Sullivan and M. Sterk Barrett. Donelan Office of Community Based Learning, College of the Holy Cross*

82. **Forces Driving the Wage Gap.** *M. Lambo and S. Gallo-Cruz. Department of Sociology and Anthropology, College of the Holy Cross*

83. **Tick Load and Tick-Borne Pathogens in Birds as a Function of Landscape Type.** *A. Magel and S. Williams, Department of Biology, College of the Holy Cross.*

84. **Investigating Bacterial Contact Dependent Inhibition Proteins to Develop New Antibiotics.** *T. Fedrigoni, E. Flaherty, C. Woodilla, and C. Hagan. Department of Chemistry, College of the Holy Cross*

85. **District Court Resistance to Expanding Executive Power: A Contemporary Application of New Deal Politics.** *C. Cicciu and G. Burnep. Department of Political Science, College of the Holy Cross*

86. **Investigating the Effects of Varied Sunlight and Dissolved Carbon Dioxide Levels on the Growth of *Vallisneria Americana.*** *S. Grosskopf and S. Findlay. The Cary Institute of Ecosystem Studies*

87. **Evolution in the Presentation, Treatment, and Outcomes of Patients with Acute Mesenteric Ischemia.** *R. McLellan, L. Wang, and M. Conrad. Department of Vascular Surgery, Massachusetts General Hospital*

88. **Arterial Closure Devices on Complications Following the Placement of Percutaneous Circulatory Support Devices.** *H. Miksenas, D. Kim, Z. Feldman, S. Schwartz, and J. Malek. Department of Vascular Surgery, Massachusetts General Hospital*

89. **Characterizing novel protein-protein interactions regulating brain development.** *C. Kearns, W. Yacawych, B. Chandler, A. Schmoker, A. Semic, A. Ebert, and B. Ballif. Department of Biology, University of Vermont*

91. **Assessing Salvadoran Mass Migration to the United States.** *B. Brownsword and J. Poche. Department of History, College of the Holy Cross*

92. **Unconscious Emotional Stimuli Influence Behavior.** *J. Skinner, N. Prunier, F. Sorcini, and G. DiGirolamo. Department of Psychology, College of the Holy Cross*

93. **Unconscious Detection of Abnormalities in Trained Radiologists.** *N. Prunier, J. Skinner, F. Sorcini and G. DiGirolamo. Department of Psychology, College of the Holy Cross*

94. **Interrater and Intrarater Reliability for Neuronal Reconstruction.** *R. Price, M. Piccione, J. Criscitiello, and A. Basu. Department of Psychology, College of the Holy Cross*

95. **The Relationship Between Social Dominance and Emotion Regulation in Mice.** *M. Piccione, R. Price, M. DeBono, M. Cronin and A. Basu. Department of Psychology, College of the Holy Cross*

96. Apology of Epicureanism in Modern Society. *M. Bateman and F. Baluch. Department of Political Science, College of the Holy Cross*

97. Perceptual Training of Abnormality Detection. *F. Sorcini, N. Prunier, J. Skinner, and G. DiGirolamo. Department of Psychology, College of the Holy Cross*

98. Diurnal Variance of Atmospheric Muons. *A. Murphy, N. Gould, J. Raccio, B. Lunden[1], and T. Narita. Department of Physics, College of the Holy Cross and [1]Department of Physics, Worcester Polytechnic Institute*

99. Gospel Meets Culture in the Andes: How Christian belief and practice in the Andes have been affected by indigenous culture. *K. Barres and W. Reiser. Department of Religious Studies, College of the Holy Cross*

100. Robert F. Kennedy and the Mafia. *A. Cannata and A. Hindman. Department of Political Science, College of the Holy Cross*

101. Investigation of Cosmic Rays. *N. Gould, A. Murphy, J. Raccio, T. Narita, and B. Lunden[1]. Department of Physics, College of the Holy Cross and [1]Department of Physics, Worcester Polytechnic Institute*

102. Measurement of East-West Asymmetry of Cosmic Rays. *J. Raccio, N. Gould, A. Murphy, B. Lunden[1], and T. Narita. Department of Physics, College of the Holy Cross, and [1]Department of Physics, Worcester Polytechnic Institute*

103. An Exploration of the Stigmatization of Disability in Church Communities in Lunyo Village, Entebbe, Uganda. *D. Wells and T. Masvawure. Center for Interdisciplinary Studies, College of the Holy Cross*

104. Long-term Declines in Predator and Prey Abundances in the Rocky Intertidal Zone. *A. Canny, N. Hearne, C. Spind, S. Volbrecht, J. Dijkstra and K. Benes. Intertidal Ecology Internship, Shoals Marine Lab*

105. Public Perception of Race in Education. *W. Walker and L. Capotosto. Department of Education, College of the Holy Cross*

S1. Exploring the Symbiotic Relationship between Literature and Art. *J. D'Agostino and M. Géracht. Department of English, College of the Holy Cross*

S2. Feminism and Contemporary Artmaking: A Female Body of Work. *M. O'Connell and R. Beaudoin. Department of Visual Arts, College of the Holy Cross*

S3. Curating and Cataloging Insect Biodiversity in the Holy Cross Entomology Collection. *A. Lucas and K. Ober. Department of Biology, College of the Holy Cross*

S4. Comparisons between Eastern and Western Arts and a view of Western Art from an Eastern Perspective. *J. Liang and V. Raguin. Department of Visual Arts, College of the Holy Cross*

Poster 1

Translation of Christian Bernadac's "Les Médecins de l'Impossible:" Prisoner Doctors of the Holocaust and their Moral Dilemmas

E. C. Flanagan and D. Bitran
Department of Psychology, College of the Holy Cross

While it is widely known that, during the Holocaust, Nazis performed gruesome medical experiments on inmates at concentration camps in occupied Europe, it is less well-known to the general public that prisoners who were doctors were often forced to tend to the welfare of fellow inmates, all under the watchful eye of the SS. This afforded prisoner doctors a privileged status, with better food, clothing, and housing conditions. At the same time, however, they were also faced with many unprecedented moral dilemmas. While there is substantial information available on the experiences of mostly Polish prisoner doctors in Central European concentration camps, such as Auschwitz-Birkenau, Christian Bernadac's "Les Médecins de l'Impossible" seems to be the only comprehensive source of information on French prisoner doctors. However, an English translation of this important manuscript does not exist. This project aims to provide a comprehensive translation of this book in order to contribute to the complex understanding of prisoner doctors of the Holocaust. This summer, I completed a preliminary translation for about half of the text. The content of the translation and information from outside sources showed that although the Holocaust revealed that anyone can be capable of blindly following cruel evil orders, many prisoner doctors were able to stay true to their morals. Given the many choiceless-choices prisoner doctors faced, perhaps our contemporary code of medical ethics can benefit from an analysis of the decisions and actions taken by prisoner doctors. In the immediate future, the translation of the manuscript will be completed. This will involve an Anglicization and a contextualization of the text in order to situate the events of the book in the broader framework of the historiography of the Holocaust. Our analysis aims to show the importance of this manuscript for educating students of the health professions on the subject of biomedical ethics.

We thank the Weiss Summer Research Program for financial support.

Poster 2

Worcester's Sewing Saga: Helping the Socially Marginalized Help Themselves

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

As part of a larger project curating a 2020 exhibition of Worcester refugees' crafts at the Worcester Center for Crafts, this archival study explored the historical parallels between the contemporary organization Refugee Artisans of Worcester (RAW) and the mid-19th-century Female Employment Society (FES) in the city. Both RAW and the FES conscientiously support socially marginalized groups through craft making. These historical parallels have not previously been investigated. The FES ties into Worcester's Female Rights' Movement of the early 1850s; famous activists like Abby Kelly Foster directly inspired the women running the FES. The FES worked to aid lower-class women (widows, immigrants, former-slaves) through craftwork. This organization's maxim of seeking to "truly help this class of people, by helping them to help themselves" sparked a wave of self-empowerment efforts in the city by identifying sewing skills and craft education as means towards self-reliance for low-income families. In RAW today, the refugees are experts in weaving, embroidery, and bamboo manipulation and the non-profit has a similar humanitarian goal. The FES helped women perform ordinary sewing tasks while refugee artisans today are more highly-skilled. Both organizations strive to support family members who might not be traditional breadwinners, such as women in the 1850s or the older generation of current refugees. This study combined historical methodologies with anthropological, ethnographic interviews with contemporary refugee artisans.

We thank the Dr. Charles Weiss Summer Research Program and the Scholarship in Action Grant for financial support.

Poster 3

Synthesis of Novel Rhenium-Based Amino Acids

K. Colon, A. Pearsall, and R. S. Herrick
Department of Chemistry, College of the Holy Cross

The metal rhenium is understood to have significant medical and organometallic applications. Interest in researching rhenium primarily extends from similarities between rhenium and technetium-99m -- an essential, but radioactive, nuclide in nuclear medicine. Luckily, rhenium serves as a cold, stable analog for technetium-99m. Therefore, work done with rhenium theoretically can be applied to technetium-99m and nuclear medicine. However, interest in rhenium and technetium has also been growing due to their joint theranostic (therapeutic and diagnostic) abilities. The work conducted by the Herrick lab this summer has focused on synthesizing novel, unnatural rhenium-based amino acids. Compounds are prepared twice by heating rhenium pentacarbonyl chloride, ester protected amino acids, and either 1-methyl-2-imidazolecarboxaldehyde or 4-imidazolecarboxaldehyde as the ligand. These compounds were prepared under four hour reflux in MeOH then purified using techniques such as chromatography. The synthesized products were characterized using ^{1}H NMR, ^{13}C NMR, IR spectroscopy, and X-Ray crystallography.

We thank the National Institutes of Health as well as Karen and Gerald P. Migliaccio '77 for financial support. We acknowledge Christopher J. Ziegler and the University of Akron for their collaborative work.

Poster 4

Does climate explain the interannual variation in vagrancy of the Ash-throated Flycatcher, *Myiarchus cinerascens*, in the eastern United States?

L. Zogby and S. Williams
Department of Biology, College of the Holy Cross

Ash-throated Flycatchers (ATFL), *Myiarchus cinerascens*, breed May to August in the southwest United States and winter in coastal Mexico and northern Latin American countries (Seavey et al., 2000). ATFL forages in desert scrubland for small fruits and insects (Rosenburg et al., 1982). During fall migration, vagrants east of -92º W are reported regularly, which is far outside of the standard breeding and wintering ranges. Vagrant individuals are almost exclusively juveniles (Stevenson and Anderson, 1994). We hypothesize that ATFL vagrancy over the last decade may be a function of trans-continental weather events displacing inexperienced juvenile migrants to the east side of the continent, and droughts in the native range causing inexperienced juvenile migrants to seek food in extralimital territories. We predict that years with more trans-continental weather events and droughts in the home range should lead to more extralimital reports of the ATFL in the eastern United States. Studying the mechanisms behind this bird's unusual migratory behavior will provide groundbreaking insight to how climate events have an impact on species' geographic trends of abundance and distribution.

I would like to thank my summer research sponsors, Mrs. and Mr. Edward J. Burke, Jr. '86 for their generous financial contribution to the program and for making this project possible.

Poster 5

A Philosophical Conception of Globalization and Its Collapse: On Xenophobia, IR Liberalism, And Misreading Plato

A. Grey and E. Fleury
Department of Political Science, College of the Holy Cross

Since the 2016 United Kingdom European Union membership referendum (Brexit) and the election of Donald John Trump as President of the United States, the system of global interconnectedness via trade and cultural exchange which has existed essentially since the Bretton Woods Agreement of 1944 seems to be under exceptional strain. National leaders across Western civilization have begun to question the need to cooperate with the rest of the world, and thus have started to close their borders to foreigners and their ears to those trying to maintain globalism. This project attempts to determine what exactly has caused the current strain to globalism. As the International Relations theories concerning globalization, stemming from Kant's theory of perpetual peace, fail to adequately answer this question, the project turns to Plato's *Republic*, *Statesman*, and *Laws* to see if his conception of primordial forces which govern human nature answers the question. In the process of sifting through these works for a cohesive theory, this project further explores how leaders of the anti-globalism campaign have used a literal reading of Plato to suggest the philosopher condones a xenophobic foreign policy, a misreading which stems from the work of Karl Popper in *Open Society and Its Enemies*, though with a far more nefarious purpose in contemporary circumstances. As such, this project, while working through Plato, also attempts to discredit these mis-readings, highlight how wrong they truly are, and to save Plato from the grips of xenophobia and racial hate. As such a topic is hard to convey in a poster, please feel free to use the QR code to access a draft of the full essay to see the whole of this project's scope.

We thank the George I. Alden Trust Excellence in Career Related Undergraduate Education, the J.D. Power Center for Experiential Learning, and the IGNITE Fund for financial support.

Poster 6

Shifting Frames: Relational Scaffolding Supports Children's Conceptual Coherence in Space Science

D. Tsitsopoulos, I. Karageorgiou, F. Anggoro, and B. Jee[1]
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Research has documented children's difficulty reconciling their observations of the sky (an *Earth-based* perspective) with scientific models of the solar system (a *space-based* perspective). Understanding the day/night cycle requires such an integration, where Earth's Eastward rotation causes the apparent motion of the Sun. In the present work, we developed and applied a comprehensive rubric to capture children's mental models before and after instruction that emphasized *relational learning*—mapping the spatial, causal, and temporal relations inherent in the day/night cycle. We examined video data from pre- and post-test interviews with 108 3rd-grade children. Verbal and modeling responses were coded separately for the cause of day/night, sunrise, and sunset. Explanations were coded along two key dimensions that reflect significant cognitive achievements in grasping the scientific model: *Frame of Reference*: a shift from Earth-based to space-based descriptions, and *Moving Object*: a shift from a Sun focus to an Earth focus. Using this rubric we classified children's responses into three categories: *Earth-based*, *Space-based/Sun motion*, and *Space-based/Earth motion*. Responses in the Space-based/Earth motion category were further classified into four subcategories of Earth movement: *unspecified motion*, *orbit*, *correct rotation*, and *incorrect rotation*. Compared to the Control condition, children who received the *relational scaffolding* intervention were more likely to change their frame of reference from Earth- to space-based and to focus on Earth rotation rather than Sun motion. These children's mental models include Earth's *Eastward* rotation, which is crucial for a coherent understanding of day/night. This finding was more pronounced in modeling than in verbal tasks.

This project was supported by the Institute of Education Sciences Grant #R305A150228 to F. Anggoro and B. Jee, and by the Weiss Summer Research Program.

Poster 7

The Great Salt Divide: Protein Splicing of the *Haloferax volcanii* Intein

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Protein splicing is a post-translational modification facilitated by an intervening polypeptide (internal protein or intein) excising itself from two flanking polypeptides (external protein or extein) through a self-catalyzed mechanism. Concomitant with the intein splicing, the exteins ligate together, thus forming the mature, functional polypeptide. We studied an intein found in the halophile *Haloferax volcanii (Hvo)*, which lives in high salt environments. A collaborator has determined that mutations to conserved homing endonuclease domain residues are potentially lethal for the cell, suggesting that these mutations may also prevent splicing, and hence ligation of the fused exteins (which is an essential DNA polymerase.) This indicates that the presence of an intein has a high fitness cost for the organism. We have devised a reaction assay that allows us to overexpress the intein in *E. coli* rather than in *H. walsbyi*, and to study the splicing activity in vitro. We are interested in the in vitro salt dependence of the splicing activity, and the influence of the nuclease mutants on protein splicing.

We thank the National Science Foundation (Grant MCB-1517138), the Henry Dreyfus Teacher-Scholar Award, and the NIH (Grant 1R15GM132817-01) for financial support.

Poster 8

Welcome to the Salty Spitoon: Studying Protein Splicing in *Haloquadratum walsbyi*

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Protein splicing is a self-catalyzed reaction by which an intein, an intervening polypeptide, catalyzes its own removal from exteins, the flanking polypeptides, as well as ligation of the exteins. Our research is focused on the inteins that interrupt a cell division control protein in the halophilic archaea *Haloquadratum walsbyi*, or *Hwa* for short. Halophiles like *H. walsbyi* are organisms that are able to survive in water with high concentrations of sodium chloride. *H. walsbyi* has four inteins that interrupt the cdc21 gene, and our research will mostly be focusing on two of these inteins (inteins A and D). We are studying the splicing activity under various salt concentrations for the A and D inteins both separately and when expressed as part of a single fusion protein. In addition, in order to study the structure of these inteins, we have prepared plasmids to express fusions of a GB1 domain to the individual inteins inactivated by mutation to active site residues, resulting in highly soluble inactive inteins for study via NMR. We are interested to learn if the inteins splice under different conditions and, if so, if this permits alternative spliced products.

This work was supported by NSF grant MCB-1517138, a Henry Dreyfus Teacher-Scholar Award, NIH Grant 1R15GM132817-01, and by the Dr. Charles Weiss Summer Research Program.

Poster 9

Protein Splicing and Homing Endonuclease Activity in Extreme Thermophiles

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Protein splicing is a post translational, self-catalyzed reaction by which an intein removes itself from a flanking polypeptide and ligates those polypeptides together. We are interested in the splicing and homing endonuclease activities that interrupt the DNA polymerase II in the extreme thermophiles *Thermococcus barophilus* and *Thermococcus kodakarensis*. Given that *T. kodakarensis* is a surface-dwelling organism and the *T. barophilus* is a piezophile that lives in deep-sea thermal vents, but the organisms are closely related, we are interested in how temperature and pressure may affect enzyme activity. We also are interested in the influence of differences of the conserved C-terminal residues in the two inteins. So far, we have found that the homing endonuclease domain of the *T. kodakarensis* intein is more active at lower concentrations and temperatures than that of the *T. barophilus* intein. Previous work in the lab has suggested that pressure may affect this activity differently and we are currently following up on those observations.

