Cover photo: Students conducting summer research in Colgate’s Foggy Bottom Observatory (L to R): Joshua Reding ’15, Zachary Weaver ’17, Luna Zagorac ’16, Anneliese Rilinger (Williams ’17), and Katie Karnes ’17. See page(s) 92, 142, and 177 to read more about their summer research project(s).

Photo by Matthew Johnson ’15.
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List of Participants
### DIVISION OF THE ARTS AND HUMANITIES (HUMN)

**Department of Art and Art History**

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<th>Name</th>
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<th>Funding</th>
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<tr>
<td>Daniel Kwartler 2015</td>
<td>Penny Lane (Art and Art History)</td>
<td><strong>NUTS!</strong></td>
<td>HUMN Division</td>
</tr>
<tr>
<td>Sak Lee 2015 (Computer Science)</td>
<td>Wenhua Shi (Art and Art History)</td>
<td><strong>Digital Art: Machine Learning, Interaction, and Sound Recognition</strong></td>
<td>HUMN Division</td>
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<tr>
<td>Miri Reinhold 2015</td>
<td>Lynn Schwarzer (Art and Art History)</td>
<td><strong>Modifications of the Self: An Exploration of the Unattainable Ideal through Self-Portraiture</strong></td>
<td>J. Curtiss Taylor ’54 Endowed Student Research Fund</td>
</tr>
<tr>
<td>Jane Trask 2016 (History)</td>
<td>Robert McVaugh (Art and Art History)</td>
<td><strong>Colgate Envisioned</strong></td>
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<tr>
<td>Shan Wu 2015 (Art and Art History; Classics)</td>
<td>Padma Kaimal (Art and Art History)</td>
<td><strong>Illustrating the Kailāsanātha Temple in Kanchipuram</strong></td>
<td>HUMN Division</td>
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**Department of the Classics**

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<tr>
<td>Melinda Bartlett 2015</td>
<td>Rebecca Ammerman (Classics)</td>
<td><strong>Exploring the Waters of a Nymph</strong></td>
<td>HUMN Division</td>
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<td>Joshua Paul 2015</td>
<td>Naomi Rood (Classics)</td>
<td><strong>Superbus and Subiectus: Establishing the Status of Turnus</strong></td>
<td>J. Curtiss Taylor ’54 Endowed Student Research Fund</td>
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**Department of East Asian Languages and Literatures**

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<th>Name</th>
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<tr>
<td>Se Min Her 2016</td>
<td>Jing Wang (East Asian Languages and Literatures)</td>
<td><strong>The genealogy of sinology and its prejudices</strong></td>
<td>HUMN Division</td>
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<tr>
<td>Duy Tran 2017 (Undeclared)</td>
<td>Jing Wang (East Asian Languages and Literatures)</td>
<td><strong>Western Orientalism on China: an Anthology with a Critical Overview</strong></td>
<td>HUMN Division</td>
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Department of English

Name: Nora Edmonds 2015 (English; French)
Mentor: Peter Balakian (English)
Title: *Ginsberg and Surrealism: A study of Ginsberg's appropriation of Surrealism and Surrealist techniques*
Funding: HUMN Division and J. Curtiss Taylor ’54 Endowed Student Research Fund

Name: Leah Robinson 2016 (English)
Mentor(s): Jennifer Brice and Jane Pinchin (English)
Title: *Living Writers Intern*
Funding: HUMN Division

Name: Estrella Rodriguez 2017 (English)
Mentor: Sarah Wider (English; Women’s Studies)
Title: *Editing Literary Correspondence through a Gendered Lens*
Funding: UNST Division

Department of Religion

Name: Julia Queller 2016 (Religion)
Mentor: Lesleigh Cushing (Religion)
Title: *Reading the Bible from the Left*
Funding: HUMN Division

Department of Theater

Name: Charlotte Arbogast 2016 (Theater)
Mentor: April Sweeney (Theater)
Title: *LONEtheater*
Funding: HUMN Division

Name: Benjamin Mandell 2014 (Theater)
Mentor: April Sweeney (Theater)
Title: Assistant director/translator on project titled “LONEtheater”
Funding: HUMN Division

DIVISION OF NATURAL SCIENCES AND MATHEMATICS (NASC)

Department of Biology

Name: William Angel 2016 (Molecular Biology)
Mentor: Geoffrey Holm (Biology)
Title: *The Role of µ2 in Reovirus Infection*
Funding: National Institutes of Health (NIH) Grant

Name: Mabel Baez 2015 (Biology; Environmental Studies)
Mentor: Catherine Cardelús (Biology)
Title: *Teclea Nobilis Foliar Nutrient Composition Sheds Light on Conservation Efforts in Northern Ethiopia*
Funding: NASC Division

Name: Katrina Bennett 2016 (Neuroscience)
Mentor: Jason Meyers (Biology)
Title: *Understanding the Zebrafish Retinal Regeneration Process*
Funding: Michael J. Wolk ’60 Heart Foundation
Name: Kayleigh Bhangdia 2016 (Geography)
Mentor: Carrie Woods (Biology)
Title: Spatial Variation of Foliar Nutrients in Ethiopian Church Forests
Funding: NASC Division

Name: Julia Ceglowski 2016 (Mathematics; Biology)
Mentor: Barbara Hoopes (Biology)
Title: The Poodle Project: Searching for another Size-Determination Variant in Small Poodles
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Emily Corkum 2015 (Biology)
Mentor: Damhnait McHugh (Biology)
Title: Evolution of Toll-like Receptors in Annelids
Funding: National Science Foundation

Name: Myles Davis 2015 (Biology)
Mentor: TimothyMcCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division

Name: Farah Fouladi 2015 (Computer Science)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Research Assistant
Funding: Systems Biology Center New York (SBCNY) Grant

Name: Kelly French 2015 (Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: Assessing antibacterial activity of traditional medicinal plants used by Haudenosaunee peoples of New York State
Funding: NASC Division

Name: Alexandra Gadiano 2016 (Biochemistry; Spanish)
Mentor: Kenneth Belanger (Biology)
Title: Investigation of Pom152 lumenal domain structure and function in S. cerevisiae nuclear transport
Funding: National Institutes of Health (NIH) Grant

Name: Grant Haines 2015 (Biology)
Mentor: Randy Fuller (Biology)
Title: The impact of in-stream and whole drainage basin lime applications as a mitigation strategy for counteracting the effects of acid deposition on stream ecosystem structure and function
Funding: NASC Division

Name: Eleanor “Elly” Hilton 2017 (Undeclared)
Mentor: Jason Meyers (Biology)
Title: Effect of HDAC Inhibition on Müller Glia in the Developing and Regenerating Zebrafish Retina
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Peter Juvelier 2015 (Molecular Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: Ethnobotany
Funding: NASC Division

Name: Salome Kiduko 2016 (Biology)
Mentor: Kenneth Belanger (Biology)
Title: Investigation and Identification of Nups and Heat Shock Proteins involved in Nuclear Protein Export
Funding: National Institutes of Health (NIH) Grant
Name: Christopher Krieg 2014 (Biology)
Mentor: James “Eddie” Watkins (Biology)
Title: Ecophysiological Cost of Reproduction in Several Dioecious Cycads
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Shannon Lacy 2016 (Molecular Biology)
Mentor: Priscilla Van Wynsbergh (Biology)
Title: KIN-20 is Essential for Appropriate let-7 Expression
Funding: Michael J. Wolk '60 Heart Foundation

Name: William Lam 2016 (Biology)
Mentor: Kenneth Belanger (Biology)
Title: Nuclear Export Kinetics in Nuclear Pore Complex of Yeast Mutants
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Nathaniel Larson 2016 (Molecular Biology)
Mentor: Barbara Hoopes (Biology)
Title: Determining the Structural and Functional Effects of a Missense Mutation on the Canine IGF1 Receptor Protein
Funding: NASC Division

Name: Amanda Liberman 2017 (Molecular Biology)
Mentor: Barbara Hoopes (Biology)
Title: The Poodle Project: Searching for another Size-Determination Variant in Small Poodles
Funding: Michael J. Wolk '60 Heart Foundation

Name: Changchang Liu 2015 (Chemistry; Molecular Biology)
Mentor: Engda Hagos (Biology)
Title: Investigating the role of Kruppel-like factor 4 on the process of autophagy, and an elucidation of the connection between KLF4 and mTOR as it relates to autophagy regulation
Funding: Michael J. Wolk '60 Heart Foundation

Name: Danielle Mazzeo 2015 (Biology)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division

Name: Lindsay McCulloch 2016 (Environmental Biology)
Mentor(s): Catherine Cardelis and Carrie Woods (Biology)
Title: Assessing the effects of Nutrient Deposition on epiphytes in the rainforest canopy at La Selva Biological research station in Costa Rica
Funding: NASC Division

Name: Rehman Momin 2015 (Biochemistry)
Mentor: James “Eddie” Watkins (Biology)
Title: Antheridiogen impacts isolate potential and mating systems in tropical ferns
Funding: NASC Division

Name: Eric Moore 2015 (Biology)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division
Name: Wesley Morgan 2016 (Environmental Biology)
Mentor: Randy Fuller (Biology)
Title: The impact of in-stream and whole drainage basin lime applications as a mitigation strategy for counteracting the effects of acid deposition on stream ecosystem structure and function
Funding: NASC Division

Name: Wendy Nicolas 2015 (Biology)
Mentor: Geoffrey Holm (Biology)
Title: Innate Immune Responses to Reovirus Infection
Funding: National Institutes of Health (NIH) Grant

Name: Christiane Olivero 2016 (Molecular Biology)
Mentor: Priscilla Van Wynsberghe (Biology)
Title: The dpy gene downregulates primary let-7 transcription
Funding: Michael J. Wolk '60 Heart Foundation

Name: James Paris 2015 (Biology)
Mentor: Randy Fuller (Biology)
Title: The impact of in-stream and whole drainage basin lime applications as a mitigation strategy for counteracting the effects of acid deposition on stream ecosystem structure and function
Funding: NASC Division

Name: Zach Pitkowsky 2015 (Economics)
Mentor: James “Eddie” Watkins (Biology)
Title: Ecology and Ecophysiology of the Fern Polystichum munitum: A Climate Change Indicator in Redwood Forests
Funding: NASC Division

Name: Joseph Porco 2015 (Biology)
Mentor: Jason Meyers (Biology)
Title: Role of Cell Signaling in Zebrafish Neural Stem Cell Development
Funding: Michael J. Wolk '60 Heart Foundation

Name: Danielle Putur 2016 (Natural Sciences)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Highly Multiplexed Quantitative Imaging with Combinatorial Fluorescence Probes
Funding: Systems Biology Center New York (SBCNY) Grant

Name: Providence Ryan 2016 (Biology; Philosophy)
Mentor(s): Catherine Cardelús and Carrie Woods (Biology)
Title: Assessing the effects of Nutrient Deposition on epiphytes in the rainforest canopy at La Selva Biological research station in Costa Rica
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Tatiana Sanabria 2015 (Biology)
Mentor: Geoffrey Holm (Biology)
Title: Innate Immune Responses to Reovirus Infection
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Gian Paolo Sepulveda 2017 (Undeclared)
Mentor: Damhnait McHugh (Biology)
Title: Transposons in Annelids
Funding: National Science Foundation
Name: Adriana Sperlea 2014 (Computer Science)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: *Reconstructing the Gene Regulatory Network Governing Traveling-Waves of the Vertebrate Segmentation Clock*
Funding: NASC Division

Name: Mae Staples 2015 (Molecular Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: *Assessing antibacterial activity of traditional medicinal plants used by Haudenosaunee peoples of New York State*
Funding: NASC Division

Name: Mateusz Szuchnicki 2015 (Biology)
Mentor: Engda Hagos (Biology)
Title: *Mouse Embryonic Fibroblasts Null for Krüppel-Like Factor 4 Show Reduced Autophagy and Elevated mTOR Activity*
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Yogita Telhu 2017 (Undeclared)
Mentor: Jason Meyers (Biology)
Title: *The aim of this experiment is to discover and understand the impact of Fibroblast growth factor and Wnt signaling pathways on lateral line development in signaling Zebrafish.*
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Amanda Toledo Hernandez 2016 (Molecular Biology)
Mentor: Priscilla Van Wynsbergh (Biology)
Title: *Germline Development in C. elegans Gonad*
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Timmera Whaley 2015 (Social Sciences)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: *The Power of Encouragement*
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Thomas Wobby 2015 (Biology)
Mentor(s): Catherine Cardelús and Carrie Woods (Biology)
Title: *Assessing the effects of Nutrient Deposition on epiphytes in the rainforest canopy at La Selva Biological research station in Costa Rica*
Funding: NASC Division

Name: Margaret Wolsey 2017 (Biology)
Mentor: Engda Hagos (Biology)
Title: *Investigating the role of Krüppel-like factor 4 (KLF4) in oxidative DNA damage caused by Reactive Oxygen Species (ROS)*
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Dean Yeh 2015 (Biology; Japanese)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: *Factors Affecting the Distribution of Earthworm Species in New York State*
Funding: NASC Division

Name: Shannon Young 2017 (Undeclared)
Mentor(s): Catherine Cardelús and Carrie Woods (Biology)
Title: *Assessing the effects of Nutrient Deposition on epiphytes in the rainforest canopy at La Selva Biological research station in Costa Rica*
Funding: NASC Division
Department of Chemistry