This work was supported by NSF grant MCB-1517138, a Henry Dreyfus Teacher-Scholar Award, and by NIH Grant 1R15GM132817-01

Poster 10

Exploring the role of the mammary stroma in breast cancer using the *EpiChip* disease model

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Cross-talk between epithelial cells and fibroblasts may contribute to breast cancer development. The ecto-domain of syndecan-1 (sdc-1) acts as a co-receptor for the fibroblast growth factor receptor, causing augmented proliferation of epithelial cells. Biopsies from patients with some forms of breast cancer contain elevated levels of sdc-1 expression and shedding from tumor-associated fibroblasts. We focused on elucidating the nature of this sdc-1 ecto-domain-mediated crosstalk and its possible role in tumorigenesis. We have shown that cultured NIH-3T3 fibroblasts actively express and shed sdc-1 ecto-domain in culture. Additionally, when cultured with these fibroblasts, mammary epithelial cells demonstrate a significantly higher rate of proliferation than when cultured on their own. Our lab sought to advance the 3D disease-on-a-chip model of breast cancer known as the *EpiChip* to include a fibroblast-containing stroma. To date, we successfully fabricated the physical portion of the chips and have developed the necessary procedures for growing fibroblasts and an epithelial cell-based duct within the collagen matrix of the *EpiChip*. We have visualized the cells in the *EpiChip* using phase contrast microscopy to a limited degree of success. In order to enhance our ability to observe cells in the *EpiChip*, we are currently creating stably-transfected cell lines of fibroblasts and epithelial cells to cause them to express either Green Fluorescent Protein or Red Fluorescent Protein. This will allow us to utilize laser scanning confocal microscopy to image the cells at a higher magnification and most importantly in three dimensions.

We thank the Alumni / Parents Summer Research Scholarship Fund, as well as Catherine and Domenic J. Dinardo ‘75 P21,17,06 for their support of our research project.

Poster 11

The Effects of a Small Peptide on VTAV aggregation

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Fourier Transform Infrared Spectroscopy (FTIR) is used to study the effects of a disordered peptide, GVTA, on the structure of VTAV, a peptide capable of forming beta sheets and aggregating. Protein aggregation is associated with neurodegenerative diseases such as Parkinson's disease. GVTA and VTAV are peptides found within residues 71-82 of the natively unfolded protein alpha-Synuclein. These residues are of interest because their deletion from the full-length alpha-Synuclein has been shown to prevent misfolding. Previous work in our lab has shown that GVTA is able to disrupt beta sheet formation in VTAV when present in a 1:1 molar concentration mixture. Mathematical fits were performed for the 1:1 molar mixture to quantify the amount of beta sheet present as concentration of both peptides' changes. As the concentration of GVTA increases the percent beta sheet decreases as the solution becomes more disordered in spite of the fact that GVTA represents 50% of the total amount of peptide in the mixture. Further, mixtures of 0.1M VTAV and varying concentrations of GVTA are studied in a series of temperature dependent experiments to evaluate the effectiveness of GVTA at disrupting beta sheet. Mathematical mixtures that predict the spectrum of a mixture of the two peptides assuming no interaction between them were created using Microcal Origin. These are compared to spectra of experimental mixtures. As the concentration of GVTA in the mixture is decreased, GVTA becomes less effective at preventing beta sheet formation. 12-hour kinetic experiments on mixtures of GVTA and VTAV at 37 degrees Celsius denote that GVTA is unable to break down beta sheets over time; instead we hypothesize that GVTA requires the energy supplied in our temperature dependent experiment to break down beta sheets.

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

Poster 12

Reversing the Aggregation of Amyloid-β Using a Small Peptide

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The three-dimensional structures of proteins are essential to the functions they carry out in our bodies. When a protein misfolds, it can self-assemble into ß-sheet-rich aggregates that are linked to neurodegenerative diseases such as Alzheimer's Disease (AD). In this study, we are targeting a seven amino acid peptide ($Aß_{16-22}$) thought to be the nucleation site for the misfolding of the Amyloid-ß protein characteristic of AD. Previous studies in the Petty Lab have led to the identification of a short peptide that can potentially reverse misfolding of $Aß_{16-22}$ and thus, potentially, the aggregation of full-length Amyloid-ß. This peptide comprises the first three amino acids (GGA) of residues 67-71 of α-synuclein, which has been thoroughly studied in the Petty Lab. For this study, we are using FTIR spectroscopy to analyze any structural changes that occur as a result of the interaction between GGA and $Aß_{16-22}$. With a specific focus on the Amide I peak IR spectra can provide evidence of the secondary structure of peptides and proteins and thus of any structural changes of the peptide mixtures. We used Microcal Origin to compare a mathematical prediction, which assumed no interaction between the two peptides, with the experimental structure when the peptides were mixed together. This comparison allowed us to investigate GGA's ability to break up ß-sheets in $Aß_{16-22}$. Our initial mixing experiments have shown that GGA disrupts some ß-sheets when added to $Aß_{16-22}$, provided it is present at a high enough concentration. Further work will ascertain the exact concentration of GGA necessary for disruption and the nature of the interpeptide interaction.

We thank Kim and Wendell P. Weeks P15 for their generous financial support of this project.

Poster 13

The Effects of a Tripeptide in Disrupting Aggregation of AVV

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The process of neural protein aggregation is associated with many neurological disorders such as Parkinson's disease and Alzheimer's disease. The α-synuclein (α-syn) protein is known to aggregate and form Lewy bodies in association with Parkinson's disease. Previous work has shown that the deletion of residues 67-71 (GGAVV) prevents misfolding of the protein, making these amino acids particularly interesting for studies related to curing the disease. The studies reported here involve two tripeptides; one that can form beta sheets (AVV) and one that is disordered (GGA). Both sequences were derived from residues 67-71. Infrared spectroscopy was used to probe the vibrational state of carbonyls in the peptides. The amide I band vibrates between 1725 cm^{-1} and 1575 cm^{-1}. Within this region there are two specific frequencies, 1650 cm^{-1} and 1615 cm^{-1}, which indicates a disorder conformation or a beta sheet rich conformation respectively. Collecting spectra of the peptides (or mixtures of the peptides) therefore allows us to determine the structure of each and any structural changes induced by mixing. Mixing experiments of the two peptides revealed the effectiveness of the GGA in disrupting beta sheet formation in AVV. GGA was effective in reducing aggregation until a molar ratio of 8:1 was reached. Additional work using a nuclear magnetic resonance instrument was conducted to observe the changes in chemical shift between the carbonyl carbons in a beta sheet conformation and those in a disordered conformation. The NMR data can be used in conjunction with the IR data in order to determine the tripeptide's conformation in solution.

We thank the Robert J. Stransky Foundation Research Fellowships in the Sciences for financial support for this project.

Poster 14

In Search of the Free Fantasia

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During the 17th through 19th centuries, improvisation was essential to both keyboard practice and composition. Many of the most highly regarded composers were also the best keyboardists and improvisors. Carl Philipp Emanual Bach was perhaps the foremost improviser and authority on the topic during his lifetime, and his Essay on the True Art of Playing Keyboard Instruments (Versuch über die wahre Art das Clavier zu spielen) of 1753 influenced all who came after him. In it he goes so far as to suggest that the free fantasia (which does not include barlines or regular meter) is "the pinnacle of the art of music, the ideal medium through which to achieve the emotional response in the listener that the composer held to be music's primary goal." This style (though with barlines and meter) was later developed in the compositions of Mozart, Beethoven, Schubert, and others. Bach's affection for the fantasia affected his compositions in other genres such as sonatas and rondos. During the late 18th and early 19th century, the boundary between a "true" fantasia and a piece that employed and is influenced by fantasy elements and fantastical gestures gradually blurred. This brings up a fundamental question: What is a fantasia? To approach this question, we explored the intersections of theory and praxis, considering eighteenth-century treatises and their literature alongside fantasies composed by Bach, Mozart and their contemporaries. To create a narrow focus, we explored three fantasias in depth, all of them written in C minor: the Free Fantasia, H. 75 by C. P. E. Bach, the Fantasia, K. 475 by Mozart, and the Choral Fantasy, Op. 80 by Beethoven. The "C minor mood" and the free fantasia complement each other in ways that are recognizable, but these are highly original and unconventional works that reveal how the fantasia grew as a genre while retaining its hallmark qualities of harmonic and metrical freedom and a sense of spontaneous creation that Bach considered essential "to achieve the emotional response in the listener that the composer held to be music's primary goal."

We would like to thank an anonymous donation to the Alumni - Parents Summer Research Scholarship Fund.

Poster 15

Two Previously Unpublished Manuscripts of the *Iliad*

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We edited two closely related eleventh-century manuscripts of the *Iliad* in digital diplomatic editions. This is an extension of our earlier work as members of the Manuscripts, Inscriptions, and Documents Club (MID), and of the international effort carried out by the larger Homer Multitext Project. The two manuscripts are nearly - but not entirely - identical, leading us to believe they are derived from a common archetype (or source). Along with the *Iliad* text, the manuscripts contain extensive footnotes known as *scholia* in the margins, which contain valuable information pertaining to how past readers understood the text. These *scholia* have never been fully published before. From a close analysis of the differences between the manuscripts, we could see that while both scribes reproduce the *scholia* almost identically, they sometimes made different choices about the text of the *Iliad*. By graphing the position of *scholia* in the manuscript's layout, we learned that readers expected to find notes in three distinct zones of the page, similar to the way modern readers learn to look for footnotes at the bottom of the page. Lastly, we compared the coverage of notes in our manuscripts with a tenth-century manuscript previously edited by MID. We discovered that even when the content of these *scholia* differs, there is a significant overlap in which lines receive comments. This suggests that scribes considered certain passages more noteworthy than others, regardless of the focus of their commentary.

We would like to thank Deborah C. and Timothy W. Diggins '80, as well as the Dr. Charles Weiss Summer Research Program for their generous financial support.

Poster 16

The Impact of Impulsivity on Suicide and Homicide Rates

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Impulsivity, defined as an unconscious willingness to act without the complete consideration of all information, varies substantially across individuals and is known in the neurological literature to impact behavior. We use the average number of binge drinking episodes as a proxy for impulsivity and find that it has a positive influence on suicides and homicides by firearm, but no impact on suicides and homicides by other means. Specifically, a one standard deviation rise in binge drinking behavior increases firearm homicides by between 2.25 and 6.5 and firearm suicides by between 7 and 12.6 in a state with an average population. Assuming that suicides and homicides by other means are more time-consuming compared to firearms, we identify impulsivity as a risk factor for these behaviors particularly for those with access to firearms.

We would like to acknowledge the Weiss Summer Research Program in Economics for financial support.

Poster 17

Effect of Motion Dynamics on Classic Visual Illusions

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Visual illusions are a powerful way to investigate how our brains place emphasis on certain cues in the world around us. Our idea of perceived size is a function of viewing distance, the size that the object projects onto our retinas, and the context in which we are viewing said object. Recent research has demonstrated different effects when dynamic motion was added to two classic visual illusions, the Ebbinghaus and Corridor illusions. When motion cues were added to the target and inducers in the Ebbinghaus illusion, the illusory effect was almost double (Mruczek et al., 2015). However, when the same motion dynamics were added to the target in the Corridor illusion, the illusion magnitude was significantly reduced (Mruczek et al., under revision). In these past studies, the whole corridor did not move across the screen because it would be awkward and disorienting. In addition, internal cues within the corridor and a lack of contrast between the corridor and its targets might account for the reduced effect. To further explore the lack of consistency across the two illusions, we incorporated different motion dynamics in novel, dynamic versions of the Ponzo illusion, a simpler analogue of the Corridor illusion. In one condition, the Revealed Ponzo, the target moved while the background context revealed itself over time. This produced a large and robust effect, which aligned with similar results for the Ebbinghaus illusion. Across these illusions, the addition of a dynamic background was cause for the individual's perceived size to vary when compared to the actual size of the target. Our results indicate that a combination of a moving target and a dynamically changing context leads to a particularly strong influence of contextual cues on perceived size.

We thank the Dr. and Mrs. Anthony M. Marlon '63 Summer Research Fellowship and the Alumni/Parents Summer Research Scholarship Fund for financial support.

Poster 18

Terminal Alkynes Attached to Nanoporous Gold in an Oxygen Free Environment

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Nanoporous gold (NPG) is a type of surface material with a sponge-like texture. NPG has a large, highly conductive surface area that makes it ideal for surface chemistry. NPG was synthesized by dealloying a silver-gold alloy in nitric acid. The de-alloy time of the gold leaf in nitric acid was conducted under the extremes of 30-minute and 48-hour conditions. Altering the de-alloy time allows us to manipulate the size of the nano-scale pores on the surface. By functionalizing NPG with terminal alkynes, we are able to study the ordering of the self-assembled monolayer. 1 mM of 1-dodecyne and 1-tetradecyne were bound to NPG in an oxygen free environment. To validate the attachment of the alkynes to the NPG, techniques including infrared spectroscopy, cyclic voltammetry, and x-ray photoelectron spectroscopy were used. Our results suggest that terminal alkynes do bind to nanoporous gold for reaction times of 17 hours or longer. The density of the molecular layer may depend on reaction duration and the identity of the alkyne molecule.

We thank Kathleen and Stephen R. Winslow P16,14 for financial support.

Poster 19

Networks and the Gender Wage Gap: Evidence from College Football Performance

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After controlling for the most robust set of labor market variables, 38 percent of the gender wage gap remains unexplained. This unexplained portion is commonly attributed to gender differences in non-cognitive abilities and gender norms, but there is little existing literature on gender differences in networks and networking's subsequent impact on labor market outcomes. This study seeks to explain the contribution of gender-biased shared interests within networks to the gender wage gap, as changes in the importance of these gender-biased shared interests may impact the development and maintenance of informal networks within and outside the college environment in the U.S., especially for male students. We use college football, with more male than female fans, as an example of such gender-biased shared interests. Using data from NCAA Division I-A schools in the Football Bowl Subdivision, the U.S. Department of Education's College Scorecard, and data on sexual assaults provided by the National Incident Based Reporting System, we examine the impact of college football team performance relative to the period of attendance on future earnings by gender and incidences of sexual assault on campus during the football season as a possible alternative mechanism driving gender differences in post-graduate earnings. We find that better college football team performance during the early years of school attendance increases average wages of males but does not impact female wages and decreases the number of sexual assaults on campuses, therefore contributing to the previously unexplained portion of the gender wage gap.

We thank the Dr. Charles Weiss Summer Research Program in Economics for financial support.

Poster 20

Analysis of 1-Dodecyne Self-Assembled Monolayers on Flat Gold over Varying Reaction Times

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This research aimed to determine the conditions necessary for significant attachment of alkyne molecules onto a flat gold surface. Previously-studied sulfur-gold bonds of thiol self-assembled monolayers lack stability. Carbon-gold bonds have a higher bond stability which make for more reliable molecular layers. The ability of alkyne groups to lose their hydrogen and to form carbon-gold bonds without being oxidized was examined. A combination of insulated gold electrodes and flat pieces of pure gold were functionalized in an air-free environment in molecular solutions of alkynes, including 1-dodecyne. The functionalization reactions took place over varying time periods to observe the effect of short versus long-term exposure to the molecules. Cyclic voltammetry, infrared spectroscopy and x-ray photoelectron spectroscopy were used to determine how densely the alkyne molecules attached to the gold surface. XPS and IR data were able to indicate that some molecules successfully attached with each reaction time. The cyclic voltammograms gave the clearest indication that molecular coverage increased with increasing reaction time. Electrochemical tests only indicated a significant difference between bare gold surfaces and functionalized surfaces for the reactions that took place for at least 17 hours in an air-free environment.

We thank Mr. and Mrs. Joseph T. Murray '58 P86, 86 for their generous financial support.

Poster 21

Non-Sports Events for Sports Stadiums

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The value estimation of sports venues considers the profit of holding non-sports events, which has been used to justify sports venues construction. However, it remains uncertain whether new stadiums are capable of attracting profitable events. Pollstar, a trade publication founded in 1981 covering the concert industry records, offers an opportunity to analyze factors that influence the occurrence of non-sports events at sports venues. We estimated the regression model *outcome = f(demand factors, new venue)*. Using 2016 Pollstar data with 49 NBA and/or NHL arenas and socioeconomic data from Bureau of Economic Analysis and Bureau of Labor Statistics as factors, the results show that the number of non-sporting events, number of tickets sold, and gross sales are positively correlated with the population of the city. We then statistically analyzed the detailed Pollstar box office information of NBA and NHL arenas from 2013 to 2019, and have the following preliminary conclusions: a) The stadiums that have teams from both NBA and NHL hold 20% more non-sports events than average; b) the stadiums that have no competitor in the same area hold more events than average until 2018 when there is no significant difference; c) the stadiums that have another sports arena in the same area are usually located in populous cities which indicate more frequent events; and d) better team performance brings more events the following year, while the degree of the positive influence varies. These conclusions may offer potential directions for future research.

We thank the Dr. Charles S. Weiss Summer Research Program for financial support.

Poster 22

C-H Bond Functionalization Approach to Chromanones

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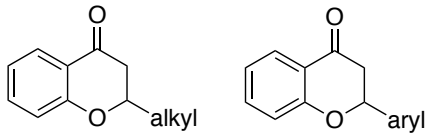

chromanone core flavanone core

Numerous biologically and chemically relevant natural products possess the chromanone or flavanone core structure. We are investigating a strategy for the synthesis of these important compounds in which oxidative C-H bond functionalization plays a key role. C-H bond functionalization is a relatively new approach in organic synthesis and often requires metallic reagents that are difficult to handle. In our work, we hope to show that these types of reactions can be conducted under metal-free conditions that are amenable to a wide variety of substrates that are capable of producing the chromanone and flavanone core structures. Our research included an examination of both the electrophilic and nucleophilic components required for intramolecular C-C bond formation. To date, we have found one electrophile/nucleophile pairing that has successfully resulted in a ring forming reaction.

We gratefully acknowledge Richard A. Marfuggi, M.D. ’72 and the Dr. Charles Weiss Summer Research Program for funding this research.

Poster 23

Copper-Catalyzed Reactivity of Ketenimines

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Ketenimines are reactive synthetic intermediates that can engage with nucleophiles, electrophiles and radicals. We applied the recently discovered 'click chemistry' that utilizes copper as a catalyst to generate desired ketenimines from the reaction of an alkyne with tosyl azide. In a one-pot copper-catalyzed process, the acyclic substrate is transformed into a 1,4-disubstituted 1,2,3-triazole that spontaneously decomposes to the ketenimine intermediate, which can then be engaged by a nucleophile at the electrophilic carbon. We sought to expand this knowledge of the reactivity of ketenimines by engaging the *in situ* generated intermediate in a cascade multicomponent reaction. Nucleophilic addition of an external nucleophile to the ketenimine generates an enamine ion which can participate in an Aza-Michael addition to a well-designed alpha,beta-unsaturated portion of the parent substrate. This allows for rapid access to the isoquinoline core which we hope to elaborate into differentially substituted isoquinolines. Isoquinolines are important structural motifs present in a wide range of naturally occurring compounds with important biological profiles. This summer, we sought to expand the substrate scope by varying the substituents on the benzene ring as well as the electron withdrawing groups. By utilizing multiple known nucleophiles, we hope to synthesize a wide variety of isoquinolines and their derivatives.

We thank the Alumni/Parents Summer Research Scholarship Fund and the Dr. Charles Weiss of Summer Research Program for financial support.

Poster 24

Financial Industry Regulatory Authority (FINRA) Dispute Resolution

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The Financial Industry Regulatory Authority (FINRA) is a Self-Regulating Organization (SRO) responsible for regulating all active securities firms in the United States, with the mission "to provide investor protection and promote market integrity." FINRA makes use of mandatory arbitration in dispute resolution with procedures that vary greatly from ordinary civil litigation. The traits that can make arbitration a desirable alternative to civil litigation (cost-effectiveness, efficiency, and privacy) also confound claimants and expert witnesses alike. This research serves to organize and clarify the arbitration rules posted at the FINRA website and interpretations of the rules and procedures that appear in related literature. The research results provide an informative base for those drawn into arbitration due to disputes over brokerage account practices, FINRA employee-employer disputes, or as testifying experts who are unfamiliar with FINRA arbitration practices.

We thank the Dr. Charles Weiss Summer Research Program in Economics for the financial support.

Poster 25

Static Solutions of Dirac Stars

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Einstein's theory of General Relativity is the dominant geometric theory describing gravity within the context of modern physics. General Relativity leads to the understanding that space and time are consolidated into one spatial-temporal continuum with three spatial dimensions and one-time dimension called "space-time." We investigated self-gravitating spin-1/2 fermions, their interactions in a static environment and their space-time. We analyzed four, time-independent field equations described by ordinary differential equations. We derived two gravitational field equations from general relativity that represent the interaction between matter and gravity. Using the Dirac equation, we derived two fermion field equations to model the behavior of the fermions within our system. With a set of four ordinary differential equations we wrote programs that would solve the differential equations numerically, utilizing the shooting method and the fourth-order Runge-Kutta method to approximate our solutions.

We thank Janna L. Murgia-Hoppin '98 and John W. Hoppin, Ph.D. '98 for financial support.

Poster 26

Dynamic Solutions of Dirac Stars

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We study massive spin-1/2 particles coupled to gravity. Gravity is described by Einstein's Theory of General Relativity, while the matter sector – specifically fermions – is described by the Dirac Equation. Considering that the matter equations are partial differential equations and the gravity fields are ordinary differential equations, we use computer programming to solve them. Provided with initial conditions of the matter fields, we perturb them by adding a small amount of energy and evolve them through time to see how they interact with gravity. In essence, we want to know if our systems of fermions are stable and will maintain their configuration through time or are unstable and will change their configuration through time. Running our simulation for multiple sets of initial conditions, we have found the cut-off point between stable, unstable, and strongly unstable systems. Furthermore, if we strongly perturb specific systems of fermions by adding a large amount of energy, they could collapse and form a black hole.

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

Poster 27

"Privacy Comes at a Cost"
Criminal Procedure and the Constitution in the 21st Century

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The United States Constitution protects all citizens equally, regardless of race, creed, gender, or alleged criminal wrongdoings. We examined two constitutional questions that affect the way our legal system deals with criminal procedure: the expectation of privacy in cell-site location information and the right to confront one's accuser. Cell phones' pervasive presence in society raises concerns over the location data that they generate. The courts have previously ruled on long-term tracking of cell phones; however, the courts have never adjudicated on whether real-time warrantless tracking of cell phones is constitutionally permissible. We attempt to assemble jurisprudence for and against allowing law enforcement agencies to request third-party cellular company location data absent a warrant. Additionally, we examine possible exigent circumstances that would allow for such data, if found to be protected by the Fourth Amendment, to be disclosed without a warrant. Another issue that has troubled the courts for decades is where the proper placement for the line between testimonial and nontestimonial hearsay statements for unavailable witnesses belongs. We examined the different qualifications for a witness to be found unavailable to testify in courts — specifically for child victims of sexual abuse. Following our examination of these factors, we looked at what constitutes a testimonial statement to determine what statements may be admitted into court without cross-examination. Our analysis of jurisprudence led us to conclude that protecting the constitutional rights of *all* citizens is of the utmost importance to the American judicial system.

Thank you to the Dr. Charles Weiss Summer Research Program for the financial support.

Poster 28

Jesus, Mary, and Joseph! Religiosity and Baby Names

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Previous studies have shown the important economic and social benefits provided by organized religion. In this project, we attempt to discern what events or conditions relate to religiosity in America. To measure religiosity, we use the proportion of new biblical baby names by state, as baby naming data is publicly available and easily accessible. We define a religious name as an entry in Hitchcock's Bible Names Dictionary. Additional data is sourced from the Social Security Administration, FEMA, Bureau of Labor Statistics, Bureau of Labor Economics, and the Stanford Mass Shootings in America data project. We regress the percent of biblical names given in a year against various economic indicators, the prevalence of natural disasters, the occurrence of mass shootings and sports championships. There is preliminary evidence of a relationship between religiosity of names and economic factors (for males and females), natural disasters (more so for males than females), and mass shootings (for males and females). The regressions produce statistically significant results, but more work is needed to ensure their reliability.

We would like to acknowledge the Dr. Charles Weiss Summer Research Program in Economics for financial support.

Poster 29

How valuable are wetlands?

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In this study, we will determine the value of wetlands, using house price hedonics. Wetlands are protected in the United States because they serve several important functions, including: reduction of flooding, animal habitats and recreational activities. Due to the importance of these areas, there are laws regarding the alteration of properties identified as wetlands. If a property is identified as a wetland and the owner wishes to renovate or alter the landscaping, the alterations must be approved by the city. Within this project we looked at the housing sales data from 1988-2005 in the town of Newton, MA to determine the effects of having wetlands on a property or having wetlands on a property contiguous to your own. To test the costs and benefits to society of having wetlands near or on a property, we ran a linear regression while controlling for housing and neighborhood characteristics, wetlands on the property, wetlands contiguous to the property and the type of wetland on the property. We hypothesize that properties with wetlands on them will have lower values due to the added difficulty of altering the property in any way. For properties contiguous to wetlands we hypothesize that these properties will have a greater value due to the security the owner has that neighboring properties cannot further develop their land. Preliminary results have shown that the type of wetland on a property impacts the price of the house, and not specifying the type of wetland may lead to inaccurate conclusions.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 30

WikiMap

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Throughout history maps have been used to better understand the world. In the age of technological advancement, we have developed a map for the modern world. Similar to the concept behind Wikipedia, "WikiMap" will be created and supported by users. This goal of this project is to create an interactive map which will allow users to create layers and visualize data over time, eventually creating a visual database. This dynamic map allows users to input datasets, in the form of csv files, and see the data displayed on the map. This project can be applied to research, education, and anyone with a dataset. "WikiMap" will enable users to visualize data over a plethora of disciplines ranging from history, anthropology and art to economics, climate change, and politics. Users are enabled to share data, creating a collective to foster knowledge further advancement of research. The goal this summer was to develop dynamic prototype to allow user input. User input will then create a new data layer on the map. This summer's work is just the beginning of what will become a global platform.

We thank the Dr. Charles Weiss Summer Research Program in Economics for financial support.

Poster 31

The Impact of the Minimum Wage on Workplace Safety

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The minimum wage is one of the most studied topics in labor economics. And with ongoing discussions over whether or not it should be raised, it is important that we have a more complete understanding of the different effects that the minimum wage has. Most of the existing research on the subject has focused on the policy's employment effects, but considerably less attention has been paid to its other effects on employees. We add to the literature by investigating the impact of the minimum wage on workplace safety. Using a difference-in-differences approach with data from the United States Office of Safety and Health Administration from 1992 to 2016 on the restaurant industry, we find evidence to suggest that minimum wage increases have led to increased workplace safety. In particular, we estimate that a 1% increase in the minimum wage results in a reduction in the workplace accident rate between 0.62% and 1.06%. Furthermore, we also find evidence suggesting that a 1% increase in the minimum wage results in a reduction in the safety violation rate of between 1.33% and 2.74%.

We would like to thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 32

Predicting Success in the NBA

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College of the Holy Cross

For many National Collegiate Athletic Association (NCAA) men's basketball players, their dream is to play in the National Basketball Association (NBA) and create a successful career out of their athletic abilities. But how can "success" in the NBA be measured and defined? Furthermore, can we determine which college basketball players will be the most successful in the NBA? In this project, I sought to answer two specific questions: (i) which college basketball statistics are the best predictors of a player's success in the NBA; and (ii) based on a player's collegiate statistics, what is the probability that this player will be drafted (or not drafted) into the NBA? For the first question, I utilized linear regression and the statistics for current NBA players to look at different measures of "success" and then used their college statistics in an attempt to predict success. For the second question, we looked at the collegiate statistics for the current class of NBA rookies to build a logistic regression model that can be used to predict the probability that a player will be drafted, and tested that model out on this year's draft class. Variables used included games played, minutes played, rebounds, points, and field-goal percentage. Our models showed that points, rebounds, steals, and blocks were important predictors of NBA "success", while assists and turnovers were important predictors of the probability that a player would be drafted into the NBA.

We thank Dr. Dan Kennedy '68 for his financial support of this project.

Poster 33

Blocking Effect of Conductive Alkyne Derived Nitrobenzene on Nanoporous Gold

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Surface chemistry on nanoporous gold (NPG) focusing on thiol derived monolayers has been studied intensively. As an alternative anchoring group, alkyne attachment remains relatively unexplored and provides new possibilities for surface reactions. We studied the attachment of 1-ethynyl-4-nitrobenzene as a way to add a nitro functional group to the surface through an alkyne attachment. We employed infrared spectroscopy, cyclic voltammetry, and capacitance tests to comprehend the binding of the alkyne on NPG. We found that the reaction created highly conductive molecular layer on NPG. Octadecanthiol served as a nonconductive control and helped confirm the attachment of the conductive nitrobenzene molecules. We discovered that alkyne derived nitrobenzene prevented octadecanthiol from anchoring and forming a monolayer on the surface. Alkyne attachment displayed a higher stability than thiol attachment on NPG. We will continue refining the reaction conditions for alkyne attachment, and also investigate the stability of a variety of alkyne derive molecules on NPG.

We thank Kim and Wendell P. Weeks P15 for financial support.

Poster 34

Optimization of a Mass Spectrometry Method for the Analysis of Targeted Drug Delivery via Gold Nanoparticles

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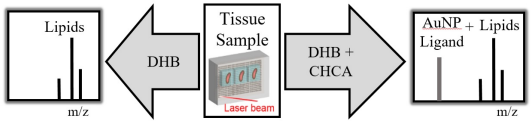
Functionalized gold nanoparticles (AuNPs) with biologically compatible ligands are useful for targeted drug delivery. Ligands with different structures and charges can be coordinated to the gold core to regulate nanoparticle accumulation within an organism. Functionalized AuNPs can be used in this manner as vessels for targeted delivery of small molecule drugs. One such drug is tamoxifen, for the treatment of breast cancer. It is necessary to develop a comprehensive technique for the analysis of biodistribution of AuNPs within an organ while simultaneously monitoring the biological response to the AuNP presence. The response can be observed by the analysis of upregulated or downregulated proteins, lipids, and hormones. Each analyte has a fixed mass-to-charge ratio which can be used like a "barcode" to identify its presence within a tissue with mass spectrometry. However, not all of these analytes are readily ionizable under the same conditions, thus it is challenging to detect multiple analytes of interest in the same experiment. Matrix Assisted Laser Desorption-Ionization mass spectrometry is a tunable technique for the detection of all analytes of interest. 2,5-dihydroxybenzaldehyde (DHB) as the matrix of choice for analysis of metabolites was observed to be unreliable for detection of certain AuNP ligands. In this study, optimization of a binary matrix composed of DHB and α-cyano-4-hydroxycinnamic acid (CHCA) gave reliable signals for gold nanoparticle ligands and lipids simultaneously. Total concentration of matrix, as well as the ratio of DHB to CHCA were both investigated. An optimized matrix provided success in detection of desired analytes, giving rise to an efficient method of study for the effects of the drug as well as nanoparticles in the body.



We thank the National Science Foundation for support.

Poster 35

Getting old stinks: Aging is associated with reduced regeneration in *Hofstenia miamia*

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The main focus of our lab is better understanding the age-related decline in stem cell function. *Hofstenia miamia*, a marine acoelomate worm, is a new model organism known for their population of highly proliferative stem cells. These cells, called neoblasts, enable *Hofstenia* to fully regenerate after being bisected. Unlike other similarly regenerative organisms, such as planaria that do not age, we hypothesize *Hofstenia* do age and that their stem cells, and therefore also their regenerative capacity, become less functional with age. Our research this summer aimed to investigate the age-related regenerative capacity of these worms. To assess this, we ran a large-scale regeneration experiment comparing fertility, mortality, and morphological regeneration after bisection between different age groups of worms. The general trend we observed was that the younger groups of worms were able to regenerate faster and more completely than the older groups. We suspect that these observations may be attributed to the reduced potency of stem cells in the older worms, but further work must be done to support this. Overall, this research has granted us a greater understanding of the macroscopic functionality of *Hofstenia*. In the future, we plan to study the potential cellular causes behind the patterns of *Hofstenia* regeneration we observed this summer.

We thank Gary R. Gregg and Karen Connelly Gregg ‘79 P10; Jacqueline H. and George A. Paletta, Jr., M.D. '84 P15; and the Dr. Charles Weiss Summer Research Program for their financial support of this research.

Poster 36

Testing a Beam Profile Monitor System

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When experimenting with charged particle beams, it is important to know the size, shape, and intensity of the beam. Our project focused on testing the functionality of a system designed to measure the intensity and shape of an electron beam. When operational, this system will be used to optimize the production of a charged ion beam used in plasma physics experiments. The system is comprised of a wire grid with 8 horizontal and 8 vertical tungsten wires, known as the beam profile monitor (BPM). A beam of electrons is accelerated onto the BPM, creating 16 electrical currents (one for each wire) which are fed to a current to voltage converter circuit (IVC). The 16 voltage outputs of the IVC are then read by a data acquisition card (DAQ) housed inside a computer. This voltage data is analyzed and displayed using a computer program written in LabVIEW which allows the monitoring of all 16 currents simultaneously and provides both horizontal and vertical profiles of the electron beam intensity. Through testing we have confirmed various aspects of the system to be working as intended. Most importantly, we have shown that the IVCs are capable of reliably reading very small currents (down to fractions of a nano-amp). We measured the BPM wire currents in two ways - first, using the IVC circuit as described above, then by measuring each wire current individually using a commercial current amplifier (CCA) to compare the two measurements. Most recently, the output of the IVC when attached to the BPM is not in agreement with the CCA measurements, but earlier measurements suggest we did successfully record a profile using the IVC circuit. In addition to the measurements described above, we present calibration data for the IVC circuit and details of the LabVIEW program written to visualize the beam profile.

We thank Janna L. Murgia-Hoppin '98 and John W. Hoppin, Ph.D. '98 and the Alumni/Parent Summer Research Scholarship Fund for financial support of this project. We also thank Dick Miller for his machining expertise and Professor Roach for assistance.

Poster 37

Methyl-4-ethynyl benzoate and 4-ethynyl benzoic acid attachment to nanoporous gold in an oxygen depleted environment

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Nanoporous gold is synthesized by selective dealloying of a gold/silver mixture and is electrically conductive with a high surface area. The high surface area allows for more attachment of molecules compared to a flat surface. This can create a self-assembled monolayer which is a molecular layer that binds to a surface in an ordered way as a result of a strong bond forming. Many of the uses of nanoporous gold require the utilization of molecular layers attached to the surface, so the project is concerned with the different types of molecular attachments to nanoporous gold. Terminal alkynes have been proven to be successful types of molecules for attachment as the Au-C bond is stable. We have investigated the binding of terminal alkynes onto the surface of nanoporous gold using both a methyl protected and unprotected carboxylic acid. We used infrared reflection absorption spectroscopy to probe the attachment of SAMs on the surface of nanoporous gold and Cyclic Voltammetry to investigate the density of the molecular layers. Through the introduction of 1-octadecane thiol after the binding of the terminal alkynes, we are able to determine the relative strength of the carbon to gold bond of these molecules onto the surface and evaluate the binding density. By studying different types of attachments, we can determine the most stable way to bind molecules to nanoporous gold and understand different intermolecular interactions in an attached molecular layer.

We Janice and William F. McCall, Jr. ‘55 P90,90,89 for their generous financial support.

Poster 38

Investigating the Mechanisms that Decrease Fertility of *C. elegans* on a High-Glucose Diet

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The amount of sugar in the average human diet has increased dramatically over the past several decades, which is correlated with increases in metabolic diseases such as Type 2 diabetes and obesity. *C. elegans* is a good model organism for studying the effects of increased sugar in our diets, because 60-80% of genes in the human genome have an ortholog in the *C. elegans* genome. Among these conserved genes are the genes that control processes like insulin signaling and glucose storage. Previous data from our laboratory shows that a high-glucose diet leads to decreased fertility in both sexes of *C. elegans* (male and hermaphrodite), but the mechanisms that cause these decreases are unknown. For hermaphrodites, we hypothesize that an increase in apoptosis (programmed cell death) in oocytes on a high-glucose diet leads to decreased fertility. We are investigating the cellular pathways that activate apoptosis, and our data suggests that the pathogen response pathway is not activated by a high-glucose diet to reduce fertility. We are planning to test other apoptotic pathways and we are also investigating whether the same factors that decrease fertility on a high-glucose diet decrease lifespan. For males, we are investigating factors that could lead to a decrease in male sperm competitiveness on a high-glucose diet. We have found that male sperm size decreases but male sperm morphology is not affected on a high-glucose diet. We are currently measuring male sperm activation and male sperm transfer. Our project will advance our understanding of the cellular mechanisms involved in responding to a large amount of glucose and the consequences of a high glucose diet.

We thank Wendy R. and Kenneth J. Edwards, M.D. ‘80 P12, the Alumni/Parents Summer Research Scholarship Fund, and the Eunice Kennedy Shriver National Institute of Child Health and Human Development for their financial support.