Name: Drew Bader 2016 (Biochemistry)  
Mentor: Roger Rowlett (Chemistry)  
Title: *High pH Crystallization of Haemophilus influenzae Carbonic Anhydrase*  
Funding: National Science Foundation (RUI)

Name: Melissa Barnard 2015 (Chemistry)  
Mentor: Anthony Chianese (Chemistry)  
Title: *Bifunctional Catalysts for the Hydrogenation and Dehydrogenation of Polar Bonds*  
Funding: National Science Foundation

Name: Kristijan Bogdanovski 2016 (Biochemistry)  
Mentor: Anthony Chianese (Chemistry)  
Title: *Alcohol and Amine Dehydrogenation Catalyzed by a Ruthenium Complex*  
Funding: National Science Foundation

Name: Tia Cervarich 2016 (Chemistry)  
Mentor: Anthony Chianese (Chemistry)  
Title: *Bifunctional Catalysts for the Hydrogenation and Dehydrogenation of Polar Bonds*  
Funding: National Science Foundation

Name: Katherine “Kate” Colville 2016 (Biochemistry)  
Mentor: Roger Rowlett (Chemistry)  
Title: *Disulfide Mutation of H. influenzae carbonic anhydrase*  
Funding: NASC Division

Name: Alain Cruz 2016 (Biochemistry)  
Mentor: Ernie Nolen (Chemistry)  
Title: *Towards the Synthesis of a Tn Antigen Mimic*  
Funding: Warren Anderson Fund

Name: Andre D'Souza 2017 (Biochemistry)  
Mentor: Jason Keith (Chemistry)  
Title: *Manganese-Chlorite Reactions/O2 Insertion on Platinum Complexes*  
Funding: NASC Division

Name: Fiona Evans 2016 (Chemistry)  
Mentor: Jason Keith (Chemistry)  
Title: *The Effect of Grignard Reagents on the Formation of Bipyrrrole Systems*  
Funding: NASC Division

Name: Julia Fisher 2016 (Biochemistry)  
Mentor: Rick Geier (Chemistry)  
Title: *Investigation of a One-Flask Synthesis of an N-Confused Porphyrin Bearing Pentfluorophenyl Substituents*  
Funding: Miller-Cochran Fund

Name: Daniel Kim 2015 (Chemistry)  
Mentor: Anthony Chianese (Chemistry)  
Title: *Synthesis of a Ru CNC Pincer Complex for Potential C-O Bond Transformation*  
Funding: National Science Foundation

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Name: Andrew Moshos 2016 (Classical Studies; Neuroscience)  
Mentor: Roger Rowlett (Chemistry)  
Title: CoHICA N Terminal Variants (D44N and delta 5)  
Funding: NASC Division

Name: Christopher Noda 2016 (Biochemistry)  
Mentor(s): Roger Rowlett and Margaret Suhanovsky (Chemistry)  
Title: Anion Inhibition of β-Carbonic Anhydrase  
Funding: National Science Foundation (RUI)

Name: Natalie Pudalov 2017 (Undeclared)  
Mentor: Anthony Chianese (Chemistry)  
Title: Bifunctional Catalysts for the Hydrogenation and Dehydrogenation of Polar Bonds  
Funding: NASC Division

Name: Celia Sherry 2015 (Chemistry)  
Mentor: Jason Keith (Chemistry)  
Title: Effects of ligand variation on 1-hexene polymerization by zirconium amine bis-phenolate catalysts  
Funding: Warren Anderson Fund

Name: Sarah Stuccio 2016 (Biochemistry)  
Mentor: Ernie Nolen (Chemistry)  
Title: Towards the Synthesis of a Tn Antigen Mimic  
Funding: NASC Division

Name: Megan Tigue 2016 (Biochemistry)  
Mentor: Ephraim Woods (Chemistry)  
Title: PAH: Uptake of Model Marine Aerosol Particles  
Funding: NASC Division

Name: Julie Wan 2016 (Geography; Geology)  
Mentor: Ephraim Woods (Chemistry)  
Title: Photosensitized Aerosol Growth Kinetics  
Funding: NASC Division

Name: Haochuan Wei 2016 (Chemistry; Mathematics)  
Mentor: Jason Keith (Chemistry)  
Title: Application of Density Functional Theory to Electronic Structure Spectroscopy and Mechanism  
Funding: NASC Division

Name: Yixin “Eli” Ye 2016 (Chemistry)  
Mentor: Quang “Mike” Shen (Chemistry)  
Title: The molecular structure and confirmation of benzyl cyanide and cyclopropyl-phenylecarbinol  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Department of Computer Science

Name: Elisha Goberdon 2016 (Computer Science)  
Mentor: Elodie Fourquet (Computer Science)  
Title: Theater Lighting Practices in 3D Software  
Funding: NASC Division
Name: Soo Bin Kwon 2016 (Computer Science; Music)  
Mentor: Michael Hay (Computer Science)  
Title: *Differential Privacy of Rank Aggregation Methods*  
Funding: NASC Division

Name: Mengxian “Martin” Liu 2016 (Computer Science; Philosophy)  
Mentor: Joel Sommers (Computer Science)  
Title: *Accurate and Lightweight Simulation of Network Flows*  
Funding: National Science Foundation

Name: Dong Mai 2016 (Computer Science)  
Mentor: Michael Hay (Computer Science)  
Title: *Differential Privacy of Rank Aggregation Methods*  
Funding: NASC Division

Name: Jung Hyun “Catherine” Seo 2016 (Computer Science)  
Mentor: Elodie Fourquet (Computer Science)  
Title: *Theater Lighting Practices in 3D Software*  
Funding: NASC Division

Name: John “Jack” Sneeringer 2016 (Computer Science; Mathematical Economics)  
Mentor: Joel Sommers (Computer Science)  
Title: *Accurate and Lightweight Simulation of Network Flows*  
Funding: National Science Foundation

Name: Hannah Bercovici 2017 (Environmental Geology)  
Mentor: Amy Leventer (Geology)  
Title: *Thalassiosira lentiginosa morphologic variability, Sabrina Coast, East Antarctic margin*  
Funding: National Science Foundation

Name: Jake Bitting 2015 (Geology)  
Mentor: Richard April (Geology)  
Title: *Mineral weathering products at the Franklin-Sterling Hill Mine, Sussex County, New Jersey*  
Funding: NASC Division

Name: Matthew Bosselait 2015 (Geology)  
Mentor: Karen Harpp (Geology)  
Title: *Investigation into the Physical Properties Responsible for the Formation of Basaltic Spatter*  
Funding: NASC Division

Name: Avalon Bunge 2015 (Geology)  
Mentor: Richard April (Geology)  
Title: *A comparative study of two community gardens: The influence of soil mineralogy and chemistry on crop nutrient content and elemental abundances*  
Funding: Hackett-Rathmell 1968 Memorial Fund

Name: Ryan Clements 2016 (Geology)  
Mentor: Amy Leventer (Geology)  
Title: *Paleoclimate Research*  
Funding: Bob Linsley/James McLelland Fund
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<tr>
<td>Richard “Rick” Cummings 2015 (Geology)</td>
<td>Martin Wong (Geology)</td>
<td>Harcuvar Metamorphic Core Complex</td>
<td>National Science Foundation</td>
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<tr>
<td>Shannon Dillon 2015 (Environmental Geology)</td>
<td>Constance Soja (Geology)</td>
<td>Resilience of endangered Acropora sp. coral in Belize</td>
<td>Keck Geology Consortium</td>
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<tr>
<td>Michael Dubois 2015 (Astrogeophysics)</td>
<td>William Peck (Geology)</td>
<td>High-Aluminum Orthopyroxene of the Adirondack High Peaks</td>
<td>NASC Division</td>
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<tr>
<td>Hailey Elder 2016 (Asian Studies)</td>
<td>Paul Pinet (Geology)</td>
<td>Current and Changing Biodiversity on the Bayside of Fire Island</td>
<td>NASC Division</td>
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<td>Jennifer Godbout 2015 (Geology)</td>
<td>Richard April (Geology)</td>
<td>Watershed weathering and its influence on the chemistry of surface, soil and ground waters at Roger’s Glen, Chadwicks, NY</td>
<td>Doug Rankin ’53 Endowment-Appalachian Research</td>
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<tr>
<td>Emily Holzman 2015 (Geology)</td>
<td>Bruce Selleck (Geology)</td>
<td>Provenance of Emsian and Givetian Clastics, Acadian Foreland Basin of New York State</td>
<td>Doug Rankin ’53 Endowment-Geology Research</td>
</tr>
<tr>
<td>Giuliana Kafaf 2015 (Geology)</td>
<td>Bruce Selleck (Geology)</td>
<td>Natural Coal Firing in Helper, Utah</td>
<td>Doug Rankin ’53 Endowment-Appalachian Research</td>
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<td>Duncan Keller 2015 (Geology)</td>
<td>William Peck (Geology)</td>
<td>Oxygen isotopes in exhalites of the Broken Hill Pb- Zn-Ag deposit, Australia</td>
<td>NASC Division</td>
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<td>Jeffrey Koch 2015 (Geology)</td>
<td>Paul Pinet (Geology)</td>
<td>Sand Budget Analysis of Fire Island, NY</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Jackson Lucas 2017 (Undeclared)</td>
<td>Amy Leventer (Geology)</td>
<td>Marine Sedimentary Records from the Antarctic</td>
<td>Norma Vergo Prize</td>
</tr>
</tbody>
</table>
Name: Mikhaila Redovian 2015 (Geology; English)  
Mentor: Amy Leventer (Geology)  
Title: Diatom-based approach to reconstructing the Holocene Paleoclimatographic history of the Moscow University Ice Shelf Region, East Antarctica  
Funding: NASC Division

Name: Christian “Hunter” Robertson 2016 (Geology)  
Mentor: Karen Harpp (Geology)  
Title: Preferential Weathering of Carbonatite Lava at Ol Doinyo Lengai, Tanzania  
Funding: NASC Division

Name: JonDavid Schiff 2015 (Geology)  
Mentor: Bruce Selleck (Geology)  
Title: Deformation Structures and Fluid Chemistry in a Subsurface Decollement Zone, Marcellus Formation of New York State  
Funding: Doug Rankin ’53 Endowment-Geology Research

Name: Katherine Schultz 2015 (Environmental Geology)  
Mentor: Amy Leventer (Geology)  
Title: Marine Sedimentary Records from the Antarctic  
Funding: Hackett-Rathmell 1968 Memorial Fund; National Science Foundation

Name: Tiong Hua “Andy” Sia 2017 (Geology)  
Mentor: Constance Soja (Geology)  
Title: Geology pamphlet and curriculum materials for Glacier Bay National Park, Alaska  
Funding: Bob Linsley/James McLelland Fund

Name: Peter Swiggett 2015 (Geology)  
Mentor: Bruce Selleck (Geology)  
Title: Trace Element Geochemistry of the Basal Marcellus Formation: Tioga County, New York State  
Funding: Doug Rankin ’53 Endowment-Geology Research

Name: Glenna Thomas 2017 (Environmental Geology)  
Mentor: Amy Leventer (Geology)  
Title: Seasonality of Diatom Species in Antarctic Peninsula  
Funding: Norma Vergo Prize

Name: Kevin Varga 2016 (Geology)  
Mentor: William Peck (Geology)  
Title: Oxygen isotope ratios of Marcy anorthosite massif as indicator of shallow emplacement  
Funding: NASC Division

Name: Alexander “Alex” Wrobel 2015 (Geology)  
Mentor: Martin Wong (Geology)  
Title: U-Pb Dating of the Hacuwar Mountains  
Funding: National Science Foundation

**Department of Mathematics**

Name: Farah Fouladi 2015 (Computer Science)  
Mentor: Ahmet Ay (Biology; Mathematics)  
Title: Research Assistant  
Funding: Systems Biology Center New York (SBCNY) Grant
Name: Sarah Johnson 2015 (Mathematics)
Mentor: Aaron Robertson (Mathematics)
Title: Monochromatic Sets of Integers of Equal Diameter
Funding: NASC Division

Name: Danielle Putur 2016 (Natural Sciences)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Highly Multiplexed Quantitative Imaging with Combinatorial Fluorescence Probes
Funding: Systems Biology Center New York (SBCNY) Grant

Name: Adriana Sperlea 2014 (Computer Science)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Reconstructing the Gene Regulatory Network Governing Traveling-Waves of the Vertebrate Segmentation Clock
Funding: NASC Division

Department of Physics and Astronomy

Name: Brett Christensen 2016 (Natural Sciences; Philosophy)
Mentor: Rebecca Metzler (Physics and Astronomy)
Title: Calcium Intake in B. amphitrite as Shown by Calcein Marker
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Trevor Dorn-Wallenstein—Wesleyan College 2015
Mentor: Jeffrey Bary (Physics and Astronomy)
Title: Testing thermocouple mounting to study insulation in building walls
Funding: Keck Northeast Astronomy Consortium (KNAC)