Poster 39

Investigating the Effects of miRNA on Clear-Cell Renal Cancer

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Clear cell renal cell carcinoma (ccRCC) is a particularly aggressive type of cancer and is the most likely form of kidney cancer to metastasize. Recently, the expression of microRNAs (miRNAs) has been found to play a role in the aggressive nature of various cancers, including ccRCC. miRNAs act as non-coding regulators of gene expression in cancer, controlling biological processes, including cell growth and proliferation. In a previous study, we identified several miRNAs associated with an aggressive phenotype in early stage ccRCC tumors. Using ccRCC cell line CRL-1932, we transfected miRs- 769 and -424 to see how they affect the cancerous phenotype. Once transfected, cell dishes were monitored in terms of proliferation, migration, and invasion compared with the control cells. Transfection success was confirmed using RT-PCR. In experiments rescuing the expression of miR-424, the rates of proliferation, migration, and invasion decreased significantly ($p<0.05$). In experiments abrogating miR-769 expression, the rates of proliferation, migration, and invasion also decreased significantly ($p<0.05$). Utilizing bioinformatics analysis tool Tarbase v7.0, we made custom transcript arrays to compare the mRNA expression levels in the transfected cells to the control cells to narrow our protein targets for miRs-424 and -769. Western blotting techniques were then used to measure the impact of the transfection on protein expression. Quantification of the blots using ImageJ allowed us to see if the protein expression was altered in the transfected cells. In the ccRCC cells transfected with miR-424, we observed a significant decrease in LRIG2 expression. In contrary to LRIG1, which has been found to be a tumor suppressor, LRIG2 is likely an oncogene in ccRCC as it appears to speed up the cell cycle, allowing for both increased proliferation and migration of ccRCC cells. Future studies will investigate LRIG2 and its role in the aggressive nature of small renal tumors.

This work was supported in part by funding from the R. K. Mellon Family Foundation and a grant from the Morton E. Goulder Research Endowment Fund.

Poster 40

Simulating the Board Game "Risk"

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In the game of "Risk," players roll dice to simulate attacks on a battlefield, with the goal of taking over the world. The first part of the project involved writing a function to determine the number of armies lost for both the attacker and defender in a single battle. Combinations of this function can simulate a single battle between the arbitrary number of attacking and defending armies. Next, we simulated the invasion of Australia, with 8, 12, or 16 defending armies face an invading force of 20 attacking armies from a single attack point. Here, we found that the distribution of defending armies had almost no impact on the probability of conquering the continent. In contrast, when splitting up the invading force between the two entry points into South America, the probability of conquering the continent decreases for the same number of defending armies when compared to the Australia simulation. Finally, we created multiple attacking strategies and used larger sections of the game board to simulate a real game between two players. The first strategy prefers the attacking path with the highest probability (at least > 0.5) of conquering, while the second strategy aims at acquiring bonus reinforcement by taking over entire continents. The two strategies are tested under hypothetical double diamond shape board and a board including North America and South America. While the second strategy can accelerate the game, the first strategy has higher probability of winning.

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

Poster 41

Tertiary C-H Hydroxylation with Mn(PDP) Catalyst

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C-H bond hydroxylation on a tertiary carbon can have significant impacts on the physical and biological properties of a molecule such as how it interacts with receptors, how it is metabolized and how biologically potent it is. Much of the previous work done in this lab has focused on developing a regioselective strategy for oxidation in the absence of pre-existing functionality. Currently Mn(PDP) has been shown to be the ideal catalyst for tertiary C-H hydroxylation via a radical mechanism which is so short lived that it results in retention of stereochemistry. Through research this summer, much has been learned in terms of what different functionalities can be tolerated on a molecule by testing a variety of substrates with this method. Notably no epoxidation of aryl functionalities was observed, and this method can tolerate a variety of electron withdrawing groups so long as they are slightly removed from the site of hydroxylation.

We thank the Snyder Scholarship Foundation for financial support.

Poster 42

Hans Urs von Balthasar and Adrienne von Speyr's Theology of Vocation and Discernment

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The 20th century Swiss theologians Adrienne von Speyr and Hans Urs von Balthasar wrote over 160 books on a wide range of theological topics. We studied a particular aspect of their work: their contributions to the theology of call, election and discernment. We discovered a theology of vocation that radically challenges today's poplar Christian and secular understandings. Equipped with this understanding of a vocation as a calling from God to a particular state of life, the Church will be better equipped to help people hear and make sense of how God is calling them. Von Balthasar and Von Speyr's approach will invigorate and inspire authentic vocational discernment within the Catholic Church. We also looked at ways in which the Church can work to create an authentic "culture of vocations," by equipping people with certain tools—like scripture, silence, and the sacraments—that will enable them to properly discern. Our findings have serious implications, because von Balthasar and von Speyr argued that a person's God-given mission is at the core of their personhood. Only by living out this God-given mission can people truly become who God made them to be, and by extension, live impactful and fulfilling lives.

We thank the Dr. Charles Weiss Summer Research Program and the Ignite Fund for financial support.

Poster 43

Effects of helminth-induced bacterial metabolites (SCFAs) on mouse adipocytes

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Helminth infection, affecting 24% of the human population, has been demonstrated to have a protective effect against obesity. Additionally, obesity is often concurrent with a leaky gut, which can have additional negative implications on the function of the immune system and the overall health of individuals. Recent work from our laboratory showed that infection with the intestinal helminth *Heligmosomoides polygyrus* protects against high fat diet (HFD)-induced obesity in mice and that this attenuation was associated with enhanced Th2/Treg responses and M2 macrophage polarization, promoting adipose tissue energy expenditure and browning of fat. New evidence also indicate that helminth infection induces marked alterations in gut microbiota and that these changes are accompanied by an increased production of short-chain fatty acids (SCFAs). However, the precise mechanism through which helminths modulate metabolic disorders is not fully understood. This study functions to elucidate the specific factors by which helminth infection reduces weight gain. This is accomplished by growing and treating 3T3-L1 (mouse adipocyte – WAT) cells with metabolites from the microbiota, the SCFAs and Th2 cytokines. Expression of essential genes, such as UCP1 and GPR41 that involved in energy expenditure, are analyzed among these treatments in order to characterize the mechanism by which the helminths induce the browning process and increased energy expenditure in the adipocyte tissue. These preliminary results suggest that SCFA treatment alone is sufficient to alter the expression of key receptors implicated in fat reduction.

Funding for this research was provided by National Institute of Health.

Poster 44

Improving High Resolution Spectrometer for Observation of Finely-Spaced Laser Modes

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The goal of this project was improving the precision and extending the range of the custom grating spectrometer used in studying laser optical behavior. We wanted to observe transitions between finely-spaced laser modes, each with its own laser emission wavelength, differing only by about 1 part in 100,000. To improve resolution, we altered the spectrometer to use a wider and more finely ruled diffraction grating. We also modified the optical path into a more compact arrangement, where the incoming light diffracts back from the grating at approximately the same angle as it enters. Different wavelengths diffract at slightly different angles, causing them to hit at different positions on an image sensor placed ~20cm away. Another change was installing a new, wider image sensor with smaller pixels, which broadened the spectral range and helped make use of the improved optical resolution. These modifications combined to give a resolution about 3.5 times better than before. To improve the resolution further, we used a 30% reflecting mirror to send some diffracted light back toward the grating to diffract a second time, which doubles the dispersion (the change in sensor position per change in wavelength), resulting in another factor of 2 in resolution. After these improvements we can readily discern the small transitions between external cavity modes of our laser system, and we have already observed interesting spectra hinting at some underlying laser physics yet to be explained. Monitoring of laser spectral behavior is important when using precision lasers. For example, the extended cavity diode laser system under study is used in some atomic clocks, among the most precise instruments ever built. Our work may provide insight into the degree in which lasers change optical modes unexpectedly, and our improved spectrometer can be a versatile piece of experimental equipment useful in atomic physics research.

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

Poster 45

Interference Patterns Observed in Cooled Rb Atoms

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In our research, a gas of Rb atom is cooled using laser light arriving from six directions, an effect called "optical molasses," now used widely in atomic physics research and recognized by a Nobel Prize in 1997. The cold atoms are at temperature of ~0.0001 K or lower and speed ~0.1 m/s or slower, compared to 230 m/s at room temperature. Our previous work has shown that the cold atoms sometimes organize into striped patterns, due to polarization phase interference, dependent on the relative alignment of the laser beams. We have studied the 3D pattern in the density distribution of atoms using camera imaging from two different directions and have studied the time of formation for these patterns. In order to observe the interference patterns, we first trap the atoms at the center of a vacuum chamber using the six beams plus a magnetic field. Next, we shut off the beams and field to let the cloud expand. This creates a cloud of atoms which is distributed fairly and smoothly across a few millimeters' region. Lastly, to see the interaction between the optical molasses and the atoms, we turn on the laser beams to illuminate the cloud briefly and then take pictures of the resulting density patterns. By varying the illumination time, we have studied how the pattern develops over time. We observed that the interference pattern starts to form within 1 millisecond, and the pattern contrast increases for about 10-to-15 milliseconds and then levels off. In addition to the striped patterns, we have seen "dislocated" striped regions and checkerboard patterns, depending on polarization phase variations. Laser cooling is an important and well-established technique in atomic physics, yet there is relatively little experimental data regarding how atoms move diffusively within the optical molasses. Our measurements on formations of interference patterns in a cold Rb gas provides such data and may give better insight into their cause.

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

Poster 46

Effects of Early Adversity on Attention and Behavioral Regulation for High-Risk Children

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Children who have faced early adversities, such as poverty, absence of a caregiver, and in some cases the involvement of Child Protective Services (CPS), are vulnerable to psychosocial problems such as increased inattention and aggression. I hypothesized that a sample of children with a history of CPS involvement (high-risk) would score significantly higher on ratings of inattention and aggression than children with no CPS involvement (low-risk). When the children were approximately 8 years old, their caregivers completed the Child Behavior Check List, a 113-question questionnaire that assesses behavioral and emotional problems in children. Results of the independent samples t-test shows that mean CBCL scores for attention differ between high-risk children ($M = 4.61$, $SD = 4.29$) and low-risk children ($M = 3.35$, $SD = 2.97$), $t(172) = -2.21$, $p=0.022$. On average, high-risk children score higher on the CBCL subscale for inattention than low-risk children. Results of the independent samples t-test shows that mean CBCL scores on the aggression subscale also differ between high-risk children ($M = 7.12$, $SD = 7.69$) and low-risk children ($M = 3.21$, $SD = 3.99$), $t(153) = -4.37$, $p=0.00$. On average, high-risk children score higher on the CBCL subscale for aggression than low-risk children. Children who have been exposed to maltreatment, violence, or constant stressors are vulnerable to developing early-onset mental illnesses. Of these psychopathologies, ADHD and disruptive behavior disorders are the most commonly found in early childhood. As high-risk children grow up, their early mental health problems can act as a catalyst for long-term emotional and behavioral problems. Evidence-based interventions, such as Attachment and Biobehavioral Catch-up (ABC), aim to alleviate the foundation of these problems by promoting sensitivity between the caregiver and child, which will reduce problem behaviors.

We would like to thank the National Institutes of Health R01 MH074374 for financial support.

Poster 47

Dialogue Found in Worcester Food Pantries

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Despite the entrenchment of the emergency food system, hunger and food poverty are still major social issues. Food banks stand ready to aid in the hunger crisis, yet, many people in need choose not to take advantage of them. Stigmas and stereotypes are attached to food banks and clients, turning people away from using what the government and society believe to be the answer to alleviating, if not ending, hunger. When food insecure individuals enter the emergency food system, their decisions to continue or limit their participation is likely influenced by language, both spoken and unspoken. In this study, I plan to examine discourse and dialogue at AIDS Project Worcester and ACORD Food Pantry. The language of those who use food banks as well as the language of volunteers who serve this population can be analyzed to understand limitations surrounding the emergency food system. The hope is that these findings will help food activists negotiate interactions with the food poor and work towards solving food insecurity in Worcester.

We thank the Weiss Summer Research Program and Ignite Fund for financial support.

Poster 48

Combat Psychiatry in Times of War

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Perhaps one of the most controversial aspects of the United States military has been their Psychiatric Healthcare system and how it has been organized in order to best function during times of war. We have examined the history of this system over the course of three wars: World War I, World War II and the Korean War. We concluded that the effort and development in preparation for treating servicemen in combat tended to become worse over time. The reasons proved to be intriguing. The U.S. Army during World War I proved to very successfully at integrating psychiatry into their healthcare, both in the treatment itself and in its availability. World War II proved to be a step backwards, with little research or organization given to psychiatry at first. However, as the war progressed, the situation improved, with the government and U.S. Army taking a greater interest in the field. The first year of the Korean War proved to be disastrous in terms of psychiatric treatment and organization. Similar to World War II, the quality of the aforementioned healthcare issues improved as the war progressed. There was an overall trend in lack of preparedness at the start of all three wars. The approaches to the treatment of combat fatigue improved with each war, though their actual implementation proved to be more varied, with poor implementation being common towards the beginning of the latter two conflicts. An important issue to take note of in this research is the historiography. Many sources that were used, especially from the Korean War, were from the government; the data could be skewed in favor of positive outcomes and analysis in the absence of outside peer review and critique.

We thank the Dr. Charles Weiss Summer Research Program for providing the financial support for our study.

Poster 49

The General, the Czar, and the Yeoman: Cooperative Federalism in the Reagan Justice Department's War on Drugs

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The Reagan Administration's "War on Drugs" is just one era in a long line of federal actions that shaped narcotics enforcement policy. Under Attorney General William French Smith, the Reagan Justice Department, in cooperation with the White House, expanded federal control in this area. This project uses the Reagan "War on Drugs" as a case study to demonstrate the office of the Attorney General as an instrument of expanding federal power in law enforcement policy. By analyzing the connection between the Reagan White House's overarching political agenda, the Justice Department's policy implementation of that agenda, and the fusion of these two elements at the local law enforcement level, this project illustrates the dynamics of cooperative federalism in drug law enforcement. This project compares the agencies, states, and localities involved in the narcotics law enforcement structure to cogs or gears in a machine that works to efficiently complete a task when all parts are turning the correct direction. This analogy also helps to visualize state struggles with legalization as well as other initiatives. Because the cogs/gears no longer spin in the direction of the federal government, the machine jambs up. This case study on the effects of one Attorney General explains how the Justice Department can be used to facilitate cooperative federalism in order to achieve political gains, and the project traces out the eventual ramifications of this policy.

I would like to thank the Ignite Fund and the Weiss Summer Research Program for financial assistance.

Poster 50

Efforts towards the Synthesis of Indolizine

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IIndolizines are 10 pi electron-conjugated heterobicycles, utilized as the central scaffolding for medicinal chemistry. Their applications include antiarrhythmics, antihypertensives, and anticancer activities. While there are a diverse range of methods to synthesize indolizines, we propose a one pot synthesis whereby a terminal alkyne is converted to a 1,4 disubstituted-1,2,3-triazole followed by rhodium-catalyzed trans-annulation arriving at the indolizine in good yields with readily available starting materials. 2-methylpyridine derivatives can readily undergo propargylation yielding the requisite terminal alkyne needed for the proposed transformation. Utilizing "Click Chemistry" the intermediary 1,4 disubstituted-1,2,3-triazole can be accessed. With the addition of catalytic amounts of rhodium (II) dimer and heat, the triazole decomposes forming a rhodium carbenoid favorably situated for a 5-exo-trig nucleophilic addition of the pyridine to furnish the skeleton which upon aromatization provides the indolizine. We have found that addition of a mild base can improve the yield of the transformation. This method allows for the synthesis of highly substituted indolizine.

We thank the Robert J. Stransky Foundation Research Fellowship in the Sciences, and Marion and Samuel E. Krug, Ph.D. '65 for the financial support.

Poster 51

Barium-141 Gamma Ray Spectroscopy and Influence on Antineutrino Spectra

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Nuclear reactors produce a large flux of antineutrinos because of the large number of beta decays that occur following the fission of Uranium-235. New precise measurements of antineutrino spectra from a reactor have hinted at a fine structure that indicates which fragments are contributing the most to the antineutrino flux from the reactor. However, some of the beta decay schemes for some of these fragments are out of date and are incorrect. By updating the decay schemes of the fission fragments, the antineutrino spectra can be improved upon with the accurate decay data. A spectrum of the Barium-141 β- decay was produced at Argonne National Lab. The spectrum was analyzed and an improved decay scheme for the isotope was produced. The scheme was then used to update the antineutrino spectra.

This work was supported by the DOE Office of Nuclear Physics under contracts DE-AC02-06CH11357, DE-AC02-98CH10946 and supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTS) under the Science Undergraduate Laboratory Internships Program (SULI).

Poster 52

Terminal Alkyne Attachment on Platinum

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Platinum is a catalytic metal that has many applications such as running fuel cells. Due to the properties of this metal, it can be useful to know how different molecules attach to this metallic surface. There are few previous studies of the formation of platinum carbon bonds. We focused on attaching 1-dodecyne and 1-tetradecyne onto the surface of platinum electrodes and sheets of flat platinum to determine the density and stability of attached terminal alkynes. Cyclic Voltammetry (CV) was used to test electron transfer to the electrodes surface. When running CV on the electrodes both ferricyanide and methanol with sulfuric acid solutions were used to measure different effects of the surface. Ferricyanide was used to test the blocking effect by the molecules on the surface of platinum. Methanol was used to test the capabilities of the surface of platinum to be used as a fuel cell. Infrared spectroscopy (IR) was used to study the chemical bonds present on platinum. Blocking by both 1-dodecyne and 1-tetradecyne was detected. The currents for both molecules when running the CV were lower than a test of the bare electrodes. Both molecules were also observed using IR. By comparing these results, we can look at how different lengths of alkyne molecules affect the flow of current on the platinum.

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

Poster 53

Drosophila DEG/ENaC ion channel *ppk29* is expressed in neuronal and glial cell types

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Members of the Degenerin/Epithelial Sodium Channel (DEG/ENaC) family play important roles in regulating ionic gradients across epithelial barriers. Many family members are also expressed in the nervous system, but their neurophysiological functions remain poorly understood. A specific *Drosophila* DEG/ENaC subunit termed *pickpocket 29 (ppk29)* is expressed in both neural and non-neural tissues, but little is known about its location of expression and function in neural tissues. By genetically modifying *Drosophila* using the Gal4/UAS and the LexA/LexAOp systems and utilizing fluorescence microscopy, we aimed to determine what cell types in the *Drosophila* larval nervous system express *ppk29*. Our data suggests that *ppk29* is expressed in sensory neurons, glia along motor neuron bundles, and in the larval brain. Research regarding determining the specific cell types that express *ppk29*, most notably the central nervous system neuronal cell type, is still ongoing. Findings from our project can better our understanding of how DEG/ENaCs impact nervous system function and their contributions to human diseases associated with these genes, such as multiple sclerosis and panic disorders.

We thank the Patricia McGovern Hill ’82 P12 and Peter J. Hill ’82 P12 Family Summer Research Scholarship for financial support.