Name: Yue Du 2016 (Physics)
Mentor: M. Beth Parks (Physics and Astronomy)
Title: Testing thermocouple mounting to study insulation in building walls
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Nathan Fritz 2016 (Physics)
Mentor: M. Beth Parks (Physics and Astronomy)
Title: Using Thermocouples to Measure Home Insulation
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Usman Ghani 2016 (Physics)
Mentor: M. Beth Parks (Physics and Astronomy)
Title: Thz Spectroscopy
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: James “Cali” Hatem 2016 (Physics)
Mentor: M. Beth Parks (Physics and Astronomy)
Title: Explaining a Diffusion Tube Experiment
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Katherine “Katie” Karnes 2017 (Astrogeophysics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: Optical Variability of BL Lacertae
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Kidanemariam “Kidane” Kebede 2016 (Physics)
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)
Title: SLM Calibration for study of C-point singularities
Funding: Justus ’43 and Jayne Schlichting Student Research Fund
Name: Nicholas Knoke 2016 (Physics)
Mentor: Rebecca Metzler (Physics and Astronomy)
Title: Balanus eburneus Shell Hardness, Elemental Composition, and its Relation to Atomic Disorder
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Dennis Liu 2015 (Astronomy/Physics)
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)
Title: Single Photons Entangled in Polarization and Spatial Modes
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Deogratius Magege 2016 (Astronomy/Physics)
Mentor: M. Beth Parks (Physics and Astronomy)
Title: Flow of Flexible Filaments
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Carolyn Morris 2017 (Astronomy/Physics)
Mentor: Jeffrey Bary (Physics and Astronomy)
Title: Constraining Dust Properties in Dense Molecular Cloud Cores
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Joshua Reding 2015 (Astronomy/Physics; Philosophy)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: An Exploration of Supernova Light Curve Production Methods
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Anneliese Rilinger—Williams College 2017 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: Optical Variability of BL Lacertae
Funding: Keck Northeast Astronomy Consortium (KNAC)

Name: Rebecca Rist 2016 (Physics)
Mentor: Rebecca Metzler (Physics and Astronomy)
Title: Examining the Structure and Chemical Composition of the Crassostrea Virginica
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Angelica Rivera—Vassar College 2015
Mentor: Jeffrey Bary (Physics and Astronomy)
Funding: Keck Northeast Astronomy Consortium (KNAC)

Name: Samantha Spano 2016 (Physics; Computer Science)
Mentor(s): Enrique “Kiko” Galvez and Rebecca Metzler (Physics and Astronomy)
Title: Study of Iridescent Shells using Optical Polarimetry
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Stephanie Warnken 2016 (Physics)
Mentor: Rebecca Metzler (Physics and Astronomy)
Title: Investigating Crossed-Lamellar Shell Strength of Gastropods in Lake Tanganyika
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund

Name: Zachary Weaver 2017 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: Optical Variability of the Blazar 3C 454.3 at Foggy Bottom Observatory
Funding: Justus ‘43 and Jayne Schlichting Student Research Fund
Name: Jovana “Luna” Zagorac 2016 (Astronomy/Physics; Anthropology)  
Mentor: Thomas Balonek (Physics and Astronomy)  
Title: *Optical Variability of the Blazar 3C 454.3 at Foggy Bottom Observatory*  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Greg Zengilowski 2015 (Astrogeophysics; Chemistry)  
Mentor: Jeffrey Bary (Physics and Astronomy)  
Title: *Constraining Dust Properties in Dense Molecular Cloud Cores*  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Jonathan Zeosky 2016 (Astronomy/Physics)  
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)  
Title: *Polarization Möbius Loops*  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

**Department of Psychology**

Name: Rachel Brown 2016 (Neuroscience)  
Mentor: Jennifer Tomlinson (Psychology)  
Title: *Physiological Synchrony During Couple Interactions*  
Funding: NASC Division

Name: Skye Challener 2015 (Peace and Conflict Studies; Psychology)  
Mentor: Jennifer Tomlinson (Psychology)  
Title: *Physiological Synchrony During Couple Interactions*  
Funding: NASC Division

Name: Chelsea Dale 2015 (Psychology)  
Mentor: Julia Martinez (Psychology)  
Title: *Project #1: “The impact of standard nutrition labels on alcoholic beverages.”  
Project #2: “What’s your ‘vice?: A combined approach to drugs and other addictive substances and activities.”*  
Funding: NASC Division

Name: Federico Elizondo 2017 (Undeclared)  
Mentor: Julia Martinez (Psychology)  
Title: *Drinking Strategies Among College Students*  
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Victoria Fontana 2015 (Psychology; Russian and Eurasian Studies)  
Mentor: Julia Martinez (Psychology)  
Title: *Project #1: “The impact of standard nutrition labels on alcoholic beverages.”  
Project #2: “What’s your ‘vice?: A combined approach to drugs and other addictive substances and activities.”*  
Funding: NASC Division

Name: David Gildin 2015 (Neuroscience)  
Mentor: Bruce C. Hansen (Psychology)  
Title: *Identifying certain features of the C1 component during early visual processing*  
Funding: NASC Division

Name: Ying Lin 2015 (Neuroscience; Japanese)  
Mentor: Richard Braaten (Psychology)  
Title: *Food choice conformity in Zebra Finches*  
Funding: NASC Division and Research Council
<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Department(s)</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joshua Miller</td>
<td>2017</td>
<td>Neuroscience; Computer</td>
<td>Bruce C. Hansen (Psychology)</td>
<td>Identifying the properties of the C1 component during early visual processing</td>
<td>NASC Division</td>
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<tr>
<td>Carolyn Powers</td>
<td>2015</td>
<td>Neuroscience</td>
<td>Ann Jane Tierney (Psychology)</td>
<td>Behavioral and life history effects of low-level exposure to serotonin reuptake inhibitors in crayfish</td>
<td>NASC Division</td>
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<tr>
<td>Jacob Proano</td>
<td>2015</td>
<td>Neuroscience</td>
<td>Jun Yoshino (Psychology)</td>
<td>Effect of antidepressants on nitric oxide production</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Ellen Rodowsky</td>
<td>2015</td>
<td>Psychology</td>
<td>Richard Braaten (Psychology)</td>
<td>Food Choice Conformity in Zebra Finches</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Michelle Roy</td>
<td>2015</td>
<td>Neuroscience</td>
<td>Ann Jane Tierney (Psychology)</td>
<td>Chronic Low-Level Exposure to Fluoxetine Affects Orconectes Rusticus Behavior, Molting, and Growth</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Taylor Santomauro</td>
<td>2016</td>
<td>Neuroscience</td>
<td>Jun Yoshino (Psychology)</td>
<td>Effect of antidepressants on nitric oxide production</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Mallory Wagner</td>
<td>2015</td>
<td>Neuroscience; Religion</td>
<td>Bruce C. Hansen (Psychology)</td>
<td>The Effect of Peripheral Images on the C1 Visual Component</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Anastasiya Yandulskaya</td>
<td>2016</td>
<td>Neuroscience</td>
<td>Richard Braaten (Psychology)</td>
<td>Conformity in Songbirds</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Julia Yarrington</td>
<td>2016</td>
<td>Psychology</td>
<td>Richard Braaten (Psychology)</td>
<td>Food Choice Conformity in Zebra Finches</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Abby Yosaitis</td>
<td>2015</td>
<td>Psychology</td>
<td>Jennifer Tomlinson (Psychology)</td>
<td>Physiological Synchrony During Couple Interactions</td>
<td>NASC Division</td>
</tr>
</tbody>
</table>
DIVISION OF SOCIAL SCIENCES (SOSC)

Department of Anthropology

Name: Laura “Lorelai” Avram 2016 (Anthropology; Educational Studies)
Mentor: Mary Moran (Anthropology)
Title: The social imaginary of two Roma communities in Central-Eastern Europe: Emic versus etic perspectives
Funding: SOSC Division

Name: Michaela “Misha” Vebrova 2016 (Educational Studies)
Mentor: Mary Moran (Anthropology)
Title: The social imaginary of two Roma communities in Central-Eastern Europe: Emic versus etic perspectives
Funding: SOSC Division

Department of Economics

Name: Wesley Gross 2015 (Mathematical Economics)
Mentor(s): Ulla Grapard and Michael O’Hara (Economics; Women’s Studies)
Title: The Extent of Income Disparities Based on the Intersections of Race, Sex, Sexual Orientation, and Education
Funding: SOSC Division

Name: Yue “Eric” Hu 2015 (Economics)
Mentor: Takao Kato (Economics)
Title: Fair Wage Hypothesis: Evidence from a Field Experiment
Funding: SOSC Division

Name: Zhehao Jiang 2015 (Economics; Mathematics)
Mentor: Thomas Michl (Economics)
Title: Repo and Federal Funds: Before, During, and After the Crisis
Funding: SOSC Division

Name: Rakib Sikder 2015 (Economics)
Mentor: Robert Turner (Economics)
Title: Developing Survey Instruments for Environmental Initiatives
Funding: SOSC Division

Name: Tianyi Wang 2015 (Mathematics; Economics)
Mentor: Robert Turner (Economics)
Title: Extreme Weather and the U.S. Economy
Funding: SOSC Division

Name: Xiyi Wang 2015 (Mathematics; Economics)
Mentor: Robert Turner (Economics)
Title: Extreme Weather and the U.S. Economy
Funding: SOSC Division

Department of Educational Studies

Name: Melissa Meléndez 2015 (Peace and Conflict Studies)
Mentor: Barbara Regenspan (Educational Studies)
Title: It’s not just about children: Contesting the normative claims of “child development”
Funding: SOSC Division
Name: Ji Hoon “Daniel” Park 2016 (Undeclared)  
Mentor: John Palmer (Educational Studies)  
Title: Developing Economic Education Model for Primary Graders: the Case of Korea  
Funding: Lampert Institute for Civic and Global Affairs

Name: Natasha Torres 2015 (Educational Studies)  
Mentor(s): Anne “Anna” Rios and Mark Stern (Educational Studies)  
Title: Portable Culture: the Experiences of Students of Color Studying Abroad  
Funding: SOSC Division

Name: Salvatore Curasi 2015 (Political Science; Geography)  
Mentor: Michael Loranty (Geography)  
Title: Effects of Landscape Position on Carbon Cycling in Siberian Arctic Tundra  
Funding: SOSC Division

Name: Melissa Haller 2016 (Geography; Economics)  
Mentor: Daisaku Yamamoto (Geography)  
Title: The Socioeconomic Impacts of Decommissioning Maine Yankee Nuclear Reactor in Wiscasset, Maine: A Case Study  
Funding: SOSC Division

Name: Zachary Lazow 2016 (Computer Science; Economics)  
Mentor: Michael Loranty (Geography)  
Title: Image Segmentation of Tundra Vegetation in Satellite Images  
Funding: SOSC Division

Name: Allison Shafritz 2015 (Environmental Economics; Geography)  
Mentor: Peter Scull (Geography)  
Title: Ethiopian Church Forests: A Land Cover Change Analysis  
Funding: SOSC Division

Name: Kate Dugdale 2016 (History)  
Mentor: Faye Dudden (History)  
Title: Abolitionism and Woman’s Rights During the Age of Reform  
Funding: SOSC Division

Name: Jamie Gagliano 2016 (International Relations; Africana and Latin American Studies)  
Mentor: Antonio Barrera (History)  
Title: Comets and the Universe: Comparing Scientific Thought across the Early Modern Atlantic World  
Funding: SOSC Division

Name: Li Jiang 2017 (Undeclared)  
Mentor: Graham Hodges (History)  
Title: African Americans in New Jersey 1600-Present  
Funding: SOSC Division

Name: Sohee Ryuk 2015 (History; Psychology)  
Mentor: Andrew Rotter (History)  
Title: A Conflicted Narrative: Textbook and Monumental Representation of the Korean War in South Korea  
Funding: Lampert Institute for Civic and Global Affairs

Department of Geography

Name: Salvatore Curasi 2015 (Political Science; Geography)  
Mentor: Michael Loranty (Geography)  
Title: Effects of Landscape Position on Carbon Cycling in Siberian Arctic Tundra  
Funding: SOSC Division

Name: Melissa Haller 2016 (Geography; Economics)  
Mentor: Daisaku Yamamoto (Geography)  
Title: The Socioeconomic Impacts of Decommissioning Maine Yankee Nuclear Reactor in Wiscasset, Maine: A Case Study  
Funding: SOSC Division

Name: Zachary Lazow 2016 (Computer Science; Economics)  
Mentor: Michael Loranty (Geography)  
Title: Image Segmentation of Tundra Vegetation in Satellite Images  
Funding: SOSC Division

Name: Allison Shafritz 2015 (Environmental Economics; Geography)  
Mentor: Peter Scull (Geography)  
Title: Ethiopian Church Forests: A Land Cover Change Analysis  
Funding: SOSC Division

Department of History

Name: Kate Dugdale 2016 (History)  
Mentor: Faye Dudden (History)  
Title: Abolitionism and Woman’s Rights During the Age of Reform  
Funding: SOSC Division

Name: Jamie Gagliano 2016 (International Relations; Africana and Latin American Studies)  
Mentor: Antonio Barrera (History)  
Title: Comets and the Universe: Comparing Scientific Thought across the Early Modern Atlantic World  
Funding: SOSC Division

Name: Li Jiang 2017 (Undeclared)  
Mentor: Graham Hodges (History)  
Title: African Americans in New Jersey 1600-Present  
Funding: SOSC Division

Name: Sohee Ryuk 2015 (History; Psychology)  
Mentor: Andrew Rotter (History)  
Title: A Conflicted Narrative: Textbook and Monumental Representation of the Korean War in South Korea  
Funding: Lampert Institute for Civic and Global Affairs
Name: Nicole Schroeder 2015 (History; Classical Studies)
Mentor: Graham Hodges (History)
Title: The Life of African Americans in New Jersey during the 1900s
Funding: SOSC Division

Name: Anastassia Bougakova 2016 (English; Sociology)
Mentor: Janel Benson (Sociology)
Title: Kin Networks during the Transition to Adulthood
Funding: SOSC Division

Name: Marielba Casabona 2015 (Spanish; Sociology and Anthropology)
Mentor: Jacqueline Villarrubia (Sociology)
Title: Living in the Shadows: The Socioemotional Impact of Legal Status on Unauthorized Youth’s Educational Aspirations
Funding: Lampert Institute for Civic and Global Affairs

Name: Sarah Chen 2015 (Sociology and Anthropology)
Mentor: Janel Benson (Sociology)
Title: Effects of Masculine Ideals in the Working Class
Funding: SOSC Division

Name: Sarah DeFalco 2015 (Sociology and Anthropology)
Mentor: Christopher Henke (Sociology; Environmental Studies)
Title: The Accessibility of Locally Produced Food for Low-Income Residents of Central New York
Funding: SOSC Division

Name: Cody Hawkins 2016 (Sociology)
Mentor: Janel Benson (Sociology)
Title: Philadelphia Educational Longitudinal Study (PELS)
Funding: SOSC Division

Name: Susan Miller 2016 (Peace and Conflict Studies; Women’s Studies)
Mentor: Meika Loe (Sociology; Women’s Studies)
Title: Contemporary Feminist Parenting
Funding: UNST Division

Name: Ariel Sherry 2015 (Psychology; Religion)
Mentor: Meika Loe (Sociology; Women’s Studies)
Title: Women and Retirement
Funding: SOSC Division

Name: Kori Strother 2015 (Africana and Latin American Studies; Environmental Studies)
Mentor: Janel Benson (Sociology)
Title: The Role of Bridge Programs in the Transition to College of Under-represented Students
Funding: Lampert Institute for Civic and Global Affairs
DIVISION OF UNIVERSITY STUDIES (UNST)

Department of Environmental Studies

Name: Stephanie Chen 2016 (Environmental Studies)
Mentor: April Baptiste (Environmental Studies)
Title: The Accessibility of Locally Produced Food for Low-Income Residents of Central New York
Funding: UNST Division

Name: Myles Davis 2015 (Biology)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division

Name: Sarah DeFalco 2015 (Sociology and Anthropology)
Mentor: Christopher Henke (Sociology; Environmental Studies)
Title: The Accessibility of Locally Produced Food for Low-Income Residents of Central New York
Funding: SOSC Division

Name: Kelly French 2015 (Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: Assessing antibacterial activity of traditional medicinal plants used by Haudenosaunee peoples of New York State
Funding: NASC Division

Name: Peter Juviler 2015 (Molecular Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: Ethnobotany
Funding: NASC Division

Name: Danielle Mazzeo 2015 (Biology)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division

Name: Eric Moore 2015 (Biology)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division

Name: Mae Staples 2015 (Molecular Biology)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: Assessing antibacterial activity of traditional medicinal plants used by Haudenosaunee peoples of New York State
Funding: NASC Division

Name: Timmera Whaley 2015 (Social Sciences)
Mentor: Frank Frey (Biology; Environmental Studies)
Title: The Power of Encouragement
Funding: NASC Division (Science and Math Initiative-SMI)

Name: Dean Yeh 2015 (Biology; Japanese)
Mentor: Timothy McCay (Biology; Environmental Studies)
Title: Factors Affecting the Distribution of Earthworm Species in New York State
Funding: NASC Division
Department of Linguistics

Name: Alexandra Pfiffner 2015 (Spanish)
Mentor: Alexander Nakhimovsky (Linguistics)
Title: Corpus-based Online Dictionary of Jamaican Creole: A Study in Theoretical and Practical Lexicography
Funding: UNST Division

Department of Peace and Conflict Studies

Name: James Carroll 2015 (Peace and Conflict Studies)
Mentor: Jacob Mundy (Peace and Conflict Studies)
Title: What do we really know about civil conflict violence? Measuring information reliability and observer effects in conflict datasets
Funding: UNST Division

Name: Jimmy Juarez 2015 (Peace and Conflict Studies)
Mentor: Susan Thomson (Peace and Conflict Studies)
Title: To be, or not to be Koya. A Case Study Concerning Indigenous Cultural Cleavages and Colonization in the Amazon’s TIPNIS
Funding: Lampert Institute for Civic and Global Affairs

Name: Liza Paudel 2015 (International Relations)
Mentor: Susan Thomson (Peace and Conflict Studies)
Title: Study the transition of female former rebel combatants in the Nepalese Civil War into civilian life
Funding: Lampert Institute for Civic and Global Affairs

Department of Women’s Studies

Name: Wesley Gross 2015 (Mathematical Economics)
Mentor(s): Ulla Grapard and Michael O’Hara (Economics; Women’s Studies)
Title: The Extent of Income Disparities Based on the Intersections of Race, Sex, Sexual Orientation, and Education
Funding: SOSC Division

Name: Susan Miller 2016 (Peace and Conflict Studies; Women’s Studies)
Mentor: Meika Loe (Sociology; Women’s Studies)
Title: Contemporary Feminist Parenting
Funding: UNST Division

Name: Estrella Rodriguez 2017 (English)
Mentor: Sarah Wider (English; Women’s Studies)
Title: Editing Literary Correspondence through a Gendered Lens
Funding: UNST Division

Name: Ariel Sherry 2015 (Psychology; Religion)
Mentor: Meika Loe (Sociology; Women’s Studies)
Title: Women and Retirement
Funding: SOSC Division
LAMPERT INSTITUTE FOR CIVIC AND GLOBAL AFFAIRS

Name: Marielba Casabona 2015 (Spanish; Sociology and Anthropology)
Mentor: Jacqueline Villarrubia (Sociology)
Title: Living in the Shadows: The Socioemotional Impact of Legal Status on Unauthorized Youth's Educational Aspirations
Funding: Lampert Institute for Civic and Global Affairs

Name: Jimmy Juarez 2015 (Peace and Conflict Studies)
Mentor: Susan Thomson (Peace and Conflict Studies)
Title: To be, or not to be Koya. A Case Study Concerning Indigenous Cultural Cleavages and Colonization in the Amazon’s TIPNIS
Funding: Lampert Institute for Civic and Global Affairs

Name: Ji Hoon “Daniel” Park 2016 (Undeclared)
Mentor: John Palmer (Educational Studies)
Title: Developing Economic Education Model for Primary Graders: the Case of Korea
Funding: Lampert Institute for Civic and Global Affairs

Name: Liza Paudel 2015 (International Relations)
Mentor: Susan Thomson (Peace and Conflict Studies)
Title: Study the transition of female former rebel combatants in the Nepalese Civil War into civilian life
Funding: Lampert Institute for Civic and Global Affairs

Name: Sohee Ryuk 2015 (History; Psychology)
Mentor: Andrew Rotter (History)
Title: A Conflicted Narrative: Textbook and Monumental Representation of the Korean War in South Korea
Funding: Lampert Institute for Civic and Global Affairs

Name: Kori Strother 2015 (Africana and Latin American Studies; Environmental Studies)
Mentor: Janel Benson (Sociology)
Title: The Role of Bridge Programs in the Transition to College of Under-represented Students
Funding: Lampert Institute for Civic and Global Affairs

OTHER

Name: Jeremy Bayer 2015 (Geography)
Mentor: Peter Rogers (Library-Reference/Instruction)
Title: Undergraduate Research Data Discovery, Management, and Curation
Funding: Libraries Summer Research Fellowship

Name: Arjun Bhuptani 2016 (Astronomy/Physics)
Mentor: Joseph Eakin (Ho Tung Visualization Laboratory & Planetarium)
Title: Animations & Productions for the Ho Tung Visualization Laboratory
Funding: Information Technology Services

Name: Matthew Johnson 2015 (Japanese)
Mentor: Joseph Eakin (Ho Tung Visualization Laboratory & Planetarium)
Title: Digital Animation and Planetarium Work
Funding: Information Technology Services

Name: YeonJu Mok 2015 (Computer Science)
Mentor: Joseph Eakin (Ho Tung Visualization Laboratory & Planetarium)
Title: Educational 3D Animation Production
Funding: Information Technology Services
Name: Mekedelawite “Maya” Atakilti 2015 (Sociology and Anthropology; Educational Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Jennifer “Jenn” Dias 2016 (Biology; Spanish)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Richard “Will” Ely 2015 (Computer Science)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Justine Gambale 2015 (Sociology and Anthropology)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Emily Hawkins 2015 (Peace and Conflict Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Lauren Kasparson 2015 (Neuroscience)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Sarah Katz 2016 (Geology)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Mallory Keller 2017 (Undeclared)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Erica “Maxine” Lammers 2015 (Art and Art History; Environmental Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute

Name: Yunheng “Ethan” Liu 2016 (Physics; Computer Science)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: Upstate Institute Summer Field School  
Funding: Upstate Institute
Name: Emily Luba 2016 (Geography; Peace and Conflict Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Roxanne Maduro 2017 (Undeclared)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Alexandra Marrone 2016 (Molecular Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Alexandra “Alex” Maulden 2016 (Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Monica Murphy 2016 (Religion)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Kendra Peeples 2016 (International Relations)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Kennedy Pope 2015 (History)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Crystal Sawh 2015 (English; Environmental Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Simone Schenkel 2014 (Peace and Conflict Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Yusra Siddique 2016 (Economics; English)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute

Name: Brendan Walsh 2015 (History)
Mentor: Julie Dudrick (Upstate Institute)
Title: Upstate Institute Summer Field School
Funding: Upstate Institute
Name: Sarah Wooton 2015 (Educational Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: *Upstate Institute Summer Field School*
Funding: Upstate Institute
Research Summaries
The reovirus genome consists of only ten genes, which encodes for 11 proteins. While this virus is relatively simple, two strains of reovirus, Type 1 Lang (T1L) and Type 3 Dearing (T3D), elicit very different responses. In mice, T1L causes myocarditis while T3D causes higher levels of interferon and apoptosis and cause encephalitis. Additionally, μ2 is a structural protein that has been associated to inhibition of interferon signaling and viral inclusion morphology, where new virus particles are formed. If μ2 is associated is responsible for the different effects of T1L and T3D, then it is likely that the slight genetic variations in μ2 are causing the capsid of the T3D virions to be less stable. The unstable capsid could expose the double-stranded RNA to the cytoplasm of cells that would activate the innate immune system and cause the cell to undergo apoptosis. Understanding reovirus, which resides in the same family as rotaviruses, would provide a good model for the study of rotaviruses.

At the beginning of the summer, μ2 was not in the appropriate vector to perform any experiments to determine its effects. Therefore, I had to transfer the gene from its original vector into a vector with a FLAG tag. This would allow me to determine the location of μ2 within a cell because there are many available antibodies that will bind to the FLAG tag; however, the multiple cloning site (MCS) of the vector required that we used Nde1 as a restriction enzyme which would have cut within the reading frame of μ2. So, I had to mutate μ2 with a silent mutation such that Nde1 would no longer cut within the reading frame of μ2. Additionally, I transferred the μ2 gene sequence into a mammalian vector without the FLAG tag so that I could transfected cells with the plasmid and treat the cells with interferon and observe the effect.

Future directions for my project include preforming the experiments mentioned above with the plasmids that I created. If there is evidence from those experiments to suggest that μ2 is related to the stability of the capsid then I would perform x-ray crystallography of μ2 from both the T1L and T3D strains to understand how the genetic variation affected their structure and therefore the stability of newly synthesized capsids within the viral inclusion bodies.

**Research Fellow:** Charlotte Arbogast (2016)  
**Concentration:** Theater  
**Faculty Mentor:** April Sweeney  
**Department:** Theater  
**Title of Project:** LONEtheater

**Project Summary:**

This summer, I worked with Professor Sweeney and Colgate graduate Ben Mandell to bring the site-specific productions of LONEtheater to New York City. In this project, Argentinean director Matías Umpierrez wrote five plays, each intended to be performed in one of five different locations in New York City. As the production team, we all helped to make this intention a reality. LONEtheater as a project aims to immerse spectators in a theater piece of their choice, placing them in a unique theater experience in which each spectator is alone with the actor(s). Each spectator is asked to respond to the piece, and even to become an active member of the performance he chooses to see. In the New York City-based project, spectators could choose from five productions: Pact, Witness, Far, Exodus, and Amnesia. Each piece asked something different of its spectators. Some spectators commented that they felt nervous in this position, as though they had a role to fill and they were not sure what this role should be, but they also seemed excited by this challenge. In addition to being placed in the production itself, each spectator was thrust into a jarring environment. Some environments were familiar, like a Subway train and Central Park, and others were entirely new to the audience member, like Clemente Soto Vélez Cultural Center. Each environment was entirely natural, though: no proscenium separated the audience member from the actor(s), and the sets consisted of whatever the environment had to offer. The poetic text conflicted with this natural environment, and actor(s) relayed stories to audience members in environments that would seem to call for conversations, rather than the monologues that made up most of the productions. This forced the audience member into the position of active listener for most of the performances. Occasionally, audience members were also called upon to answer questions about themselves or perform small tasks. In one instance, they had to choose whether or not to set a hostage free, and were asked to go as far as to untie him themselves. Audience members often backed away from such active participation, but a surprising number of spectators were willing to actively participate when asked, and most spectators were excited to listen. In New York City, many stories are overlooked, as people pass others without a second glance. Matías Umpierrez’s five pieces called attention to such overlooked stories. Spectators were called into an apartment to watch the decline of a family in Exodus, and pulled onto the Subway to hear the story of an average college graduate, told through the eyes of the speaker in Witness. Spectators left the productions with a greater sensitivity to the lives of the strangers that surround them in the city. Each different location, as well, was placed in a new light during the productions. The Subway became a place to enter others’ lives; the old school building housing Clemente Soto Vélez Cultural Center became a place to hold a man hostage; Central Park became the center of a story of migration and familial love. Suffice it to say, spectators left with a new take on the setting of the productions they had seen. Each piece was written in Spanish, Matías Umpierrez’s native language, and later translated into English. Rehearsals took place in a mix of Spanish and English, leading to a necessary cooperation between actors who did not speak any Spanish, those who did, as well as myself, a Spanish student striving to increase my fluency. It was also a constant reminder of the fact that this piece has already taken place in multiple countries, in multiple languages, and will go on to be translated into more languages, changing slightly with each interpretation. The project has so far taken place in Argentina, Spain, and New York City, and rehearsals are now in progress in Brazil. As the Production Stage Manager, I worked on scheduling, rehearsal notes, acquiring props, and any other tasks that needed to be completed. Because the production had no budget, we had a much more cooperative experience, which was only augmented by the language barrier. The project altered the way we think of theater, stripping theater down to story-telling and rebuilding it from there, just as it altered spectators’ perception of New York City. With each translation and each country in which the project takes place, it is edited to fit the current socioeconomic climate and issues faced in that particular location. The project is currently occurring in Brazil, where it will continue to demonstrate to spectators the importance of the stories that surround them.