Poster 54

Investigating ERG Channel-Encoding Gene *Seizure’s* Role in *Drosophila* Development and Stress Resistance

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In *Drosophila,* the gene *seizure* (*sei)* encodes a voltage-gated potassium channel as a member of the ERG channel family. Mutations in the human homolog*, KCNH2*, play a critical role in the cardiac disorder long QT syndrome (LQTS). Expressed in neurons and glia, *sei* has been shown to be important for protecting *Drosophila* from heat-induced seizures. Previous work has also suggested that *sei* may have additional effects, including modulation of both development timing and oxidative stress resistance. We conducted developmental and oxidative stress assays, using *sei* mutants and animals with RNAi-mediated knockdown of *sei,* respectively. *Sei* mutant flies emerged faster than the control, showing a shortened development period. Exposing animals to hydrogen peroxide revealed a potential difference in the ability of males and females to cope with oxidative stress, where males are more susceptible than females. Investigating *sei’s* multiple possible functions offers insight into additional effects of *KCNH2* mutations, some of which could potentially be beneficial in contrast to the life-threatening LQTS for which these mutations are known. Future studies will include using immunofluorescence to observe *sei* expression during embryogenesis, as well as repeating developmental and stress resistance assays with larger sample sizes. We will also further investigate any sex-based differences in oxidative stress resistance.

We thank Wendy R. and Kenneth J. Edwards, M.D. ’80 P12 for their generous financial support.

Poster 55

Enkurin Antibody Development for *Drosophila melanogaster*

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Enkurin is an essential protein for the fertility of male animals ranging from insects to mammals. To determine how enkurin acts, and why it is essential for the fertility of *Drosophila melanogaster*, we have attempted to develop an antibody to the protein that will allow us to visualize its location in sperm. Antibodies are made by injecting purified protein into a mammal. Unfortunately, prior work in our lab found that the full-length enkurin protein is insoluble, making protein purification difficult. To attempt to circumvent this limitation, we instead tried to clone and express in bacteria three segments of the protein. Each segment was placed into a plasmid that allowed for inducible expression and that would produce the protein with a 6x-Histidine tag for purification. We tested the expression of each segment and found that one segment, the N terminus, expressed as soluble. However, during purification, this protein was unable to bind to cobalt columns. We have therefore turned our attention back to the full-length enkurin and begun to optimize ways to purify this insoluble protein from *E. coli*. Once protein purification is successful, we will send the protein for injection into guinea pigs for antibody production. After obtaining the antibody, we will first test its ability to recognize enkurin by using a western blot and then use it to examine enkurin's cellular localization.

We thank Deirdre O'Brien Soltesz '94 and Edward G. Soltesz, M.D. '94 for their generous financial support of this project.

Poster 56

Characterization of *atlas,* a putative *de novo* evolved gene essential for *Drosophila* male fertility

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Department of Biology, College of the Holy Cross

Unlike genes that arise from duplication events, *de novo* genes arise from previously noncoding DNA. Many of these *de novo* genes exhibit testis biased expression and their function remains uncharacterized. Using an RNAi screen, we have identified several testis-expressed putative *de novo* genes that are required for successful male reproduction. The removal of one such gene, *atlas,* results in almost complete male sterility, as demonstrated by both RNAi knock down and, now, CRISPR/Cas9 mediated knockout (KO). Observation of *atlas* KO male reproductive tracts showed few sperm in the seminal vesicle (SV) and a distended basal end of the testis, suggesting that sperm in *atlas* mutants are not being transferred to the SV during spermatogenesis and, thus, to the female during mating. Staining of whole testes for both actin and DNA revealed that *atlas* KO flies seem to lack actin-based individualization complexes (ICs), which are required for the formation of individual sperm cells. Interestingly, when *atlas,* a testis-expressed gene, is removed from females, it also causes decreased fertility. We are currently working to generate an *atlas*-GFP fly line in which we have inserted GFP immediately following the protein coding region of *atlas*, allowing us to visualize where the *atlas* protein localizes in the testis. The essential role that *atlas* plays in spermatogenesis demonstrates how *de novo* are able to quickly become essential for an organism's fitness.

We thank the National Science Foundation for financial support.

Poster 57

Investigation of *atlas* and *juno,* two *de novo* evolved genes necessary for full fertility in male *Drosophila*

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De novo genes are genes that have originated from previously non-coding regions of DNA and are unique to only one or a few species. In *Drosophila melanogaster*, many *de novo* genes are expressed in the testes, including some that have become essential for male fertility. Here, we focused on the functional characterization of two such genes, *atlas* and *juno.* Previous research showed that CRISPR/Cas9-mediated knockout of *atlas* results in almost complete sterility in males, and the atlas protein appears to play a role in late spermatogenesis. This summer, I developed reagents to allow us to use CRISPR to replace the protein-coding region of *atlas* with green fluorescent protein (GFP). This will allow us to further investigate the *atlas* gene's role in fertility, and to visualize the cells in which *atlas* is normally expressed, giving us further insight into its function in spermatogenesis. The *juno* gene was previously identified in an RNAi screen as another critical gene for male fertility. I replicated this result in a more sensitive fertility assay and confirmed that loss of *juno* leads to complete male sterility. I am now creating a *juno* knockout line using CRISPR/Cas9. Through a series of crosses, we will stabilize this line and then use it to further investigate the effect of *juno* on reproduction. Preliminary analysis suggests that *juno* loss-of-function males can produce sperm, causing us to hypothesize that *juno* may affect sperm function after mating.

We thank the National Science Foundation for financial support.

Poster 58

Effects of NAMPT Inhibition on PD-L1 Expression in Glioblastoma

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Glioblastoma (GBM) IDH-Wildtype is the most common and most aggressive primary brain tumor with a median survival prognosis of 15 months for patients at diagnosis. GBM's aberrant metabolism, which propels tumor growth, is aided by ample blood and nutrient supply it receives from vasculature. Selective inhibition of NAD+ salvage pathway enzyme nicotinamide phosphoribosyltransferase (NAMPT) has been observed to deplete NAD+ necessary for GBM's metabolism and induce cell death. However, the effect of NAMPT inhibition on the GBM immune microenvironment has not been explored. This study aims to characterize the effects of NAD+ depletion on the immune microenvironment. Patient derived and murine GBM cells were exposed to NAMPT inhibitors FK866 and GMX1778 in vivo and in vitro and we studied their effects on the expression of T-Cell inhibiting ligand PD-L1. Through flow cytometry and cell count of immunohistochemistry staining it was found that both selective NAMPT inhibitors significantly increased PD-L1 expression within the tumor microenvironment, implying that NAMPT inhibition leads to immunosuppression of the GBM microenvironment. Based on this finding, a murine in vivo experiment which tested the addition of an anti-PD1 antibody to GMX1778 was conducted and yielded longer rates of survival among groups treated with anti-PD1 and NAMPT inhibitors when compared to control groups and NAMPT inhibition/anti PD1 mono-treatments. These results point to a promising innovation in NAMPT inhibitory GBM therapy by pairing it with immune checkpoint blockade, and further research may help such a therapy become a strong candidate for clinical trials.

We thank the National Institute of Health for financial support.

Poster 59

Understanding Behavioral Synchrony: Differences in Behavioral Synchrony in Adolescents with Autism Spectrum Disorder using Functional EEG Networks

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People engaged in social interactions exhibit natural, unintentional coordination of their body movements. Although intense efforts have been made to localize behaviors in human brain activity, little is known about the functional networks that underlie human social interaction. We are interested in how behavioral synchronization corresponds to functional networks in the brain. To this end, we analyzed electroencephalograph activity recorded at 64 electrode locations on the scalp from an experiment in which participant pairs swing pendulums in different interpersonal coordination conditions (in-phase, anti-phase, unintentional, and intentional). Data are collected for both adolescent participants with Autism Spectrum Disorder (ASD) and Typically Developing (TD) adolescents. Using the weighted phase lag index as a pairwise electrode coordination measure, we compare functional networks in selected frequency bands. We apply network analysis techniques to evaluate and compare the dynamic expression of subgraphs in adolescents with ASD and TD adolescents, as social disconnection is one of the suggested tendencies of individuals with ASD. Finally, our analysis lends support to the hypothesized dysfunction of the mirror neuron system with regard to ASD.

We thank Dr. Dan Kennedy ’68 for financial support.

Poster 60

The Effects of Doxorubicin on the Immune Response to Cancer

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Eliciting an immune response to attack cancer cells is a promising tactic for cancer therapies, but it is challenging as tumors often create immunosuppressive environments that exclude immune cells or reduce their function. Additionally, many standard treatments kill cancer cells in a manner not conducive to generating an effector response, potentially causing immune tolerance. Several chemotherapy agents cause immunogenic cell death and generate an immune response against the remaining tumor cells, but they lead to different outcomes between cancer types. We investigated the immune-stimulating effects of doxorubicin, one of the drugs shown to cause immunogenic cell death. For an in vitro approach, we treated melanoma, breast cancer, and leukemia cells with a range of doxorubicin concentrations and measured the cancer cells’ surface immune profile, indicators of immunogenic cell death, and ability to activate dendritic cells to gain a more holistic view of how doxorubicin may affect the immune response to cancer. Finally, we investigated local delivery of doxorubicin by characterizing its release from alginate hydrogels. This technology has been successful in delivering cancer vaccines and other immune-stimulating agents. Optimizing doxorubicin release from this system may lead to more effective combination therapies with these other approaches. Better understanding the immune effects and delivery of doxorubicin will hopefully lead to developing more effective cancer immunotherapy treatments.

We thank the Harvard-Amgen Scholars Program, the Amgen Foundation, the John A. Paulson School of Engineering and Applied Sciences, and the Wyss Institute for Biologically Inspired Engineering for financial support.

Poster 61

Interrogating the role of MDM4 in metastatic prostate cancer

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Prostate cancer affects 220,000 American men each year, killing some 30,000 by metastatic prostate cancers. The standard of care for such patients involves androgen-deprivation therapies (ADT) such as the androgen receptor (AR) antagonist, enzalutamide. However, most patients develop resistance to these drugs and progress to metastatic castration resistant prostate cancer (mCRPC). In this work, we examined the genomics of over 1000 prostate cancer patients to find recurrent mutations, utilizing genome-scale screens to identify, out of 17,255 possible candidates, genes that promoted the most robust resistance against enzalutamide. Our efforts identify MDM4, a negative regulator of the tumor suppressor TP53, as a critical mechanism in mCRPC. Specifically, our research identified MDM4 amplifications as one of the most differential clinical features upon comparing the genomics of primary prostate cancer and mCRPC. MDM4 is amplified in 11% of metastatic prostate cancers, 10-fold higher than in primary prostate cancer. Examining a potential therapeutic strategy that targets MDM4, we tested the efficacy of an MDM4/2 inhibitor, RO-5963, in three cell lines, finding RO-5963 efficacious in only TP53 wild-type cells (LNCaP). Upon optimizing RNAi techniques that specifically ablate MDM4 expression in LNCaP cells, we examined the potential of targeting MDM4 and found that MDM4 suppression in wild-type TP53 cells significantly reduced cell viability. These experiments demonstrated the potential of targeting MDM4 in TP53 wild type mCRPC, indicating that up to 66% of mCRPC patients may respond to such therapies. We also identified a novel role of MDM4 in ADT resistance. Overexpression of MDM4 promoted greater proliferation in 99.7% of 17,255 candidate genes in an ADT sensitive prostate cancer cell line. MDM4 also promoted resistance in a short-term proliferation assay. Overall, we identify MDM4 as a potential therapeutic target in mCRPC. Pre-clinical studies should develop on-target approaches to blockade its activity.

We thank the Dana Farber Cancer Institute for its support.

Poster 62

Cameras in the Courtroom: Televised Proceedings and the Consequences of Increased Transparency on the United States Supreme Court

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The Supreme Court has long been a reclusive institution, with justices enjoying anonymity, but also great power; however, some believe that a rise in judge-made-law, paired with controversial cases and appointments, require increased oversight of the Court. Scholars, congressmen, and the media have long advocated for televised proceedings of the Supreme Court, citing a need for transparency of an institution with enormous power and few ethical rules. The justices are opposed to the idea, arguing that cameras might compromise the effectiveness and functionality of proceedings. Although the Supreme Court is often seen as politically compromised, it remains a legal institution that necessitates a different kind of transparency than, say Congress. While advocates for cameras and increased transparency hope for more present and accountable justices, televised proceedings would likely inflict irreversible harm, by changing the perception of the Court and the behavior of its justices.

We thank the Weiss Summer Research Program for financial support.

Poster 63

Analysis of Acoustic Waves During Simulation of Hydraulic Fracturing

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Hydraulic fracturing is the process of inducing mechanical discontinuities, fractures by pumping pressurized sand, water and chemicals deep within the Earth's interior to extract natural gas. The detection of these fractures could allow for characterization of this otherwise unobservable phenomenon. Acoustic waves are compressional waves that propagate from the energy release of a material undergoing stress. The goal of my research is to determine whether acoustic emissions from transportable chemical sources can detect the presence of fractures. The samples were fabricated using a FormLabs printer. All samples contained a central borehole for the release of chemically reactive granules that emit an acoustic signal upon dissolution. One intact sample and 3 fractured samples were printed with external dimensions of 50 mm x 50 mm x 100 mm. The fractures were composed of equally spaced tubes with elliptical cross sections. Fracture lengths varied among the samples and ranged from 1/3, 2/3 and to the full height of the sample. 18 acoustic emission sensors were placed in the same locations on each of the samples and used to record the acoustic emissions from the reactive granules. The Mistras Group Acoustic Emissions software was used to process the data to obtain the locations of acoustic emission events and to record the signals. Observation from the event location graphs for each sample shows that the event positions became less localized to the borehole when a fracture was present in the sample. Examination of the signals from the intact and fractured region of the samples found that signals that propagated through a fracture had longer periods (low frequencies), later arrival times and attenuation.

This research was funded by NSF REU grant PHY-1852501.

Poster 64

Restaging Women's "Private" Lives: A Historical-Institutional Analysis of the Battered Women's Movement

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Without notice and without noise, the Department of Justice's Office on Violence Against Women issued a revised definition of domestic violence during April of 2018. Divorcing itself from the understanding that psychological and physical harm are equally reprehensible and damaging in intimate partnerships, the current definition limits the scope of domestic violence to include only felony and misdemeanor acts committed by one partner against the other. This change took place within a national context marred by rising domestic violence rates; from 2014 to 2017, the number of individuals killed by an intimate partner rose from 1,875 to 2,237 and since 2010, such gun-related murders have increased by 26 percent (Fox 2019). Therefore, research on what is at stake amidst national efforts to reduce our social commitment to battered women could not be more pertinent. Sociological theory has long provided a conceptual framework for understanding the process by which social problems are created and capture public interest, as well as how formal organizational structures are built to confront these problems once they gain saliency. In my historical-institutional analysis of the battered women's movement, I examined records spanning early modernity in England and colonial America to the latter part of the 20th century and found that only when a specific constellation of social factors were present—an institutional environment that was sensitive to activist initiatives, sex-segregated spaces where women could publicize private abuses, a body of feminist psychotherapeutic literature dissecting the intricate dynamics of abuse, and a mass-mobilized movement for women's rights—did the creation of a battered women's movement and a national institutional structure addressing domestic violence become possible.

We thank the Weiss Summer Research Program for financial support.

Poster 65

Generational Divides in U.S. Immigration Opinion? Millennials' Views in Comparison, 2004-2018

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The constantly evolving immigration policy is a hot button issue in contemporary U.S. politics and media. Public opinion toward immigration is related to a variety of factors, such as economic interests, labor market competition, "symbolic" or cultural factors, (perceived) group threat, and political conditions. Yet, less research focuses on potential generational divides in public opinion toward immigration policy in the U.S. This is an important oversight because studies paint a picture of "Millennials"—those born between circa 1980 and the mid-1990s or later—as having more liberal attitudes than their counterparts on a number of social issues in the U.S. Still, ostensible generational divides in immigration policy attitudes may be little more than a sign of changing times or the progression of aging, which represents the problem of disentangling age, period, and cohort effects. Using bivariate analyses, χ^2, and *z*-tests on biannual General Social Survey data between 2004 and 2018, the preliminary results indicate that Millennials' views on immigration significantly differ from non-Millennials' views, albeit with some variation by year. Millennials also appear to be gradually more supportive of increasing immigration over time. Analyses planned for the future will attempt to understand interrelationships among (multiple) cohorts, age, time, and immigration opinion.

We thank the Greisch Family Summer Research Fellowship in Sociology for financial support.

Poster 66

Structural analysis of the force chains within communities of particles

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Granular materials are collections of macroscopic particles in contact with each other, which exhibit a variety of behaviors. Granular materials can act as solids, liquids or gases, depending on the physical circumstances and can exhibit complex behaviors, which have not yet been sufficiently explained. In order to improve the understanding of interactions between the particles, we provided a mathematical analysis of the structures created by the forces between the particles from an experiment performed on a set of photoelastic disks by Dr. Eli Owens at North Carolina State University. Randomly distributed disks placed in a flat upright container were subject to consecutively increased pressure in each trial caused by weight applied on top of the container. In each case, the forces due to pressure create unique structures called force chains, which combine into force networks. To study the changes in those force networks, we tracked individual disks along the pressures. We grouped the disks into communities to study the changes in the force chains across pressure levels. We applied two different versions of the community detection algorithm based on the Newman-Girvan and geographical null models to obtain two unique sets of communities along all pressures. The community plots along the increasing pressures revealed that the greater the pressure applied, the fewer communities are observed for both null-models. The larger communities also tend to encompass smaller communities because larger groups exhibit stronger connectivity.

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

Poster 67

The Gospel of Anti-Judaism?

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"Anti-Judaism" refers to the denigration and rejection of Judaism as an inferior or even a bad religion. The Gospel of John can be understood as a Jewish Gospel since its protagonist, Jesus, and his early followers are all Jews. However, the Gospel also seems to contain anti-Jewish elements. There are no fewer than 70 references to the *Ioudaioi* (often translated as "the Jews") in John's Gospel, and most of these references present the *Ioudaioi* as opponents who want to arrest and kill Jesus; with the Gospel at one point even calling them children of the devil (John 8:44). After analyzing the Gospel as well as secondary sources by religious studies and classics scholars, I find it hard to ignore the anti-Jewish implications of the Fourth Gospel. However, I will argue that we do not have to interpret the Gospel in anti-Jewish ways. Even though John excludes those who do not accept Jesus as their Messiah, the Gospel's ultimate message is life and salvation for humanity. Moreover, we must realize that "the Jews" may not be the best way to translate the Greek *hoi Ioudaioi*; it is important to realize that our understanding of John is often influenced by translations if we cannot read the text in its original language.

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

Poster 68

The Effects of Revising the Preoperative Fasting Protocol in Arthoplasty Patients

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Traditionally, patients to undergo total joint arthroplasty (TJA) are asked to refrain from oral intake of food or liquids after midnight prior to surgery in order to reduce the risk of pulmonary aspiration or regurgitation during the perioperative period. Intra- and postoperatively, dehydration and hypoglycemia can contribute to morbidity, prolonged recovery, and even mortality. Prolonged fasting can be specifically detrimental for elderly arthroplasty patients, who are asked to mobilize immediately after surgery. We hypothesize that postoperative dehydration and hypoglycemia, resulting from fasting, can contribute to dizziness and poor performance with physical therapy, and in turn, prolonged hospitalization. In an effort to address these concerns, our institution initiated a new protocol that relaxes the traditional nothing by mouth after midnight requirement for surgical patients. Prospective patients undergoing THR or TKR received carbohydrate drinks preoperatively to reduce fasting in hopes to optimize recovery. It was recently discovered that there is no additive risk of aspiration and gastric content with carbohydrate-rich drinks (CHO), but whether or not this change in protocol improves patient post-operative nausea and recovery is unclear. We intend to demonstrate that relaxation of the traditional NPO after midnight protocol promotes TJA patient's 1) ability to participate with in-hospital physical therapy, 2) reduces length of stay, and 3) is safe without increased risk of intra- and post-operative complications.

Thank you BIDMC sponsors for financial support.

Poster 69

Documentation of Catholic Worker Thought: Conversations in Worcester & Hartford

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The Catholic Worker Movement (CWM) is, in some regards, an enigma of resistance movements—it has survived many decades as a medium of passionate social justice, when many similar (often secular) resistance movements died with the epoch. It is also an enigma of religious movements—decentralized, anti-establishment, Anarchist-Pacifist, and Personalist. The profoundly unique interpretation of Catholic living, of resistance and protest, and of personalist humanitarian 'works of mercy,' is all found in this movement which continues to thrive. The CWM deserves both further academic and journalistic attention. To contribute to the archived history of this movement, I interviewed a collection of individuals currently operating self-described Catholic Worker Houses (in one case a soup kitchen), or who have been historically involved as CWs in Worcester and Hartford. I then organized eight hours of interviews into numbered segments. Additionally, I have created a reference document of quotations from Dorothy Day's diaries, books by her related to the movement, various tomes by historians of the movement, and have collected a number of CW-affiliated newspaper publications. All of this compiled material will be used to service a thesis on the subject, where I will plot the genealogical nature of the philosophy, or ethos, behind the CWM. My intention is to argue that contemporary generations of concerned individuals will find an empowering lifestyle in the Catholic Worker, with a focus on relationship building, independent living, and an individualized relationship with God. Academics from the fields of sociology, history, philosophy, and theology will all find the CW approach to the world's ailments as worthy of interest.

My efforts were assisted by financial support from the Weiss Summer Research Scholarship Fund.

Poster 70

Procedural Approach Associated with Incidence of Long-Term Laparotomy Complications Post Open Abdominal Aortic Aneurysm Repair

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While the transabdominal (TA) and lateral approaches (LA) to open abdominal aortic aneurysm repair (OSR) are generally regarded as equivalent in terms of postoperative outcomes, there is a paucity of data evaluating subsequent laparotomy-associated complications (LC). The aim of this study was to establish the incidence of LC after OSR, and to determine if procedural approach was associated with long-term LC. Institutional data for OSR from August 2010 to January 2019 were queried. The primary endpoint was long-term LC, which was defined as any complication related to entry into the abdomen. The TA cohort included repairs via the transabdominal approach, and the LA cohort included repairs via both the retroperitoneal and thoracoabdominal approaches. Kaplan-Meier analysis estimated freedom from LC for each cohort, and a Fine-Gray model for competing risks with death as a competing risk determined predictors of LC. There were 241 patients who underwent OSR; 91 via TA and 150 via LA (mean age 70.0 ± 9.1 year; 71.7% male). Patients who underwent repair via TA were significantly younger (66.7 ± 8.9 vs 72.1 ± 8.7 years; $P < 0.001$), more likely to be male (83.5% vs 64.7%; $P = 0.002$), and more likely to have a history of small-bowel obstruction (3.3% vs 0%: $P = 0.025$). Patients who underwent repair via LA where more likely to require a supraceliac clamp (20.7% vs 1.1%; $P < 0.001$). There was no difference in perioperative complications or long-term mortality between the cohorts. Unadjusted 1, 3, and 5-year freedom from LC was 77.7%, 60.5%, and 54.0% for the TA cohort versus 94.8%, 82.2%, and 79.1% for the LA cohort, respectively. In patients with amenable anatomy, LA may be favorable for preventing long-term LC, especially in high-risk patients.

Poster 71

Capitalism and Ethics

C. Whiteside, J. Fisher, E. Liskov, and D. Brand
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Whiteside, Fisher, and Liskov are Carroll Fellows who participated in a seminar "Capitalism and Ethics" taught by Professor Donald Brand. Introduced to different facets of capitalism as well as ethical and moral theories, each of us sought to investigate specific dimensions of capitalism and the role of ethics with regard to each. Throughout the summer we have worked collaboratively. We believe that the research we completed this summer is a stepping stone to a better understanding of the potential for an ethical capitalism. Liskov specifically researched Milton Friedman's shareholder value theory and how it affects companies and their stakeholders (workers, consumers, others affected by corporate decisions). By looking at how the theory has impacted corporate behavior, she concluded that it led to economic inefficiencies and ethical shortcomings. Fisher specifically researched philanthropy and its role within capitalism. Given the rising amount of ultrawealthy people in both the United States and the world more generally, what has been the role of the top one-percent in giving back to society. How can this altruism be encouraged and channeled to maximize social welfare? Why do some billionaires give yet others do not? Is the behavior of the ultra-wealthy influenced by their country of origin? Whiteside examined political polarization with regard to the economy. Drawing upon research from moral and political psychology, she looked into the different norms that shape behavior at each end of the political spectrum. She evaluated possible reasons for increasing polarization and how this adversely impacts economic and political discussion.

We thank the Weiss Summer Research Program for financial support.

Poster 72

US funded HIV Interventions in Eswatini and Gender Equity

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The signing of the Development Objective Agreement Grant with the Kingdom of Eswatini will lead to $225 million over the next 5 years to the small monarchy to combat HIV/AIDS through the U.S President's Emergency Plan for AIDS Relief (PEPFAR). According to USAID, over $19 million has been invested this fiscal year. This marks a 50% decline in investment from 2018. Its top partner, Pact World, funds programs such as Ready, Resourceful, Risk Aware, a program that targets adolescent girls and young women, a group that the US defines as their target population. The objectives of this study were to understand the distribution of US funding to organizations that implement HIV interventions in Eswatini, the strategies these programs utilize, and whether or not they are effective in addressing gender issues related to HIV. PEPFAR distributes its resources through 46 different program activities. Five programs utilized $8,361,471 that were designed to specifically target women, mothers and girls. These 5 programs seek to organize discussion groups, provide educational and preventative services, and encourage young women to develop leadership skills within their communities in an effort to combat gender inequity. On the other hand, $144,356 was funneled into 3 programs to target men and boys. These programs exclusively focused on promoting male circumcision in men, boys, and infants. American programs such as the MeToo movement have focused on women as a subjugated group but as an intervention, it has failed to address male societal attitudes that influence rape culture and contribute to gender inequity. The US has taken a similar approach in funneling substantially more funding into programs in Eswatinti that focus on women in terms of gender inequity issues that contribute to HIV transmission. Providing educational and preventative services specifically to adult men will contribute to changes in societal attitudes and reduction in HIV transmission.

We thank the George I. Alden Trust Excellence in Career Related Undergraduate Education for funding this project.

Poster 73

Altering Institutional DNA: In Pursuit of the Eco-Campus

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This research project draws on 35 in-depth, semi-structured interviews with campus-based sustainability practitioners, two national surveys, and over 400 sustainability reports in order to identify the strategies these professionals adopt as they strive to make their campuses sustainable places to live and learn. The triangulated findings reveal that for many institutions of higher education (HEIs), sustainability initiatives are not high priority issues, necessitating creativity and extensive collaboration in the face of scarce resources, leadership transition, and conflicting institutional foci. It is this collision of priorities and constraints, in particular, that renders the allocation of needed resources unpredictable and insufficient as these professionals attempt to execute a sustainable transition. By examining institutional contexts and resource mobilization strategies, researchers can identify the socio-economic forces mediating the productivity, aspirations, and enduring successes (or failures) of sustainable development advocates and their initiatives. These mixed methods findings will have important implications for researchers by highlighting the complex ways in which sustainable development occurs in higher education, and will hopefully generate more practical solutions in pursuit of the eco-campus.

We wish to thank the George I. Alden Trust Excellence in Career Related Undergraduate Education for their financial support.

Poster 74

Nationwide Injunctions, Polarization, and Judicial Restraint

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In recent years, lower federal courts have repeatedly blocked the federal government from implementing policies on a national scale. These "nationwide injunctions" bar the action of a defendant on a universal basis. Single district court judges are using nationwide injunctions to block the government from applying policy anywhere in the country based on the decision from one case. This phenomenon is rapidly accelerating in its use. The Obama Administration was enjoined six times by nationwide injunctions. As of spring 2019, three years into the Trump presidency, judges have already blocked the Administration thirty-seven times. Our project attempts to assess the impact of these nationwide injunctions on the American political system. Our research has yielded complex results. On the one hand, nationwide injunctions limit the power of the executive, and offer immediate and complete relief to individuals who would be harmed by a government policy, and would otherwise not have the resources to bring their own case to trial. On the other hand, nationwide injunctions create legal uncertainty, sidestep the slow and methodical decision-making process of the courts, encourage forum shopping for politically friendly judges, and run the risk of conflicting injunctions where two judges issue contradictory orders to the government. Our research also suggests that the acceleration of nationwide injunctions might be understood in part as a product of the rising hyperpolarization in present-day American politics. As each party increasingly views the other as a threat to the country, they are determined to block policies enacted by the opposite party everywhere, every time.

We thank the Weiss Summer Research Program for financial support.

Poster 75

Law, Politics, and Human Nature: Harry Blackmun and the Separation of Powers

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The Supreme Court of the United States is often viewed and studied as being cut off from the political and social motivations that define the other two government branches and the country at large. Yet Supreme Court Justices are not immune to political and emotional persuasion from politicians, family and friends, and the general public. The papers of Associate Justice Harry Blackmun demonstrate how a Justice can be affected by forces outside of the Supreme Court. By looking in depth at two particular cases—United States v. Nixon (1974) and DeShaney v. Winnebago County (1989)—this paper illustrates the humanity inherent in being a Justice, a job that is supposedly solely defined by the blind eye of the law.

I thank the Weiss Summer Research Program and the Ignite Fund for financial support.

Poster 76

Dragon Ladies: Comic Depictions of Vietnamese Women as Metrics of American Memory of the Vietnam War

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Juxtaposing recent scholarship on women in the Vietnam War with close readings of comics and graphic novels written during or about Vietnam provide conflicting images of women. The comics that defined America's cultural memory of the war have created a deceptively false mythology that excludes women's humanity, if not their historical presence. Evolving from fractured wartime commentary in the 1960's into the comics of the 1980's which sought to "re-masculinize" America and its memory of the Vietnam war, comic depictions of the war now appear primarily as graphic novels authored by Vietnamese refugees and their descendants. The portrayals of Vietnamese women have also evolved, from oversexualized allegorical figures into historically present humans. Comic depictions of women in the Vietnam war, functioning as examples of mythology and counter-memory, serve as a metric of America's evolving cultural memory of Vietnam. The comic medium continues to offer a non-normative avenue apt at portraying a war that defied popular representation due to its non-traditional nature, controversy, and shocking images. Authors used comics to commentate on the war, portraying allegorical themes through recognizable icons, often representing Vietnam as a vulnerable woman and America as a soldier. The enduring appeal of Milton Caniff's archetypal Dragon Lady character reveals that comics birthed the gendered terminology used to describe the nation and people of Vietnam during the war. Wartime comics, produced and enjoyed by GIs, cemented the icons that permeate depictions of the war and revealed America's fear of Vietnam and its women. While male soldiers on the fringe of society used comics to project their voices, women have now reclaimed their physical representation through comics and have expanded their narrative role from voiceless object to storytelling protagonist.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 77

Investigating the Anti-Cancer Properties of *Withania Somnifera* in Colorectal Cancer Using Metagenomic Analysis of the Gut Microbiome

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Colorectal cancer, the third most commonly diagnosed cancer in the United States, is also the second deadliest of its type. The 5-year survival rate for patients diagnosed with metastatic colorectal cancer remains poor at only 12%. The frequency and mortality that characterizes this cancer indicate that it is imperative to develop novel diagnostic tests and treatments that are unlike the current toxic and invasive approaches of chemotherapy and immunotherapy. Therefore, researchers have shifted their attention on repurposing herbal medicines, such as *Withania Somnifera*, better known as ashwagandha – an Indian ginseng whose extracts have shown anti-oxidant and anti-cancer properties. In addition, ashwagandha may also prove to be effective against colorectal cancer if it helps to generate a diverse gut microbiome, as many past studies have highlighted the association between the gut microbiome and colorectal cancer. This link exists because the metabolites produced by the microbiome can modulate tumorigenesis and response to treatment by increasing the "helpful bacteria" and/or decreasing the "harmful bacteria" population. This study sets out to investigate the effects of ashwagandha on microbiome diversity in mouse models of colorectal cancer. Five experimental groups were set up: control, active ingredients of ashwagandha, ashwagandha, ashwagandha with cancer drug, and the cancer drug alone. Extracted tumor DNA was amplified at the variable regions, V3 and V4, of the 16S ribosomal RNA gene, and will be sequenced and analyzed thereafter. Sequencing analysis of the variable regions will enable the phylogenetic classification of the bacterial population. While the experiment is ongoing, it is hypothesized that mice which received ashwagandha will have a different microbiome make up when compared to the control mice. Future work in this study will determine the efficacy of ashwagandha as a potential anti-cancer drug through the modulation of the gut microbiome.

We thank the National Cancer Institute for the financial support.

Poster 78

Russia's Revamped Blood Libel Accusation: Indicative of a Return to Antisemitic, Monarchist Times?

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A conspiracy theory has recently gained official footing in Russia, which claims that the last tsar and his family were brutally murdered as a part of a ritual. The phrase "ritual murder" has always implicated Jews throughout Russia's history, yet Bishop Tikhon Shevkunov, the foremost advocate of the theory, denies any antisemitic intent, purely because "no one has mentioned the ethnic origin or religious affiliation of the people who fired the shots." Hence, the Russian Orthodox Church's perpetuation of the Romanovs being killed by ritual murder, yet denying antisemitic intent is indicative of two alarming realities: first, that the Russian Orthodox Church is reminiscent of monarchist times, when its own power was on equal footing with that of the tsar's, and second, a new era of tacit antisemitism has begun to manifest in Russia. As a means of finding historical parallels, we examine the relationship between church and state, and antisemitic ideologies both today and in the early twentieth century, when the last tsar was killed.

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

Poster 79

Education, Advocacy, and Service: Documenting AIDS Project Worcester

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Most of us are aware of how the AIDS epidemic wreaked havoc in major metropolitan areas throughout America, but how did it effect smaller communities such as Worcester, Massachusetts? An extension of Professor Stephanie Yuhl's LGBTQ+ history project, *From Margin to Center*, we partnered with two local non-profits, AIDS Project Worcester (APW) and the Worcester Historical Museum, to help organize the documentation of Worcester County's response to the HIV/AIDS epidemic. In particular, we facilitated the exchange of historical artifacts and resources between the two organizations to chronicle APW's legacy in Worcester and to share the stories that, for too long, have gone untold. We organized APW's decades-worth of institutionally relevant newspaper clippings and literature and added them to the Worcester Historical Museum's digital LGBTQ+ archive. We then used those materials to create a timeline of APW's efforts to combat the spread of HIV/AIDS in Worcester county. The ends of the project were twofold: APW was given a display of its many contributions to Worcester county that can be used for future fund-raising, outreach and educational work, and the stories of APW's clients and staff were included in an archive of Worcester's larger history. When considering the long-standing exclusion of these marginalized populations from the larger historical narrative, the inclusion of these key documents in a digital archive is perhaps the project's largest result.

We thank the Scholarship in Action fund at College of the Holy Cross and the Weiss Summer Research Program for financial support.

Poster 80

Implementing Democracy

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Following the Arab Spring, calls for the democratization of the Middle East and North Africa region rung far and wide. Yet, when countries like Tunisia and Egypt held their first ever democratic elections, Islamist parties rose to the top of polls, and in the case of Egypt, even won the presidency. Due to these events, some questioned whether the Islamists, who called for "implementing *Shari'ah,*" could actually be faithful to democracy, or were simply using it as a guise to enforce their conservative interpretations of Islam. Yet, *Shari'ah* itself is not a tangible law code in Islam; rather, it is a shifting concept which contains a profound diversity in terms of application and interpretation. Thus, its interpretations notably vary amongst even ideologically linked Islamist parties. This project analyzes the goals of some of the world's oldest and most influential political Islamist groups across the Muslim world (namely the Muslim Brotherhood, the Jamaat-e-Islami, and Ennahda) and identifies the way in which the views of these parties often violate the political and civil liberties that are central features of democracy. These areas include limits on the freedom of religion, women's rights and general political leadership. Since the Islamist perspective on these issues is only one interpretation of the vast Islamic tradition, I also look to the other stances on these issues offered by leading Islamic authorities. By examining these two perspectives, I am able to present a larger picture of the potential of Islamic governance. Using this theoretical framework, I look to recent surveys which indicate that trust in political Islamists parties has significantly decreased since 2011. These polls also indicate that although support for *Shari'ah* remains widespread across the Islamic world, Muslims disagree on what *Shari'ah is*, and *when* it should be applied. Therefore, while support for existing Islamist parties is on the decline, there *is* potential for moderate Islamist parties who are inclusive of these differences in interpretation. It is these parties who may be able to implement the idea of *Shari'ah*, as perceived of by Muslims, whilst also implementing democracy.

We thank the Weiss Summer Research Program for financial support.