**Source of Support:**  
- [x] HUMAN Div.  
- [ ] NASC Div.  
- [ ] SOCS Div.  
- [ ] UNST Div.  
- [ ] Other (specify):
Research Fellow: Mekedelawite “Maya” Atakilti (2015)  Concentration(s): SOAN; Educational Studies

Faculty Mentor: Julie Dudrick  Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

I was placed at the Mohawk Valley Refugee Center in Utica, NY through the Upstate Institute. My original reason for applying to the Upstate was that I wanted a summer job that mattered. I previously worked in many locations including offices, movie theaters, and restaurants. This summer I was looking for something that went along with my interests, which includes working with marginalized communities. When I was informed that I was placed at the Refugee Center I was pleasantly surprised. My mother immigrated to the United States when she was sixteen and struggled to figure out how to settle into the new culture. Being able to work for a non-profit organization that not only resettles refugees but also continues to support them seemed perfect. Before starting my summer I was informed that my planned projects for the summer would be to update the cultural PowerPoint presentation and to continue a health navigator program that the previous year’s Fellow started.

The first part of my summer was pretty simple. Because I am a sociology major, I was accustomed to performing research. It took a little time to find information because qualitative data on the refugee community tended to be mixed in with immigrants in general, but once I figured out the key words for searches I not only updated the PowerPoint but also added a lot more information that I came across. Along the way I made an effort to change formatting and visuals in order to make the slides easier for non-experts to understand. This made the PowerPoint more appealing and easier to read for everyone. I was also working with the Compass Interpreters section of the Refugee Center. There I would update interpreters’ profiles with new qualifications or contact them about new opportunities. I also updated Compass Interpreters’ customers about regulations and language interpretation that was now being offered. One week I created resumes for the more recently resettled refugees in order to assist them in obtaining jobs.

The second half of my summer was spent working on the Health Navigator program. I was given the work that was done by Ewa Protasiuk, ’15 in the summer of 2013, which was a very detailed and organized research binder. I was asked to put Ewa’s project into practice and widen the scope of services with which Refugee Center volunteers could help. Because there are only a few caseworkers with the Refugee Center people that often turned away because of lack of time. Resettlement policy states that refugees are only provided with a case worked for 3 months after arrival, even though they often need a lot of assistance after that. I created a manual for the volunteers that would work with this Navigator program, which information about the most common things for which refugees need assistance along with detailed steps on how to deal with each issue. By the end of my work with the Refugee Center the Navigator program was up and running, and staffed with volunteers.

□ Other (specify): Upstate Institute
Title of Project: The social imaginary of Roma communities in Central-Eastern Europe: Emic versus etic perspectives

Project Summary:

Our project was a comparative ethnographic study conducted in four different Roma communities: the neighboring villages of Nová Farma and Dobrá Voda in Western Bohemia, Czech Republic; the ghetto of Chanov near Most, Czech Republic; the villages of Munteanu, Liesti and Ivesti in the Galati County of Romania, and in the suburbs of Bucharest, Romania. We also visited six NGOs working with the socially excluded and a Roma music festival in Liberec, Czech Republic. Our research was motivated by a desire to understand how individuals in these different socially excluded groups negotiate their identities through reverting to professions that they had not been able to perform until the early 1990s, when the newly democratic governments abolished the previous regimes' forcible assimilationist practices. Such professions include musicians in the Czech Republic and florists, fiddlers and semi-iterant tinkers and horse-shoers in Romania.

Our theoretical framework departed mainly from the studies of Margaret Beisinger, Svanibor Pettan, and Ursula Hemetek, all of whom explain many Roma individuals' turning to once-traditional professions as a way to define themselves against the stigma associated with being Roma and a way to gain political momentum. On a more speculative level, we drew on the work of Mattijs van de Port, who recognizes some Roma people's choices of stereotypically Roma professions as a fulfillment of the mainstream society's imaginary.

Through a survey of English, Czech, and Romanian academic and non-academic resources, our own series of interviews of varying degrees of formality, and our own participant and non-participant observations, we were able to expose ourselves to both emic and etic perspectives on what constitutes the Roma identity.

Contrary to our expectations, we discovered that the main factor influencing the Roma's professional choices was financial solvency. Most of the interviewees did not choose their occupations because of an emotional tie they felt to the cultural heritage of which they had been robbed during communist times, as we initially hypothesized. Rather, they felt that these were the only professions available to them: because of wide-spread discrimination in the mainstream society, most of them had not been able to access the educational opportunities that would equip them with the skills necessary for other jobs. Additionally, many of them dislike the idea of having a “non-Roma profession” (typically, one can only encounter Roma florists, tinkers or horse-shoers), because that would involve working with many “gadjé” (white, non-Roma people). They preferred to work within their communities, and with their families. Moreover, contrary to our beliefs, the horse-shoers and tinkers we were able to interview also disliked the nomadic aspect of their profession. Even though this is traditionally regarded as a central feat of the Roma heritage, the Roma we spoke to complained about the difficulties of a semi-iterant life: the lack of social ties, the impossibility to attend school, the lack of comfort and hygiene. They wanted to settle down, and not be forced to travel in search for more business. By and large, most seemed to agree that these were professions that they would abandon if they had a choice, and that they did not want for their children to have. They wished for more stable and better compensated occupations for their children.

However, we were indeed able to see some of the conclusions drawn after our secondary research, reflected into the discoveries we made about Roma musicians, in both Romania and the Czech Republic. As Beissinger states, we did find that, in Romania, the profession of a Roma fiddler can represent a way of defining oneself against the stigma associated with this ethnicity. In the villages we visited, the fiddler was a much respected figure, and his craft perceived as magical. Most, Roma and non-Roma alike, agreed that “no party is a party, no wedding a wedding, and no christening a christening” without a “gypsy fiddler.” Nevertheless, in the Czech Republic, we found something completely different. While many Roma dedicated themselves to music-making, very few of them seemed to espouse any “distinctively Roma” sounds, lyrics or instruments, even though they might have presented their music as such. Both the Roma who make “gypsy hip hop” in the city of Most and the Roma we found in the festival of Liberec, admitted that very little of their cultural and musical heritage had been directly preserved, and so they played genres varying from Hungarian rock to Spanish flamenco. Regardless of the fact that the Czech Roma weren’t necessarily able to display their identity by playing a particular music, they did music and were taught music in the NGOs we visited, because it was thought that, par excellence, “the gypsies are musicians.” We thus concluded that the phenomenon we observed might represent what van de Port calls “fulfillment of the mainstream society’s imaginary.”

☐ Other (specify):
Title of Project: High pH Crystallization of Haemophilus influenzae Carbonic Anhydrase

Project Summary:

*Haemophilus influenzae,* is most notably known for being an opportunistic bacterial pathogen that that resides in the human lung and can cause diseases like pneumonia and bacterial meningitis. Carbonic anhydrases are a family of metalloenzymes, meaning that the enzymes require a metal for functionality, that catalyze the interconversion of water and carbon dioxide into bicarbonate as shown in the following equation: \( \text{CO}_2 + \text{H}_2\text{O} \overset{\Delta}{\rightarrow} \text{HCO}_3^- + \text{H}^+ \). Carbonic anhydrases are found in almost all kingdoms of life, but this project is interested in structure of the *H. influenzae* \( \beta \)-carbonic anhydrase (HICA). More specifically, the goal of this project was to determine the structure of the HICA protein in the active state through crystallization of the wild type of this protein. The HICA protein is found in two states, active and inactive, known as the relaxed (R) or tense (T) states respectively. The R state requires a catalytic deprotonated (separated into hydrogen and hydroxide ions) water molecule to maintain the relaxed confirmation of the enzyme. Considering the fact that the vital water protonates at pH less than 7.5, high pH crystallization conditions were needed for R state analysis. Crystallization is a process in which a solution is super-saturated with pure protein, a buffer is then used to control the pH, and finally a precipitant is used to cause the protein to ‘clump’ together in a uniform pattern known as a lattice structure. Ultimately the main goal of this project was find high pH conditions in which the HICA protein was able to crystallize for later structural analysis through the use of X-ray diffraction.

Considering that the HICA protein has yet to be crystallized and that the crystallization process is unpredictable when it comes to useful conditions, it was necessary to create a sparse matrix screen with 96 different conditions. Through the use of commercially available screens, a screen was created that tested different precipitants, buffers ranging from 7.5 to 9.0 pH and additives. From my initial screen through to the optimized screen, I was able to determine that a combination of 0.1 M Tris-Cl buffer at 8.0 pH, 17% w/v polyethylene glycol (PEG) 3350 and 0.2 M KSCN produced the largest usable crystals. The original hit on the matrix screen (A) is 0.1 M Tris-Cl at 8.5 pH, 20% w/v PEG 3350 and 0.2 M KSCN, which was then optimized using hanging drop method which resulted in (B). These crystals however, due to their high solvent concentration, made removal for use in the X-ray diffractometer impossible. Thus a further optimization was required which changed the pH of the buffer and the concentration of the precipitant slightly but made usable crystals seen in (C). Though these crystals were less fragile, flash freezing was still impossible for both conditions. Thus a room temperature mount was necessary. This also proved difficult because the crystals would exciscate and fragment shortly after being mounted. Ultimately, a structure was unable to be determined as of yet, however other room temperature mounts could prove to be effective and make X-ray analysis possible.
Catalysts for hydrogenation and dehydrogenation of polar bonds can play extremely important roles in different processes. For example, bifunctional catalysts can provide a more atom-economical and sustainable way to perform selective redox reactions for synthetic chemistry. Additionally, these bifunctional catalysts could also help provide a more sustainable and secure energy source. Technology to split water into oxygen and hydrogen gas using solar energy is progressing quickly. However, hydrogen gas is limited as an energy carrier due to difficulties with storage and transport. A potential solution is chemical storage of hydrogen; a hydrogen acceptor, such as carbon dioxide, could be reduced to methanol and water, which can be easily stored and transported. The reverse reaction would release the hydrogen for energy use.

This summer I have been working to find a catalyst that can be used for hydrogenation and dehydrogenation of polar bonds. The mechanistic theme for this kind of catalysis involves the hydrogen being cleaved heterolytically, with the metal center of the catalyst acting as a Lewis-acid, and a site on the ligand of the catalyst acting as a Lewis-base. The catalyst I have been working on utilizes a ligand based on N-heterocyclic carbenes, which form strong metal-carbon bonds, allowing the ligand to bind to a first-row transition metal. Furthermore, my ligand contains an acidic functional group in close proximity to the metal center to accept or donate hydrogen during catalysis (Figure 1).

First, I focused on synthesizing the ligand. Its synthesis had three separate steps, each being a nucleophilic substitution reaction. Next, I worked to metalate the ligand. I was able to successfully coordinate my ligand to iron, however, x-ray diffraction confirmed that two equivalents of the ligand bound to the metal center (Figure 2). This made the catalyst unreactive; there was not site on the metal center to accept or donate a hydride ion. To fix this problem, I did the reaction with excess iron. This method seems promising, but I have not yet successfully purified the compound, and therefore have been unable to complete catalytic trials or get a crystal structure of the compound. During my senior research this year, I hope to isolate the compound, and test its catalytic activity.
Research Fellow: Melinda Bartlett (2015)  
Concentration: Classical Studies

Faculty Mentor: Rebecca Ammerman  
Department: Classics

Title of Project: Exploring the Waters of a Nymph

Project Summary:

This summer I worked with Professor Rebecca Ammerman conducting research about the worship of nymphs in the ancient Mediterranean world. The research will contribute to her publication of 500 terracotta figurines dedicated as votive gifts in the 4th and 3rd centuries BCE at a spring sanctuary in Metaponto, in Southern Italy. Most of the figurines depict a female figure accompanied by a male figure who is Pan in many terracottas or a silen in others. She believes that these terracottas provide evidence that the spring sanctuary was dedicated to a nymph. I helped Professor Ammerman with this research by collecting data about the nymphs, helping to organize her data, ordering articles and books through interlibrary loan, and translating and summarizing relevant French studies.