Poster 81

Disrupting the Summer Slide

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Research conducted by The Northwest Evaluation Association has found that students can lose anywhere from twenty to fifty percent of what they learn during the school year in the summer months. Students in low-income neighborhoods often account for the highest percentages of summer learning loss. Through our SPUD experiences tutoring at the Ascension After School Program, we learned of many students in the Worcester community that did not have any formal summer plans. Thus, we knew they would be vulnerable to the "summer slide" as this school year came to a close. We decided to create and implement a summer program for students in the community to be run out of the Ascension Center. We spent the 2018-2019 academic year gathering the needed financial and human resources to make this possible. We were able to focus on previous research regarding best practices in designing summer programs and conduct visits to a long-running academic summer program in Cleveland. We utilized this information to influence how we structured our daily activities in the Ascension Summer Program. We implemented our plans and carefully tracked student progress over a four and half week period. We found that short lessons in writing and math followed by fun activities were the best way to keep students engaged and give them the opportunity to use what they had learned. We also discovered that reading in small groups, field trips and artistic activities were very helpful in preventing the summer slide. Our assessment results indicate that students improved 16% (on average) from their administration of pre-tests to post-tests (which were modified MCAS assessments in math and English Language Arts). While we did have success in improving these test scores, there are aspects of creating an effective summer program that we would like to investigate further.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 82

Forces Driving the Wage Gap

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Empirical evidence shows the existence and prevalence of the gender-based wage gap in the United States. Despite numerous legislative efforts which led to significant gap closure in the 1970s, 1980s, 1990s, and into the 21st century, the wage gap persists at about 20% disparity between men and women. Today there are few and insufficient efforts being made to close the remainder of the gap. This study examines the wage gap between the sexes over time with particular attention to variables including male/female labor force participation across industry, education level, marital status, parenthood status, race, part-time employment, and full-time employment. We determined the wage gap persists because of a combination of socialization and culture as well as legislative shortcomings. Some cultural phenomena which perpetuate the gap include the expectation of women as caretakers and men as care receivers, unequal division of domestic labor, and the exclusion of women in social circles colloquially referred to as "the boys club." Legislative shortcomings include placing the onus of gender pay discrimination on the discriminated, forcing those who want justice for discrimination through lengthy litigation processes. While socialization is an important piece of the discussion, we conclude that in order to achieve pay equality, legislative intervention is imperative.

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

Poster 83

Tick Load and Tick-Borne Pathogens in Birds as a Function of Landscape Type

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Humans alter landscapes by disturbing natural habitat, affecting environmental processes such as biodiversity, ecological interactions, and prevalence of disease. Ticks serve as vectors for a number of human pathogens, such as *Borrelia burgdorferi* sensu lato, *Anaplasma phagocytophilum*, *Babesia microti*, and *Ehrlichia muris*. Birds are important hosts of ticks, and they may serve as reservoirs of pathogens. The density of ticks infected with *B. burgdorferi* is negatively affected by forest patch area. It is unknown whether tick load and prevalence of tick-borne pathogens on birds differ between disturbed and undisturbed landscapes. Further, young forest habitat is in serious decline in Massachusetts, and the Massachusetts Division of Fisheries and Wildlife is invested in increasing its abundance. Therefore, we compared tick loads on passerine birds in young forest habitat in central Massachusetts that was surrounded by either natural or disturbed landscapes. In addition, we investigated the prevalence of pathogen-infected ticks on birds. We extracted ticks from passerine birds, identified the species and life stage of each tick, and tested engorged nymphal ticks for pathogens. In the field, we determined all ticks feeding on birds to be *Ixodes scapularis*, the Deer Tick, which were supported by DNA analyses. Average tick load on birds was significantly higher in the disturbed landscapes than the undisturbed landscapes. We found *B. burgdorferi* (sl) to be prevalent in ticks at a consistent rate in disturbed and undisturbed sites. *E. muris* was absent in all ticks. *A. phagocytophilum* and *B. microti* were more frequent in ticks from the disturbed sites. These findings suggest that the frequency of ticks and tick-borne pathogens is higher in forest close to residential areas. Furthermore, this study emphasizes the role of birds as tick hosts in the New England region. More data collection is necessary to compare tick loads and pathogen rate within species at disturbed vs. undisturbed sites.

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

Poster 84

Investigating Bacterial Contact Dependent Inhibition Proteins to Develop New Antibiotics

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New classes of antibiotics are needed to combat antibiotic-resistant bacterial infections. Meanwhile, developing new drugs is challenging—especially for Gram-negative bacterial infections. Gram-negative bacterial cells are surrounded by two membranes. One of these membranes, the outer membrane, excludes many antibiotic molecules that would otherwise be effective if they could penetrate this membrane. This means there are fewer antibiotics available to combat Gram-negative bacteria. Thus, new methods of combating these types of infections are required. Our goal is to better understand one mechanism Gram-negative bacteria use to kill each other: contact-dependent inhibition (CDI). CDI is a toxin delivery system employed by certain species of Gram-negative bacteria. We aim to determine the molecular mechanism of this toxin delivery and establish whether CDI can be exploited for therapeutic purposes or if there are aspects of the mechanism that we could mimic with conventional drug-like molecules. Our research is concerned with how the large CDI toxin protein (named CdiA) binds to and transverses the outer membrane of the cell it targets for death. By making mutations and studying their effects in both the CdiA protein and its receptor in the outer membrane, we aim to pinpoint which regions of the two proteins are critical for binding and to understand the structure of the toxin-receptor complex. We evaluated this toxin-receptor interaction with *in vitro* binding assays, *in vivo* site-specific photo-crosslinking, and co-purification and crystallization. We identified regions of the CdiA protein important for binding with the target cell receptor protein. We are optimizing the conditions for our photo-crosslinking assay and crystallization of the CdiA-receptor complex for structure determination. Our goal is understanding the interaction between these two proteins well enough to engineer a CdiA protein to target Gram-negative pathogens.

We would like to acknowledge the Alumni and Parents Summer Research Scholarship Fund and Richard B. Fisher ‘47 P79 whose contributions made this research project possible.

Poster 85

District Court Resistance to Expanding Executive Power: A Contemporary Application of New Deal Politics

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In recent years, there have been two profound evolutions in American politics. First, through the continuous growth of the administrative state and use of unilateral executive action, the executive branch has expanded its influence more directly into the creation of domestic policy. Second, through the recent emergence of what are known as "nationwide injunctions", lone district court judges have assumed the power to block federal policies on a national level. Overall, this has led to a growing discontent on both issues among politicians and scholars alike. Some believe the size and scope of the executive branch has grown too large, others believe the judiciary has become too willing to obstruct policymaking, and others argue a mixture of the two. This state of affairs is not new. This research argues that the contemporary trends seen today bear striking similarities to those of the New Deal Era. It also argues that today's state of affairs is not as troubling as some commentators are arguing. By making the relatively modest reforms stated in this paper, primarily reinstating three-panel judges similar to those of 1935 and 1936 for cases questioning national policy, we can improve on our situation. By doing so, the power to block a federal policy would no longer lie in the hands of a single district court judge.

We thank the Dr. Charles Weiss Summer Research Program for funding this project.

Poster 86

Investigating the Effects of Varied Sunlight and Dissolved Carbon Dioxide Levels on the Growth of *Vallisneria Americana*

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Vallisneria Americana, commonly known as water celery, tape grass, or eel grass, is a freshwater marsh plant found on the banks of both the upper and lower regions of the Hudson river. *Vallisneria Americana* is unique because it exhibits significant blade growth while exposed to both high and low amounts of light. The factors that trigger this blade growth are currently unknown. To determine if increased dissolved carbon dioxide levels affect *V. Americana*'s blade growth, I divided sixty young plants into four treatment groups and varied the amounts of light and CO_2 that each was exposed to. The light levels consisted of 'sun' and 'shade' treatments, where the shade treatment received 100 $\mu E/m^2/s$ of sun light and sun treatment received 700 $\mu E/m^2/s$. The discrepancy between the 'sun' treatment group and normal full sun (approximately 1500 $\mu E/m^2/s$) was due to a UV reflective coating on the greenhouse in which the experiment was conducted. The light levels were controlled with shade cloth and were measured with a photometer. The CO_2 levels were controlled through use of a pressurized CO_2 tank and measured using GC analysis. Air was bubbled into the second tub as a control. Phosphate, dissolved oxygen, and Ph readings were also taken as needed. Of the three treatment groups, the CO_2/sun, CO_2/shade, and the air/sun treatment group all exhibited net negative blade growth. The air/shade treatment group was visibly the healthiest (green as opposed to brown leaves) and exhibited net positive blade growth over the 26-day experiment. These results could indicate that *Vallisneria Americana* preforms better in turbid rather than clear waters and in water that is not overly saturated in dissolved CO_2.

We thank the Cary Institute of Ecosystem Studies for financial support.

Poster 87

Evolution in the Presentation, Treatment, and Outcomes of Patients with Acute Mesenteric Ischemia

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Acute mesenteric ischemia (AMI) is a life-threatening condition associated with dismal outcomes. This study evaluated the evolution, presentation, treatment, and outcomes of AMI over two decades. AMI patients presenting at a single institution were reviewed (1993-2016). Primary outcome was 30-day mortality: 303 patients were stratified by etiology and diagnosis date (before 2004 versus 2004 and later). AMI mechanisms included: embolic (49%), thrombotic (29%), and non-occlusive (NOMI) (22%). 345 procedures were performed in 242 patients: 321 open and 24 hybrid/endovascular. Among the 189 embolic/thrombotic patients who were managed operatively, 85 underwent mesenteric revascularization while 39 had findings of non-survivable bowel necrosis. Among the 104 patients who did not undergo revascularization, 64 died within 30-days compared to 36 out of 85 patients who were revascularized. 30-day mortality was 61% and stable over time; when stratified by AMI etiology, the thrombotic cohort had worse survival than embolic and NOMI patients. Since 2000, there was a trend towards increased AC use with an accompanying decrease in the percentage of embolic AMI events. The percentage of patients who underwent operative management decreased over time (81% → 61%), which was correlated to an increasing number of patients being made comfort measures (CMO) prior to surgical intervention (50% → 70%). The majority of patients (55%) were ultimately made CMO during their hospitalization. Despite advances in critical care over the past 25 years, AMI continues to be associated with poor prognosis. The survival benefit in patients who undergo revascularization suggests a more aggressive approach towards early vascular intervention, particularly in patients presenting with thrombotic/known mesenteric vascular disease. Better guidelines for and compliance with AC appear to contribute to decreasing AMI embolic events. The high morbidity associated with AMI has raised the importance of prognostication and advanced directives.

We thank the Vascular Surgery Education Funds for financial support.

Poster 88

Arterial Closure Devices on Complications Following the Placement of Percutaneous Circulatory Support Devices

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Intraaortic balloon pumps and percutaneous ventricular assist devices are important in aiding the hemodynamic stability of patients undergoing surgery. Extracorporeal membrane oxygenation (ECMO) is an extracorporeal technique to provide cardiac and respiratory support. IABP, PVAD, and ECMO can be removed via three different ways: manual pressure, closure devices, and surgical repair. Percutaneous arterial closure devices are used to obtain hemostasis after the circulatory support device is pulled. Our objectives were to determine the overall complication rate associated with removal of percutaneous circulatory support devices and assess the overall use of closure devices in the setting of circulatory support device removal and associated complication rate variation. This was a retrospective analysis of patients who underwent a percutaneous placement and removal of a circulatory support device between 2016 and 2018. Patients were stratified into two groups based on the type of removal, whether it was manual pressure or the use of a closure device. The primary endpoint was to stratify access complication rates based on the type of circulatory support device. We used chi-squared tests for univariate comparisons of categorical variables. There were 463 patients with a circulatory support device in place, with a majority, 266 patients, receiving placement of an IABP. Of these patients, the local complication rate associated with manual pressure closure was 5.1%. The overall local complication rate associated with manual pressure closure after the removal of the PVAD was 18.2% versus percutaneous closure devices with a local complication rate of 5.3%. The use of closure devices following the placement of IABP and PVAD resulted in fewer local complications than the use of manual pressure. There is a possible trend towards higher 30-day morbidity with manual pressure versus closure device across all three types of circulatory support devices.

We thank the Vascular Surgery Education Funds for financial support.

Poster 89

Characterizing novel protein-protein interactions regulating brain development.

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Signal transduction cascades allow cells to communicate with one another and to respond to their environment. Adaptor proteins within these cascades connect and convert the signals of other proteins. The adaptor proteins CRK (CT10 regulator of kinase) and CRKL (CRK-like) are essential for proper neuronal development. It is then interesting to fully characterize the role that these adaptors have within the cell, assembling protein complexes, and interacting with other proteins within a cascade. CRK/CRKL interact with several other proteins via a specific amino acid region, the Src Homology 2 (SH2) domain. The SH2 domain has been characterized in many proteins and has been shown to allow these proteins to bind phosphorylated tyrosine residues in YxxP motifs (where x denotes any amino acid). A previous bioinformatics screen revealed several proteins that are highly enriched in these YxxP motifs, which may interact with CRK/CRKL via the SH2 domain. The SH family of proteins was highlighted and each contained several of these potential interaction sites. These proteins were then evaluated for their potential to participate as binding partners with CRK/CRKL. Using a variety of biochemical and cell biological methods we identified a novel interaction between CRKL and the SH family of proteins with anticipated essential roles in neurodevelopment.

We thank the National Science Foundation IOS grants 1021795 and 1656510; the Vermont Genetics Network through U. S. National Institute of Health Grant 8P20GM103449 from the INBRE program of the NIGMS; U.S. NIH Grant 5P20RR016435 from the COBRE program of the NIGMS for financial support.

Poster 90

Poster 91

Assessing Salvadoran Mass Migration to the United States

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Since the latter decades of the 20th century, the Central American republic of El Salvador has been mired in civil conflict and political instability. The resulting Salvadoran migration to the United States created immigrant communities both nationally and in the Worcester area. This project seeks to examine how these communities came into being and the factors that shaped their development First, it argues that American foreign policy bears a major responsibility for creating the waves of immigrants that resulted in Salvadoran-American migrant communities. U.S. preoccupation with anti-communism enabled a brutal Salvadoran dictatorship to utilize and normalize terrible levels of violence against the Salvadoran citizenry. At the same time, increasingly stringent American immigration policy has become a hindrance to the stability of both Salvadoran-American communities and the Salvadoran nation as a whole. However, while examining this crisis from a federal policy perspective, it is essential to understand the immigration experience of Salvadoran-Americans themselves. Moving beyond statistics, this grassroots approach enables a more sophisticated understanding of U.S. policy failure and a better understanding of community formation that must guide any policy reform moving forward. It shows what kinds of services and organizations have developed from within and for the Salvadoran immigrant community. These organizations reveal the ways that Salvadorans shape their own processes of assimilation and community development while also facing significant structural limitations.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 92

Unconscious Emotional Stimuli Influence Behavior

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Seeing a growling pit bull or a returning loved one causes a visceral reaction like making your heart race. Emotional stimuli can dramatically increase physiological arousal. DiGirolamo et al. (2016) have shown increased physiological arousal influences behavior, particularly automatic behaviors. Most studies of emotional stimuli use conscious awareness of the emotional images. Here we explored the ability of unconscious emotional stimuli (positive, negative or neutral) to influence behavior. Twelve participants were asked to touch one of four quadrants as fast as they could, based on an auditory presentation of one of four numbers. Prior to this auditory cue, an emotional stimulus of either negative, positive or neutral emotional content was presented in one of the four quadrants and masked to prevent conscious awareness of the stimulus. Negative emotional stimuli influenced this arbitrary reaching behavior, with touches in the quadrant being pulled toward the location of the unconscious negative stimulus within that quadrant. These results suggest that positive and negative emotional stimuli are processed differently by unconscious brain functions.

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

Poster 93

Unconscious Detection of Abnormalities in Trained Radiologists

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The predominant role of biomedical imaging continues to be diagnosis, as early diagnosis is a major factor in the reduction of both the mortality and cost of cancer. Yet even with advanced training, experience and dramatic improvements in technology, diagnostic error rates of 30-50% are as high as they were half a century ago. Searching for a potentially cancerous nodule employs both conscious and unconscious processes. While conscious recognition has high error rates, unconscious processing might still be automatically detecting the abnormality. Here we determined if unconscious processes can detect an abnormality. 12 radiologists were flashed a CT scan of the stomach which could contain an abnormality. This image was masked, ensuring that awareness of the abnormality did not reach conscious awareness. Subjects were then presented a black screen with four quadrants and were auditorily cued to move their finger to touch one of the quadrants. Radiologists were significantly faster to touch the quadrant where an abnormality had been presented, compared to a normal image, despite being consciously unaware of the presence of the abnormality. These data suggest that the brains of the radiologists are unconsciously and automatically detecting an abnormality even when the abnormality is not part of the task.

We would like to thank the Crusader Internship Fund for financial support.

Poster 94

Interrater and Intrarater Reliability for Neuronal Reconstruction

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Three-dimensional neuron reconstruction is a method of taking quantitative measurements of neuronal complexity that requires subjective determinations. In the absence of standardization, variation between not only different researchers but also between different tracings by the same researcher have the potential to influence results and drastically reduce reproducibility. The goal of this project was to standardize reconstruction of neurons from mouse brain samples to produce reliable measures of dendritic length and dendritic complexity. Mouse brain specimens were processed with Nissl stain, which stains all cells, and Golgi stain, which stains approximately five percent of neuronal cell bodies. Hippocampal neurons were selected for reconstruction based on location of the cell body near the center of the tissue section and low overlap with neighboring cells. Neurons were traced using an automated system that allows the user to mark points on a microscope image of a neuron using three axes (x, y, and z). These sample neurons were reconstructed by four different researchers: one expert and three novices. Three of the four researchers traced the same neurons multiple times. Measurements of total dendritic length and branching (operationalized as total number of intersections from Sholl Analysis) were used to compare these tracings, yielding measurements of interrater and intrarater reliability. We observed changes in accuracy and precision as a novice researcher gained experience with reconstruction. On the basis of these results, we will establish a training program within our lab through which new researchers achieve high intrarater and interrater reliability prior to generating experimental data sets.

We thank Diane D. Brink P12 and the Dr. Charles Weiss Summer Research Program for financial support.