I spent a large part of my summer reading about nymphs using as my primary guide the book, *Greek Nymphs*, by Jennifer Larson. Based on my reading, I compiled a catalogue of the locations where nymphs were worshipped in the Greek world. I found approximately 100 examples of nymph worship, which I then organized in an Excel spreadsheet. This was my first time using Excel, which will definitely be a helpful skill to have in the future. I created several different categories to explain and order the evidence for and nature of worship of nymphs at each site. Some of the categories were: location, type of evidence (literary, archaeological or epigraphic), source (if literary), other divinities worshipped at the site, date, etc. I think this spreadsheet will be a helpful tool for Professor Ammerman to be able to see the various examples of nymph worship, and to see connections with the site she is studying at Metaponto. By assembling this data I learned a lot about nymphs and how significant they were in religious practices throughout the ancient world.

I also assisted Professor Ammerman by collecting more bibliographic resources relevant to her research. Most of these articles and books had to be ordered through interlibrary loan. It was the first time that I had used interlibrary loan, a skill that will definitely be helpful in the upcoming school year.

In addition, I worked with two French texts, translating one article and summarizing each chapter of a lengthy (512 page) book for Professor Ammerman. I studied in France this past spring semester and was happy to continue using my French skills. It was really challenging for me to translate these works, but it was very helpful to me in keeping up with my French. The French book I read, *Balaneutikè: recherches sur le bain dans l'antiquité grecque*, by R. Ginouvès, discussed the many different usages of baths in the ancient world. I looked for connections between the use of springs and other water sources in ritual practices and the specific spring site in Metaponto.

I learned a lot not only about nymphs but also about Southern Italy through my research this summer. I had never studied the history of Southern Italy before it became part of Rome and I found it very interesting. I knew very little about how distinct the cultures of Southern Italy were and how closely connected they were to Greece. This is an area I would like to study more.

This summer contributed a great deal to my knowledge as a Classics student. I learned a great deal about unfamiliar areas of study and I learned how to use new tools that will help me do research in the future. It also helped me figure out what I would like to do in the future. It directed me towards the idea of teaching Latin and French at a high school level. Although I do find the study of archaeological remains interesting, I am more interested in the study of history and language. While doing this research this summer, the things that interested me most were studying the history of Southern Italy and using my French skills.

Source of Support:  
- HUMN Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  
- Other (specify):
Research Fellow: Katrina Bennett (2016)  
Concentration: Neuroscience

Faculty Mentor: Jason Meyers  
Department: Biology

Title of Project: Understanding the Zebrafish Retinal Regeneration Process

Project Summary:

For my research, I worked in Professor Jason Meyers' neurodevelopment lab. For my projects, I focused on zebrafish retinal regeneration, and the fact that zebrafish have a special type of cell, Müller glia, that can regenerate cells in damaged retinas after injury. I investigated the specifics of this fascinating process; what affects the regeneration and what can increase or limit it, and what happens to the actual vision quality of the fish throughout the regeneration process. Although many questions are still left unanswered surrounding this process, interesting observations were made. The conclusions were that the immunosuppressant dexamethasone decreased retinal regeneration in zebrafish following lesion, and the visual strength of zebrafish can be analyzed and compared between control and lesioned fish throughout the regeneration process and certain differences are visible.

To analyze the effects of dexamethasone on zebrafish retinal regeneration, 6 day old larvae were light lesioned, treated or not treated with the drug, then fixed, cryosectioned and immunostained 3 days later and observed under fluorescence. Fish that were lesioned and treated with dexamethasone showed less dividing Müller glia and less division spreading into the damaged photoreceptors, indicating reduced retinal regeneration taking place (Figure 1).

To analyze the vision quality, or the visual acuity, of the zebrafish through the regeneration process, a response called the optokinetic response (OKR) was elicited, recorded and analyzed in the lesioned and unlesioned larval zebrafish. The OKR describes a series of slow and fast movements that stabilize an image on the retina and compensate for any large scale movement in the visual field. Fish were tested for the OKR by projecting a horizontally moving vertically striped image across the outside of a petri dish with a smaller petri dish inside. Inside of the smaller petri fish, 5-13 day old zebrafish are placed in 2.5-3% methylcellulose which ensures they stay in place and do not swim around and are forced to watch the moving image. If the fish are following the image, their one eye that is pointed towards the stimulus will move with the movement of the image (Figure 2), and show fast corrections to attempt to center the eye. The stimulus was made to be faster, slower, wider, and various different colors. The OKRs were analyzed by tracking the angle of eye orientation as it moved in a video that was captured to determine how strong or weak the response was.

For the most part, the OKRs elicited from lesioned and unlesioned fish were relatively similar. Not all fish showed an OKR in response to the red stimulus and when an unlesioned fish did, the lesioned fish was still unable to respond to the red. Sometimes, the lesioned fish seemed to have much weaker OKRs in general than the lesioned fish and their eyes would rotate much less and sometimes not at all. Often, there seemed to be a much weaker OKR in response to the dark blue stimulus among lesioned fish when compared to the control fish from the respective groups. Many more trials and much more research will need to be completed to fully understand the OKR throughout the zebrafish retinal regeneration process.

Figure 1: Red staining shows PCNA, a marker for cell proliferation and division. A shows a retina not treated with dexamethasone and the red lines across the retina show the Müller glia dividing in response to the lesion. In B a retina treated with the drug shows less red Müller glia indicating less regeneration occurring.

Figure 2: In the three images of the same fish eyes presented above, the eye being presented with stimulus is rotating in response to the stimulus, while the other is not.

Source of Support: ☑ HUMN Div. ☑ NASC Div. ☑ SOSC Div. ☑ UNST Div. ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Title of Project: *Thalassiosira lentiginosa* morphologic variability, Sabrina Coast, East Antarctic margin

Project Summary:

The Sabrina Coast, East Antarctic margin is one of the least explored areas of Antarctica, and is a region that appears to be experiencing ice loss over the past decade. However, in order to understand the role of modern warming and changes in the Antarctic cryosphere, scientists must evaluate the long-term climatic history of the area. One way to do this is through representative records from marine sediment cores, with polar marine diatoms, a type of algae, as a critical recorder of oceanographic conditions. This project investigated the size variability within a single species of diatom, *Thalassiosira lentiginosa* to test its utility as a paleoceanographic proxy.

The core that was examined, NBP1402 KC27B, was taken offshore of the Moscow University Ice Shelf, in sediments underlying the Dalton Polynya. The core is 2.17 meters long and was recovered from a water depth of 546 meters. The diatom assemblage that characterizes the core is unusual in the occurrence of species, like *T. lentiginosa*, that are more common in the open ocean, despite the coastal location of this site. In addition, the core contains layers of needle-like diatoms that most likely represent massive blooms associated with frontal zones. This study focused on *T. lentiginosa* and how it varied between sedimentary layers dominated by the needle-like diatoms (“fluff layers”), versus sections of the core characterized by other species (“non-fluff”). The goal was to see if morphologic variability of *T. lentiginosa* could provide any clues as to the oceanographic conditions responsible for the massive blooms. A total of 13 slides were examined, 7 from fluff layers and 6 from non-fluff sections of the core. One hundred valves were measured from each slide.

The data showed little size variation between fluff and non-fluff layers for *T. lentiginosa*. The average diameter from all samples was 37.2 microns, varying from 33.5 to 39.9 microns. The lowest and highest average diameters were both in fluff layers and the second highest average diameter appeared in a non-fluff layer. The lack of variation in diameter sizes in KC27B may be related to potentially high sediment accumulation rates, hence the short period of time represented by the core. The chronology currently is being developed via a combination of lead-210 and radiocarbon work. It is possible that environmental variability over this time period was not great enough to result in morphological changes in this species. Previous work documenting morphological variability in *T. lentiginosa* reflected glacial versus interglacial differences; however, this core spans at most the mid to late Holocene, a shorter period of time. Longer cores from this area should be examined in order to examine the range of environmental variability along the Eastern Antarctic margin.

The purpose of this research was to explore the foliar nutrient levels in the Ethiopian Church Forests as part of the multidisciplinary study that five Colgate professors are taking part in. I planned to combine my knowledge of geographic information systems with my experience in Professor Cardelus’ lab in order to spatially analyze the nutrient levels of various church forests. This past winter, 220 foliar samples had been collected from Ethiopia and I planned to work with 120 of them. During the first two and a half weeks of summer I measured the Specific Leaf Area (SLA) for 120 Ethiopian tree leaf samples and prepared them for nutrient analyses. SLA is the area of a leaf divided by its dry weight and is used as an indicator of its ecological strategy. Fast-growing trees, for example, have a high SLA as they put little investment in their leaves (low dry weight). To calculate SLA, I took four hole punches of each sample, put them in the oven over night, and weighed them the next day. I ground the remaining leaf samples using a Wig-L-Bug grinder. I put the ground samples in vials with labeled bar codes and put them in the oven for 24 hours with their tops off to prepare them for nitrogen and carbon analyses. After 48 hours in the oven, the samples were then ready to be rolled. Rolling the samples consists of weighing out ground leaf material along with various amounts of a control sample and rolling them each up in a small foil. The rolled samples are placed in a 96 well plate and stored in a desiccator to ensure the samples do not absorb any moisture. Once all of these samples were rolled, I was not able to do anything else with the samples until the rest of the lab returned from Costa Rica, which was at the beginning of July.

The following two and a half weeks I helped Professor Scull work on GIS work related to Ethiopia. I located each of the 13 forests in which long-term data plots were set up in January on Google Maps, Google Earth, Bing Maps, and the 1962 declass images. I compiled all of these images into a power point in order to illustrate noticeable differences in forest size that occurred over the years. I also created inset maps using GIS for each of the forests that show their relative location in the South Gondar region of Ethiopia. I helped create a binder with all of the information about the church forests that had been collected so far for the Ethiopian conference that occurred the second week of July. I worked with all five professors on the project to organize and format the information before sending the large document to the print shop. I spent the final five weeks working in the lab with the students who had gone to Costa Rica for research. The six of us worked on the Costa Rican samples and the Ethiopian samples simultaneously. We had to grind, roll, and weigh out many more samples. I also learned how to prepare samples for analysis of phosphorus. All the samples are now prepared for the nutrient analyses and I will be continuing this research over the school year. Once all of the tests are done, I will use geographic information systems to explore the results and attempt to spatially understand the distribution of various nutrient levels throughout these forests. This will possibly help us understand the impacts of various factors such as edge effects, distance to markets, presence of a wall and human disturbance.
Project Summary:

The research I undertook this summer focused on samples collected from the Franklin-Sterling Hill Mine in Sussex County, New Jersey. This mine is world renowned for its unusual variety of minerals; 28 mineral specimens are unique to this area. Additionally, the mine was a major source of zinc and iron for much of the 20th century. Although the mine has been the object of extensive research, most studies have focused on the nature of the ore bodies; little attention has been given to the secondary weathering products that have developed over time. My research attempts to analyze the weathering products found in this area, with the goal of identifying the minerals present. Of particular interest are the clay minerals, since these are poorly understood. After running a number of analyses — including X-ray diffraction and X-ray fluorescence for clay mineral identification and major, minor and trace element concentrations, respectively, it became apparent that there was a limited quantity of clay minerals in the fine, clay-sized fraction (<2 microns). This made it difficult to fully characterize these minerals, thus far. The data collected to date indicate that zinc and iron rich minerals are abundant in sediments and soils. These minerals include hemimorphite, magnesiohornblende, albite, quartz, and calcite/dolomite. The phyllosilicates that might be present are kaolinite, chamosite, chlorite, saucnite, illite, and possibly a variety of talc. As seen in the diffractograms below, iron removal treatment resulted in a steep drop in the intensity of the 7 Å peak. This might indicate the presence of an iron-rich 7 Å chlorite. Further analysis is necessary to confirm this. Additional testing is also needed to explain the unnaturally high concentrations of heavy metals (including zinc, gallium, and lead) found within soil samples collected at the mine. There appears to be a trend of decreasing concentration with depth in the soil, and an explanation for this has not yet been determined. A museum specimen that was assumed to be the expandable smectite saucnite might actually be a form of talc or chamosite. This is yet to be determined. Work on my project will continue into the fall semester.
Research Fellow: Kristijan Bogdanovski (2016)  
Concentration: Biochemistry

Faculty Mentor: Anthony Chianese  
Department: Chemistry

Title of Project: Alcohol and Amine Dehydrogenation Catalyzed by a Ruthenium Complex

Project Summary:

The challenge of using H₂ as a fuel source is its efficient storage and safe transportation. Therefore, my project this summer involved the synthesis and characterization of a ruthenium-based catalyst that could reduce polar C-X bonds to store H₂ in molecules for later usage as an alternative fuel to fossil fuels.

![Scheme 1: Synthesis of the Ruthenium-based catalyst](image)

The synthesis of the catalyst was previously accomplished in the Chianese lab by metalating a N-heteroyclic carbene ligand (Scheme 1). The catalyst was separated from impurities in the sample mixture using flash chromatography. Then, COSY and NOESY were used to determine the spin systems. Once the product was characterized, the catalyst was tested for dehydrogenation activity (Scheme 2).