Poster 95

The Relationship Between Social Dominance and Emotion Regulation in Mice

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Social dominance relationships spontaneously emerge in laboratory-housed mice and are related to stress responses. The importance of these relationships is poorly understood, and may contribute to poor reproducibility of results in behavioral neuroscience. This study investigated whether there is a relationship between social dominance in mice and emotional regulation, particularly anxiety-like behaviors. In this study, we assessed the social dominance of 32 male and female C57BL/6J mice using a series of behavioral observations, including home cage observation, territory urine marking and the tube test. Following these observations of social hierarchy, we assessed emotion regulation using a series of non-invasive behavioral tests of anxiety-like behaviors. Our results revealed some main effects of rank on auxiliary analyses, but none on specific measures of anxiety-like behaviors. However, we did find statistical interactions between sex and rank in the results of several tests, indicating that that the relationship between anxiety-like behaviors and rank differed between males and females. This set of results therefore suggests that social dominance may be involved in anxiety-like behaviors, and that sex is a relevant variable to consider in this relationship. Laboratory-based tests of anxiety-like behaviors are used to assess effects of drugs as well as genetic and environmental contributors to neuropsychiatric disorders in male and female mice. Ultimately, the data from this pilot experiment allow us to assess the variability in these various measures of anxiety-like behaviors and on their basis design a study that is sufficiently powered to conclusively assess the effects of sex and rank on these outcomes.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster 96

Apology of Epicureanism in Modern Society

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Although Epicurus was a prolific writer, much of his writings has been lost. However, through careful reading of his remaining works and the works of his followers, one can reasonably deduce most of Epicurus's philosophy. Even on the basis of this limited primary material, scholars offer divergent interpretations of Epicurus's thoughts. I was specifically interested in the disagreement between scholars such as Leo Strauss, John Armstrong and Phillip Mitsis over the issue of how justly and morally someone who subscribes to Epicurus's philosophy would live. I ultimately disagreed with Strauss who argued that an epicurean would be unlikely to perform acts of charity because his happiness is dependent on his own measurements of pleasures and pains and the serenity of his own mind. I agree with Armstrong, who disagrees with Strauss, and argues that an epicurean would be likely to perform charitable acts and avoid injustices because it will be in their own self interest. I believe that Strauss does not properly recognize the importance that Epicurean philosophy puts on acting justly and nobly in order to have a serene mind, which is a requirement for happiness according to Epicurus. Mitsis also points out the importance that Epicurus places on friendship and even putting one's friends pleasures over one's own, which I argue further disproves Strauss's critique. I even go further and point to the possibility that that the adaptation of epicurean philosophy might be good for society because it aligns one's self interest with the common good.

We thank the Weiss Summer Research Program for financial support.

Poster 97

Perceptual Training of Abnormality Detection

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The continuous improvement in radiological technology has not been met with the same level of advancement in radiological training for medical students. Shadowing an attending radiologist and learning by simply observing how they read scans has been the standard method of teaching. Here we seek to determine whether perceptual training, that is, training the brain's perceptual system to detect abnormalities both consciously and unconsciously, is an effective method that could be used by trainers in the future. This is done by having participants (undergraduates and medical students) decide whether an abnormality is present in an image of a mediolateral breast computed tomography (CT) scan shown to them, using keys on a keyboard to indicate their decision. Following this, participants will given feedback whether they are correct (in green) or incorrect (in red). The feedback is either given consciously, giving the participant enough time to understand the feedback, or unconsciously, which involves a short period of time (20 milliseconds) that the feedback is present, followed by a mask (50 milliseconds) to eliminate any possible conscious perception of the feedback. We expect improvement in participant accuracy as they go through multiple sessions of perceptual training due to both conscious and unconscious feedback.

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

Poster 98

Diurnal Variance of Atmospheric Muons

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High-energy cosmic rays collide with nuclei in the Earth's atmosphere to produce showers of pions; these pions decay into leptons such as electrons and muons. We can observe cosmic rays through detecting the showers of muons that reach the Earth's surface. Each telescope that detects showers is a pair of plastic scintillator paddles whose alignment restricts observation to a region of the atmosphere and reduces noise detections. We infer that particles that pass through both scintillators and deposit significant energy are muons and record these events electronically. Short-term exponential models of the time intervals between shower detections for individual telescopes suggest that we are detecting events randomly distributed in time with a nearly constant expected rate. This is characteristic of atmospheric muons and is evidence that we are detecting cosmic rays. For many of these exponential models, $R^2 > 0.98$ and the time constant $\tau \approx 1.9$s, which is close to expected values for our telescope viewing solid angles. These exponential models became more practical after more consistent microcontroller technology developed last summer was installed on each telescope. We even automated our modeling processes because they are integral to interpreting the quality of all collected data. We were also able to further reduce the dead time between detections from about 15ms to about 1ms with no complications. When investigating the diurnal variance of muon flux, there was not consistent evidence of detection-rate oscillations over 24-hour periods due to daily periodic changes in atmospheric conditions, which were hypothesized to affect the muon shower rate. However, we found evidence suggesting that the overall detection rate changes slowly over time.

We thank Drs. Daniel J. Wasser and Karen Randall P15 for financial support.

Poster 99

Gospel Meets Culture in the Andes: How Christian belief and practice in the Andes have been affected by indigenous culture.

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Theology in the Andes continues to develop as Christain doctrine and indigenous cultures interact. It is particularly difficult to define due to these continuous transformations. It is a type of theology based on the recovery of the cultural richness of the indigenous peoples of the altiplano of Bolivia and Peru and the gradual restoration of their self-esteem after five centuries of cultural oppression. Accordingly, the main purpose of our project was to study how the expression of the Christian faith in the Andes has been and continues to be shaped by the traditional Andean culture. We began our study by focusing on an anthropological perspective of the history and culture of the Andean world. Later, we discussed a more philosophical and theological perspective regarding how Christian belief and practice in the Andes have been affected by indigenous culture. It was revealed that the indigenous culture has greatly impacted the life of the Andean Christian. Everyday practices, such as meals and work, are considered to be very spiritual in Andean theology. Their roots emphasize an ancient message of "Vivir bien," meaning that everyone should live well enough to survive and be relatively happy. This includes all walks of life, meaning that they seem to be very environmentally conscious. The belief corresponds with the everyday lifestyle of their agricultural indigenous ancestors. In fact, many images of Christ depict him as the partner of the Pachamama, one of the most important indigenous gods. As the restoration of indigenous culture increases in modern day, so, too, does the existence of indigenous images, symbols, and practices. This recovery creates a sense of liberation within the Christian Andean community, producing a constantly changing form of theology. It also propels the call for action against social, political, and economic issues such as fair pay, racism, and sexism.

We thank the Weiss Summer Research Program for financial support.

Poster 100

Robert F. Kennedy and the Mafia

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Robert F. Kennedy (RFK), as Attorney General under his brother President John F. Kennedy (JFK) spent the majority of his years in office pursuing organized crime. By nature of his relationship with his brother, RFK was given the special opportunity to set policy for the Kennedy Administration. Between the years of 1960-1963, the Department of Justice's main goal was taking down organized crime, something that was never a main feature of the Kennedy Administration's Campaign promises. Using archival documents collected from the John F. Kennedy Presidential Library, as well as oral histories with members of RFK's Department of Justice and other secondary sources like biographies and scholarly articles, we researched the intersection of law and politics in the context of RFK's pursuit of organized crime. Looking at how RFK's legislative package, tailored to target organized crime, his prioritization of cooperation among the intelligence gathering agencies of the government and how he deployed lawyers and investigators to prosecute members of organized crime, we learned that Robert Kennedy oftentimes crossed the lines between law and politics. This suggested a disregard for traditional democratic practices like the separation of powers and the electoral campaign process. Given that there are now laws that protect against nepotism, preventing a relationship like RFK and JFK's from forming in government again, RFK's tenure sets a good example of why nepotism should be prevented in government, and why the intersection of law and politics, while dangerous to democratic practices, can have practical and effective uses.

We thank the College of the Holy Cross Ignite Fund for financial support.

Poster 101

Investigation of Cosmic Rays

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Cosmic rays are constantly bombarding Earth, colliding with the atmosphere and showering our planet with subatomic particles as a result of these collisions. The most common subatomic particle to reach Earth's surface is the muon. A single cosmic ray produces many muons, also described as a muon shower. We investigated cosmic rays by building multiple muon detectors or muon telescopes. The telescopes were synced in time using a GPS so that coincidental muon detections between two different telescopes could be recorded. Coincidental muons are detected when muons from the same shower hit our telescopes. By comparing the number of coincidental detections compared to the individual detection rates of the telescopes in order to estimate the density of muons within individual muon showers. This can therefore tell us about the typically energy of a primary cosmic ray because the number of muons produced is directly related to the energy of the cosmic ray. The typical zenith measurement for an individual telescope typically around 1.90 ± 0.05 muons per second, while there are 0.05 ± 0.01 coincidences per second between two telescopes placed 1 meter apart. This implies that that most showers have a relatively low density due to the low number of coincidences relative to the individual count rates of each telescope.

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

Poster 102

Measurement of East-West Asymmetry of Cosmic Rays

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Cosmic rays are mostly protons and ionized nuclei traveling through space at extremely high speeds. These particles collide with Earth's atmosphere and decay into a shower of muon, as well as some other particles. Many of these muons have enough energy to reach the Earth's surface, where they can be detected using muon telescopes. It can be observed that more muons reach the Earth's surface coming from the west than from the east. This east-west effect can be explained by the Earth's magnetic field, which pushes positively charged particles, such as protons, eastward. Previous measurements of east-west asymmetry have found that the strength of the effect diminishes as geomagnetic latitude increases. At our geomagnetic latitude of 51.54°, an asymmetry coefficient below 0.05 was expected. Using two telescopes and correcting for their different efficiencies, we measured a significant east-west asymmetry coefficient within this range.

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

Poster 103

An Exploration of the Stigmatization of Disability in Church Communities in Lunyo Village, Entebbe, Uganda

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The Amaanyi Empowerment Center, the first school for students with disabilities in in Uganda is centrally located in Lunyo Village. The students face extreme isolation from the community due to the stigma surrounding disability. My research goal was to better understand disability-related stigma experienced by the students and community attitudes towards disability. I interviewed parishioners, church leaders, and community members at the Entebbe Baptist Church (EBC) and the Redeemed Christian Church of God (RCCG). Many people believe disabilities to be contagious and a sign of the devil. Global narratives of healing were dominant in the visiting pastors' sermons at both churches, highlighting the wide-spread conception that disability can be healed through worship. There is also a gender dimension to disability: most women who raise a child with a disability do so alone because they have been left by their partners because having a child with a disability is a mark of the devil. EmbraceKulture, an organization jumpstarting the disability rights movement, notes that 9/10 women with disabilities experience sexual violence because of a traditional belief that these women are not human and should therefore not be treated as such. Many students at the Amaanyi Center had experienced sexual and physical violence, death threats being tied outside with goats and placed in dumpsters outside their home communities. Witnessing the treatment of the Amaanyi Empowerment Center students each day and through the church services shed light on the stigmatization felt by this population due to the traditional understandings of disability being an indication of demons and bad omens. The relationship between traditional beliefs and evangelical teachings creates an interesting, and seemingly contradictory, dynamic which perpetuates the gospel of healing and use of miracle worship to "rid" society of disability rather than accept and celebrate these differences as an essential part of our humanity.

We thank the Ignite Fund for financial support.

Poster 104

Long-term Declines in Predator and Prey Abundances in the Rocky Intertidal Zone

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Intertidal Ecology Internship, Shoals Marine Lab

Previous research on the predator *Nucella lapillus* and its prey, *Semibalanus balanoides* and *Mytilus edulis,* indicates their trophic relationship is bottom-up controlled in which *Mytilus* and *Semibalanus* abundances drive that of *Nucella.* We used a long-term data set of intertidal biota to quantify changes in the abundance of *Nucella, Semibalanus,* and *Mytilus* over time, and the associations between predator and prey abundances. Since 1985, students at Shoals Marine Laboratory (Appledore Island, Maine) have conducted annual surveys to record intertidal zone biodiversity. Students estimate abundances of intertidal species using 400-cm^2 quadrats placed at 0.3-m elevation increments, repeated along five transects. We found *Nucella* and *Semibalanus* abundances have significantly declined on Appledore Island since 1985, and in the last ten years *Mytilus* abundance also declined rapidly. This indicates *Nucella* and *Semibalanus* are experiencing a slow, long-term decline while *Mytilus* experienced a recent, rapid decline. Further, *Nucella* abundances are significantly correlated with *Semibalanus* and not *Mytilus*. Our results align with the known bottom-up trophic dynamics of this system and such predicted patterns between predator-prey abundances. Additionally, *Nucella* are known to preferentially feed on barnacles to maximize energy intake. This, and our finding of the significant relationship between *Nucella* and *Semibalanus* abundances suggests that *Nucella* populations could be more resilient to changes in *Mytilus* abundances as long as *Semibalanus* populations are stable. In the Gulf of Maine, *Mytilus* populations are declining, possibly due to increasing ocean temperatures and biological changes in the region. Future monitoring and maintenance of *Nucella* populations may require examination of *Semibalanus* abundance given the tight association between these two species.

We thank Shoals Marine Laboratory for financial support.

Poster 105

Public Perception of Race in Education

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This research examines Massachusetts public middle school practices and messaging for summer reading assignments. To answer this question, we conducted one round of coding of summer reading letters, with disagreements resolved through discussion by both authors. Additionally, we found that schools tended to emphasize the academic benefits of summer assignments over the personal benefits of reading, while many (roughly one third of 6th and 7th grade letters, and one quarter of 8th grade) did not express any purpose for their summer reading assignment. This research demonstrates that despite existing research showing the value of intrinsic motivation and autonomy in student reading, summer reading assignments may be lagging in their structure, and could benefit from research-based alterations.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster S1

Exploring the Symbiotic Relationship between Literature and Art

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It may not be surprising that William Blake illustrated his own *Songs of Innocence and Experience*, but did you know that many writers have found (and continue to find) equal means of expression in visual art? From the Brontë sisters to Victor Hugo, from watercolors to caricatures, one can see the intersection between art and literature. When studying the connections between written word and visual form, one can often be surprised by an interdependence. Though each work can stand alone, examination of both dimensions yields a plethora of information about the fields themselves, the writer-artists, and their respective subject matters. Although Donald Friedman, author of *The Writer's Brush: Paintings, Drawings, and Sculptures by Writers*, was not the first to investigate the interconnectedness between word and image, his anthology allows for the information to be more readily accessible to laypeople with interest in this subject. His work presents art by more than 200 writer-artists juxtaposed with a biography, and often words from the artists themselves. Friedman has generously donated his research materials, manuscripts, and artwork to the College Archives and the Iris and B. Gerald Cantor Art Gallery, and we hope to collaborate with the Cantor Art Gallery to present the exhibition. Through the process of archiving, we have preserved these records so that they are more readily available to those who are interested in researching them.

We thank the Weiss Summer Research Program and Dinand Library for financial support.

Poster S2

Feminism and Contemporary Artmaking: A Female Body of Work

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Contemporary artists often face the challenge of understanding and implementing the lessons of their predecessors. The works and formal experiments I carry out illustrate the complexities of pursuing a standalone body of work that speaks to the ever-developing legacy of feminism in art. Beginning in the 1960s, female artists began to investigate the ability of their own bodies to communicate the greater challenges of womanhood. As pioneers of performance art, these artists explored themes of physicality by centering their work on the female body and its social function in the modern world. My studio practice, as illustrated in the pieces presented at the Academic Conference, communicate my own bodily frustration. Working predominantly in sculpture and documenting the process as a performative measure, I strive to raise questions about the nuances of female identity and gender expression. Because my own outward appearance is decidedly feminine, I have created an alter-ego that seeks a higher level of gender neutrality. By appropriating traits that are generally considered "masculine," this alter-ego reveals her desire to achieve a more androgynous affect. She constructs absurdities such as *Ab-hancer 2.0*, where she repurposes feminine supplies to craft a muscle augmentation device, not only poking fun at conventional machismo, but also creating a "convincing" prosthetic. *Leg Hair Garment (Latex)* revisits a prior theme in her experimentations, in its attempt to enhance (and sometimes replace) her body hair. The *STP Devices* display an interrelation of power, appropriation, and the male form, while also speaking to ideas of sanitation and self-sustainment. With this body of work, I reflect on and honor the women and movements that have laid the foundation for female expression in the art world today.

We thank the Ignite Fund and Dr. Charles Weiss Summer Research Program for financial support.

Poster S3

Curating and Cataloging Insect Biodiversity in the Holy Cross Entomology Collection

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The Holy Cross Biology Department has an Entomology collection that is an invaluable and irreplaceable resource for teaching and research. This collection is open for both Holy Cross students and other members of the Worcester College Consortium. We have curated and electronically databased the specimens in the Entomology collection, thus ensuring its usefulness as an organized teaching and research resource. Insect specimens were systematically sorted, preserved, identified to order and family, and cataloged to ensure the quality and integrity of the specimen and associated information. Damaged specimens were also repaired or replaced if needed. The adult specimens were dried, pinned, and organized phylogenetically in metal display cabinets. Juvenile specimen, preserved in alcohol, are yet to be organized and included in the final count but are still available in the Holy Cross collection. As a result of this work, we have curated and cataloged over 6,022 adult insect specimens in over 20 insect orders and over 188 insect families. The properly identified, preserved, and stored insect specimens are a rich source of potential samples for research and an essential reference for Entomology students.

We thank the Dr. Charles Weiss Summer Research Program for financial support.

Poster S4

Comparisons between Eastern and Western Arts and a view of Western Art from an Eastern Perspective

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My research attempts to understand how Eastern aesthetic views differ from Western aesthetic views through visits to the Worcester Art Museum, Boston's Museum of Fine Arts, and the Peabody-Essex Museum in Salem. With the same elements and themes, how do different cultures (East and West) perceive the art and present the art? As a student from an Eastern country, how do I perceive those Western arts from my Eastern point of view? I have selected several categories of subject matter: landscapes, portraits, architectural views, and craft objects such as stained-glass, enamel, and jades. My reflections are that the arts can break the barriers of culture and distance. For example, in the late 19th century, American and European artists were inspired by the two-dimensionalities of Japanese prints, but there will probably never be one universal aesthetic perspective. I am designing a study guide for visitors to the Worcester Art Museum and hope that it will be useful for classes at Holy Cross and for docents at the Museum. In the future, I want to apply similar analysis for art in the Peabody Essex Museum and the Museum of Fine Arts in Boston.

I thank Prof. Virginia Raguin at Holy Cross, Dr. Vivian Li at Worcester Art Museum for their suggestions and information. Also, I thank JD Power Center Ignite Fund and the Dr. Charles Weiss Summer Research Program for financial support.

NOTES