![Scheme 2: Dehydrogenation of substrates](image)

The dehydrogenation of primary alcohols worked well in the formation of esters but secondary alcohols seemed to form an unexpected ketone product. No reaction was observed when an amine was added to the catalyst. Further experimentation will be performed to confirm results and standardize reaction conditions.

Research Fellow: Matthew Bosselait (2015)  
Concentration: Geology

Faculty Mentor: Karen Harpp  
Department: Geology

Title of Project: Investigation into the Physical Properties Responsible for the Formation of Basaltic Spatter

Project Summary:

Pyroclastic material from basaltic eruptions takes many forms, including ash, scoria, spatter, and clastigenic flows. These products define a spectrum that is a function of clast temperature, how clasts interact with each other when deposited, and the extent of welding or fusing as clasts cool. The pyroclastic deposit properties depend largely on microscopic structures developed at clast interfaces: a) scoria clasts retain their original shapes after deposition; b) agglutinated clasts deform but have a limited weld; c) stronger welding occurs when neighboring clasts deform and their contacts are fused; and d) fusion results when clasts have completely merged with one other. We examine conditions necessary to produce spatter using 2 experimental approaches: small-scale tests in a muffle furnace, which vary the parameters of clast size, deposit thickness, and temperature; and large-scale tests at Syracuse University’s Lava Project facility. Starting material is Keweenaw Peninsula basalt (~50 wt.% SiO2, 7.5 wt.% FeO, 7.3 wt.% MgO). In the furnace, pea-sized chips (0.5-7 mm) begin to deform at 1100°C, and agglutination occurs from 1100 to 1150°C, with clasts beginning to weld ~1125°C. Clasts are completely molten at ~1150°C. Furthermore, the thicker the deposit, the more extensive the welding in the middle, owing to greater heat retention by overlying material. To examine the role of clast size, crushed samples were sieved into 3 fractions and heated; the smallest clasts with the most surface area and least thermal mass were most extensively welded. Finally, temperature experiments reveal that at 1100°C, boundaries between clasts are 29% welded (extent of welding is measured by comparing the length of welded contacts between clasts with that of unwelded contacts in SEM images). At 1125°C, clasts are 62% welded, and at 1150°C, they are fully welded. Above 1150°C, clast shapes are no longer discernable. These results are consistent with work by Rader (2014), conducted at 1130°C on basalts from Devil’s Garden, OR. Our results indicate that a potentially wide window exists for spatter formation, depending on eruptive temperature and cooling rates upon deposition. In the fall we are conducting large-scale simulations performed at the Syracuse University facility, to be reported at the American Geophysical Union conference in San Francisco.

Project Summary:

During the summer, I worked with Professor Benson and another student on data gathered by the Philadelphia Educational Longitudinal Study (PELS). The study’s sample consisted of 95 young adults between the ages of 17 and 24 from the urban Philadelphia area, who were asked a series of questions about their family, education, aspirations, and other life experiences during their transition to adulthood. Transition to adulthood describes a period in the life course when adolescents begin taking on some adult roles—such as moving out or getting jobs—and generally achieving a measure of independence. This transition, while often marked by some common experiences and role acquisitions, is still a complex process that presents itself differently in—and is perceived differently by—the individuals who experience it. The overarching theme of my summer research was the study of this transitory life course phase, which I later narrowed down to focus on the role of family and extended kin during this period. Studies on the role of family in this transition tend to focus exclusively on nuclear family structures and the transfer of resources and cultural capital from parents to children. I wanted to re-conceptualize family to include extended family, fictive kin, and neighborhood communities and explore how their support influences the transition to adulthood.

While there exists an extensive body of literature on the salience of two-parent family units during this transition, as well as on the impact of divorce and remarriage, there is little research on the support offered by extended and fictive kin networks. I was especially interested in the phenomenon of fictive kin—individuals that are treated and referred to as family despite having no biological relation to the respondent. Carol B. Stack’s ethnography *All Our Kin* covers this concept extensively and was very helpful to my research. Along with several other papers, it led me to see that poor working-class communities seemed to generally rely more on the support of fictive and extended kin than middle- and upper-class households. And while Stack focused her research exclusively on an African American community, I saw similar patterns of reliance on extended kin among PELS respondents of all races.

To further explore these patterns, I read the PELS interview transcripts, coded them using NVivo—a qualitative data analysis software—and wrote coding summaries. The coding process involves categorizing certain pieces of the transcript into themes, such as “college social experience” or “relationships with parents.” These thematic categories are called coding nodes. Parsing the transcript into these nodes not only allows for easier retrieval of this information later on, but also helps the researcher organize data for analysis. After I had read through and coded a substantial amount of transcripts, I began noticing certain patterns emerging in the data. I kept track of these in a research notebook and wrote memos about the patterns that seemed to occur with the highest frequency. I was particularly interested in the way many respondents spoke about their families, often mentioning grandparents, aunts, and close family friends without having been prompted by the interviewer.

My summer research helped lay the groundwork for what I hope will become an independent study project. I would like to use my work with the PELS data to thoroughly explore the extended and fictive kin support networks of working-class emerging adults. Given how little sociological inquiry has been made into the impact of non-nuclear family structures into young adults’ lives, I believe that it is important to more fully understand these complex kin networks and how they affect the resources, life trajectories, and perceptions of individuals transitioning into adulthood.
Relationships have fascinating effects on our health and self-perception. Much research has been done on how relationships affect younger couples but there is less research on older couples especially during difficult life transitions. Considering that life transitions are often the times relationships are truly tested, we explored the influences relationships have on self-perception during the transition into retirement. Retirement is a time when withdrawal from the workforce challenges most people’s sense of who they are and opens up time to expand interests or pursue new goals. We were interested in whether the retiree’s likelihood to use their freed up time to expand could be linked to their perceptions of support and relationship satisfaction. Through a longitudinal study of 100 couples we examined self-expansion (defined as seeking out new hobbies, interests, experiences and/or roles that stimulate personal growth) and shifts in self-concept (defined as “a multi-faceted entity that may encompass all of the physical characteristics, material belongings, social roles, prototypes, scripts, attitudes, beliefs, and attributes individuals define as ‘me’” [Slotter & Gardner, 2012, p. 387]) within one year following retirement.

Self-concept was assessed using an open-ended questionnaire that asked “Who are you today?” Participants were given three minutes to write down all words they believed holistically represented who they were at that point in time. The questionnaire was distributed at three time points each six months apart. Someone who experienced self-expansion would write down more words from a greater variety of self-concept areas over time. Additionally, participants filled out established questionnaires that asked them about their relationship with their spouse, allowing us to assess their perception of how available, encouraging, and supportive their spouses were. These questionnaires also included items that allowed us to analyze how committed the participants felt to their relationships and how satisfied they were with their marriage. Because present research has found that relationships that improve the self-concept are associated with greater love, satisfaction and commitment (Mattingly, Lewandowski, & McIntyre, 2014) we hypothesized that participants whose responses indicated strong support from their partners would predict positive changes in the retiree's self-concept over the year.

To analyze our data we created our own coding system in which the characteristics listed on the “Who Are You Today” questionnaires were coded into self-concept categories by two independent coders. We then coded for “uniqueness” (the number of diverse categories the participant’s characteristics fell into) and “diversity” (a 1-5 rating that considers both the number of unique categories and number of characteristics provided). Our results indicate that commitment and perceived partner availability are correlated with a more unique and diverse self-concept at the beginning of retirement. Perceptions of support for self-expansion, satisfaction, availability, and encouragement from the partner predict an increase in diversity of the self-concept six months following the initial session.

These findings suggest that relationship quality in older populations can have an impact on how an individual perceives him/herself during significant life changes. Thus, a strong relationship helps retirees continue to expand their self-concepts throughout the transition to retirement. We have submitted these results as a poster to the Society for Personality and Social Psychology annual meeting and hope to present them in Long Beach if the poster is accepted. This project was a challenging and rewarding experience, in which we had the opportunity to expand our skills and knowledge concerning integral aspects of research in Psychology. We were able to increase our background knowledge on the current body of research on close relationships and self-expansion, which guided us in creating a unique coding system specific to the project. While analyzing the results, we became more proficient in SPSS and were able to develop our understanding and application of inferential and descriptive statistics. Through this entire process, we learned the value of collaboration regarding the development and direction of this project.
Faculty Mentor: Richard April  Department: Geology

Title of Project: A comparative study of two community gardens: The influence of soil mineralogy and chemistry on crop nutrient content and elemental abundances

Project Summary:

I am a geology major interested in sustainable and organic agriculture and how agricultural productivity/efficiency and crop health may be affected by changing soil conditions. I spent my summer doing research for my senior thesis project, comparing the soil chemistry and mineralogy of two organic community gardens (Hamilton College and Colgate University). I chose four crops to compare between the two gardens (Swiss chard, carrots, winter squash, and zucchini) and took soil samples from the root zone of each plant in each garden, and then performed analyses to determine soil characteristics such as pH, bulk chemistry, clay mineralogy, trace element presence, and presence of nutrients such as calcium, magnesium and potassium (in the form of exchangeable cations, e.g. Ca^{2+}, Mg^{2+}, K^+). At the end of the summer, as harvest time began, I collected tissue samples from four corresponding crops in each garden. I ground, dried, and ashed the tissue samples in Professor Catherine Cardelus’ biology lab, and will be working more in that lab in the fall, analyzing the plant tissues to determine if plant chemistry/nutrient content is influenced by soil chemistry or mineralogy, or both.

So far, I am seeing clear differences in soil mineralogy (as determined by X-ray diffraction analysis) and in the soil chemistry (as determined by X-ray fluorescence analysis) between the two gardens (some chemical parameters shown below). From here, I will try to determine if plant chemistry is related to any of the soil characteristics I have studied, especially focusing on Fe and other minor and trace elements. Whether or not there is a relationship is yet to be determined. Nevertheless, I look forward to continuing this project in the fall.

![Bar charts of exchangeable Ca, Mg, % Loss on Ignition (indicates organic content), soil pH (July) for carrots, chard, winter squash, and zucchini from Hamilton and Colgate gardens.]

Research Fellow: James Carroll (2015)  
Concentration: Peace and Conflict Studies

Faculty Mentor: Jacob Mundy  
Department: Peace and Conflict Studies

Title of Project: What do we really know about civil conflict violence? Measuring information reliability and observer effects in conflict datasets

Project Summary:

The merits of studying civil conflict can easily be quantified; with an understanding of why and how civil wars begin as well as the dynamics of ongoing conflicts, through effective policy-making it could become possible to eliminate violence as a way to settle disputes at the state level. Recently, scholars have suggested that attempts to understand civil warfare are undermined by problems in the way we understand warfare itself (specifically distinctions between civilian/combatant, types of geographies, symmetrical/asymmetrical violence, etc.) (Mundy 2013). We attempt to identify sources of ambiguity in original source material used to compile the Uppsala Conflict Data Program's comprehensive quantitative dataset. Our methodology involved creating a new dataset on the violence in the Algerian civil war (1991-present) using the aforementioned source material and using Google Earth to quantify spatial variance in purported location among different sources covering the same event. Our findings suggest large interpretive leaps made between the steps of source acquisition and quantification in the dataset. The goal in undertaking this project was to expose the vulnerabilities of quantitative conflict research, and in doing so lead to the development of new conflict research discourse.

Our methodology involved selecting a statistically significant sample of the UCDP Armed Conflict Dataset, acquiring the original source material used to create the sample, and coding the original source material in MaxQDA (a program designed for qualitative data analysis). To select the sample, we sorted the entire Algeria portion of the dataset using the =RAND function in Microsoft Excel, then used the first 369 events. Next, we obtained both original and external source material for the events using news databases. Finally, we cataloged the events into MaxQDA, where we tagged the documents using “codes” to examine the similarities and differences with which different sources covered the same event. The original sources were predominantly from BBC and Reuters newswire services, which could be found using the Lexis Nexis and Factiva databases respectively. We also created a Google Earth file recording the purported location of each violent event in our sample.

Developing a coding system by which to evaluate the articles we found was done on a trial-and-error basis; several times we developed a code only to realize that it was irrelevant or too difficult to apply to our source material to be an effective tag. The code system we determined to be most effective included the following tags, which we used in MaxQDA in order to analyze a large number of articles alongside one another: date reported, location reported (including purported distance from a known landmark), armed participants, casualties, and type of violence (symmetrical or asymmetrical). With this coding system in place, it became possible to evaluate each article we found against a uniform set of criteria.

We found that large interpretive leaps had often been made between gathering source materials and coding them into the quantitative dataset, and that for some of the events cataloged in the UCDP dataset the original source could not be found in Lexis Nexis or Factiva. When the articles were present in the databases, they were often less than a paragraph in length, or a sentence in an article covering a different event. Coding the articles in MaxQDA allowed us to qualify the type of ambiguity that we were attempting to measure. Future projects may be interested in investigating other quantitative datasets, or different countries within the UCDP dataset.

Source of Support:  
☐ HUMAN Div.  ☑ NASC Div.  ☐ SOSR Div.  ☑ UNST Div.  
☐ Other (specify):
Research Fellow: Marielba Casabona (2015)  Concentration(s): Spanish; Sociology and Anthropology

Faculty Mentor: Jacqueline Villarrubia  Department: Sociology

Title of Project: Living in the Shadows: The Socioemotional Impact of Legal Status on Unauthorized Youth’s Educational Aspirations

Project Summary:

Of the 11.7 million unauthorized immigrants living in the United States as of 2012, 1.8 were under the age of 18 and approximately 78% of them were of Latino heritage (Pew Research Center: 2013). With about 1 million of these undocumented students coming of age there should be more concern for their process of integration into mainstream U.S. society and the possible barriers that affect their postsecondary aspirations, such as socioemotional experiences (Suárez-Orozco et al., 2011). In this context, the socioemotional aspect of the individual is based on the way certain interactions with others (peers, family, faculty, etc.) may shape and/or shift their postsecondary aspirations for the future (Pérez et al., 2010). As these youth age, those same interactions will have an impact on their educational aspirations and achievements and an emerging sense of disappointment, fear, or on the contrary, motive may develop as they look forward into their future.

The lack of literature on unauthorized youth’s academic aspirations have shaped my research and it I acknowledge the very importance of socioemotional experiences in the educational outcomes of a segment of the population that has been socialized in the U.S. After all, their legal status does play a role in their development and the way that they are being stripped of their “American” identity could quite possibly be considered as one of the most traumatic experiences ever felt (Pérez et al., 2010). This is in no way underestimating the influence of the broad number of factors that affect unauthorized youths educational aspirations and achievements, such as language learning, family separation, lack of financial support, etc. Rather it emphasizes how it is necessary to truly understand their educational trajectories as more of these students have decided to publicly disclose their status as advocates of the DREAM Act and their reception has continued to be constantly negative (Gleeson and Gonzalez, 2012, Galindo, 2012).

The primary objective of this study was to understand the impact of socioemotional experiences on the educational goals and aspirations of undocumented immigrant youth by conducting in-depth interview with undocumented students of Latino descent found through immigrant youth community organizations, college campuses, and churches in the California Bay Area. Given that there are certain experiences that become key influential factors to the Latino/a undocumented student’s college decision process, this study’s research question is: How are postsecondary aspirations influenced by the socioemotional experiences of unauthorized youth who have been raised and socialized in the United States? This study differs from previous ones in that it focuses on unexplored systemic barriers that limit and change many undocumented students’ personal expectations when compared to their documented immigrant or American counterparts.

By giving light to the barriers, motivations, and sources of support of undocumented students and the role they give to their higher education, this study contributes to the still minimal understanding of the incorporation processes of these students into mainstream America. This is particularly significant in the case of the recent policy changes that have taken place and the way they may be further expanding the creation of an immigrant underclass and spread of inequality in the country.

☒ Other (specify): Lampert Institute for Civic and Global Affairs
Small poodles often did not fit the model predicted by their genotypes. Outliers are shown in red.

**Research Fellow(s):** Julia Ceglowski (2016)  
Amanda Liberman (2017)  

**Concentration(s):** Mathematics; Biology  
Concentration: Molecular Biology

**Faculty Mentor:** Barbara Hoopes  

**Department:** Biology

**Title of Project:** The Poodle Project: Searching for another Size-Determination Variant in Small Poodles

**Project Summary:**

Over the past 300 years, artificial selection by humans has made dogs ideal for genetic studies. Between breeds, dogs vary dramatically in appearance. Among breeds, on the other hand, dogs express very little appearance or genotype variation due to artificial selection. Currently, seven known variants influence at least 53 percent of size variation between dog breeds. This figure is incredible—by comparison, 180 known size variants in humans cannot even account for 10 percent of all size variation! Of the seven dog size variants, six are single-nucleotide polymorphisms (SNPs, single-base-pair changes in the DNA sequence) and one is a large deletion. Our hypothesis is that these six genes are insufficient to explain variation in body size in small dogs. We are specifically focusing our research on small poodles, since these dogs can vary by more than 50 percent in height and 300 percent in weight.

Using the seven variants found in the size genes, we attempted to predict some dogs’ sizes. To do this, we collected cheek swabs from purebred poodles, corgis, Australian Shepherds, and Shetland Sheepdogs. We then extracted genomic DNA (gDNA) from the swabs and used the polymerase chain reaction (PCR) and DNA sequencing to look at each variant of interest. We determined whether each dog contained the “ancestral” (“normal”) DNA sequence, the “derived” allele found in smaller dogs, or both (one copy from each parent). Using the number of derived alleles each dog possessed at each gene, we performed a multiple regression to find an equation with which we could find the dogs’ predicted sizes. For example, in Figure 1, we predicted the sizes of Australian Shepherds and Shetland Sheepdogs. These predicted sizes matched the dogs’ actual sizes well. However, when we applied the same measures to compare the actual and predicted sizes of small poodles, the model fell apart (see Figure 2). We conclude from this result that although the seven variants we know about can explain variation within breeds for Shetland Sheepdogs and Australian Shepherds, they are insufficient to explain the extensive variation seen in small poodles. Therefore, we are looking specifically at poodles to find another size variant, which would explain why these dogs do not fit the model. Interestingly, several of the genes mentioned above have human homologs. For instance, mutations to the genes coding for IGF-1, IGF-1R, and GHR have all been associated with human growth disorders. Thus, if we discover a new dog size variant through our research, it could have long-term consequences for humans.

Our plan for the future is to finish collecting and genotyping 96 small poodle samples. We will then perform a genome-wide association study (GWAS) on these samples at Cornell University, using two separate analysis methods. First, we will perform a quantitative analysis to relate size to certain genotypes. Second, we will perform a case-control study to compare dogs that fit the model to those that do not. This final step, which we should complete in August, may unveil the mystery variant for which we are searching.


**Source of Support:**  
☐ HUMAN Div.  
☐ NASC Div.  
☐ SOSC Div.  
☐ UNST Div.  
☒ Other (specify): Michael J. Wolk ’60 Heart Foundation
With the world’s oil and natural gas reserves quickly being depleted, scientists are looking for new energy sources that could someday replace fossil fuels. One fuel that has emerged as a front-runner is hydrogen. It can be easily produced using solar energy, efficiently releases stored energy, and produces only water for waste. However, hydrogen is hard to store and transport. As a gas, it requires extremely high pressures to store, and in order for it to be stored as a liquid, the temperature needs to be near absolute zero (−273°C). Both of these eat energy and are impractical for widespread use. However, these are not the only ways hydrogen can be stored. Chemical storage is a real possibility that many laboratories, including our own, are looking into. Chemical storage entails hydrogenating a compound and then later removing that hydrogen. For instance, carbon dioxide can be hydrogenated to form methanol and water and then dehydrogenated to reform carbon dioxide and hydrogen gas. But to do this reaction efficiently, a catalyst is needed.

This summer I have been working on synthesizing, isolating, and testing the above catalysts. The first two are CNC catalysts, meaning that the central ruthenium atom is bonded to the carbons of the two N-heterocyclic carbenes and to a nitrogen atom. The third is a CNN ruthenium catalyst, meaning that the ruthenium atom is bonded to two nitrogen atoms and one carbon atom on the ligand. I began the summer by working on the first catalyst, fine-tuning the metallation of the ligand. We found that adding the ligand and a strong base (like NaOtBu) together while cold and then adding the RuHCl(PPh3)3(CO) later formed the catalyst in good purity and yield. However, we found no good way to isolate the pure product. Since it was extremely air-sensitive, running a column was not an option and recrystallizing it did not remove the triphenylphosphine. Despite this, we moved forward with catalytic trials, using the in situ catalyst. Dehydrogenating benzyl alcohol, we got 209 catalytic turnovers in 28 hours. This is a respectable showing (though not wonderful), but since we could find no way to isolate the catalyst, it had to be abandoned.

Next I began to work on two other ligands—a modification of my first ligand and the CNN ligand. I began by attempting to synthesize them, which turned out to be very simple so I moved onto metallating each ligand. This turned out to be much harder than expected and I finished the summer still working on it. The CNC ligand didn’t metallate well using the same procedure as before, so I tried transmetallating it using Ag2O, but it also failed. For the CNN ligand, transmetallation worked, but the catalyst was not produced in good yield or purity. Furthermore, attempting to purify the reaction mixtures also failed.

Moving forward, we are looking at yet more analogs of these catalysts and at new ways to synthesize and purify them.
Inequality exists in many forms, and one of the social structures in which it is most evident is education. How much education one attains and how well they do in school is stratified based on different demographic characteristics. Working-class and poor males, of all races, are the least educationally successful group even though a college-going habitus has become commonplace as it is a credential which is seen as necessary to attain any desirable job. So despite this new norm, working-class males still attain degrees at a lower rate. This study sought to investigate how working-class males view their education, and how, if at all, it differs from the college-going norm of American culture. A group of male students from a lower-tier public university were interviewed about their goals and aspirations as well as what they sought from their college education. Overall they were proud to be attending college, something which contradicts a traditional marker of working-class masculinity which considers higher education as a “soft” option for success as compared to a physically demanding job. Through this study, it seemed that the males retained some of the base ideals of working-class masculinity, such as a disdain for school and authority, but have realized the necessity of a college education to survive in the modern economy. How this shift came about is a topic that could be further explored, and helps understand how concepts and ideals such as those of masculinity can be changed over time.

The subjects interviewed were working-class males of different races and ethnicities who are currently attending or just recently graduated from a private lower-tier university in New Jersey. All of the males in the study looked at higher education as a necessary credential if they wanted to be successful, which in their definitions meant, money, stability, happiness, or comfort. Although being successful in education is a trait typically shunned by working-class males as a display of their masculinity, all of the participants were proud to be obtaining their college degree, and all considered themselves above average. However, they conceded that they did not do as well in school as they thought they could have because they disliked the actual school work and putting a lot of effort into their classes. This behavior was more expected considering the traditional disregard by males of putting effort into their education. Their pride in obtaining a college degree seemed to be linked more to parental expectations to achieve more than their parents had and to be able pass over jobs like “work in the host at McDonald’s or Burger King. I’m not saying those aren’t hard, bad jobs, but I didn’t see myself working those places.” They recognized that the college degree was necessary if they wanted to work in a job past that kind of low skill and unstable job. The majority aspired to own their own businesses as well, regardless of the field. This is in line with the traditional working-class ideal of having a distaste for authority as proof of masculinity. One male said specifically “I don’t wanna work for anyone else, I wanna be my own boss, I wanna work for myself, be CEO.” Others obtaining higher education degrees aspire to rise up in a company, or work for a specific organization, while these working class males did not want to work for other people, but work for themselves so that they could support their parents once they were retired.

So as the students represented disdain for authority and a dislike for “liking” school, they have been conditioned through their peers to realize that a college education is necessary for attaining most all jobs in the labor market. These shifts in habitus for the college-going students, even in the population which has been historically least likely to pursue a college education, may be a direct result of the labor market, but also may be a result of the changing ideals of society and the marked shift from a labor to a service-based economy. Investigation into how these ideas have changed will be a meaningful subject of further research.

Source of Support:

- HUMN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify):
Title of Project: Calcium Intake in *B. amphitrite* as Shown by Calcein Marker

**Project Summary:**

Barnacles are marine organisms that begin life as larvae that move about in the water. Eventually, these larvae settle on a single surface, where they will spend the remainder of their lives in the adult stage. Adults have a hard exoskeleton composed primarily of calcite (a form of calcium carbonate, CaCO₃). Exactly when in its life cycle the organism begins to take up this calcium from the surrounding seawater in order to incorporate it into its exoskeleton is unknown. To investigate this, I raised members of the barnacle species *B. amphitrite* starting at different points in their life cycle, and treated them with a calcein solution for varying lengths of time. Calcein is a molecular marker that binds to calcium and, when viewed under certain types of light, emits green fluorescence. Therefore, when the individual takes up calcium, it will also take up the calcein that is bound to it. When the sample is viewed using fluorescence microscopy, the presence of calcein is indicated by green fluorescence. The results of this study indicate that calcium begins to be incorporated within 96 hours after the motile life stage settles on a surface. Further work will help to establish a more exact time at which this occurs and will elucidate more information about the calcification process, such as where the calcium is initially taken in, and how it is distributed to the exoskeleton. This work is relevant to the field of biomineralization, and has applications in fighting against the fouling activities of barnacles on ships and other marine vessels, as well as in the study of biomineralization in higher-order animal species, such as the process of bone-creation in vertebrates.

**Source of Support:**

- [ ] HUMN Div.
- [ ] NASC Div.
- [ ] SOSC Div.
- [ ] UNST Div.
- [x] Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: Paleoclimate Research

Project Summary:

Very little is known about the paleoclimate of the East Antarctic margin due to its remote location and difficult access as a consequence of heavy sea ice cover. However, remote sensing data of the region indicate accelerating glacial ice loss over the past decade, thus the need to learn more about the climate history of this region. This research focused on developing paleoclimate records of the Sabrina Coast, East Antarctica, by analyzing sea-floor sediment cores taken from this region during a 2014 cruise, NBP1402. Preliminary assessment of the cores suggests that records extend back approximately 10,000 years. The primary tool used in this paleoclimate research was micropaleontology, the analysis of the microscopic glass shells of a group of marine algae, diatoms.

Two research projects are in progress. The first project analyzed size variability of the diatom species *Fragilariopsis kerguelensis*. Previous studies have indicated that size may be related to nutrient content of the upper ocean, with larger specimens associated with highly productive marine environments. The lengths and widths of 100 specimens from each of 14 sample depths were measured under the microscope to determine the total surface area of the diatom valves. The average valve area of *F. kerguelensis* at each depth varied from 180 microns$^2$ to 230 microns$^2$. Some sections of the core are characterized by massive diatom blooms and it was hypothesized that size variability throughout the core might correlate with these sections of the core. Initial results however, do not show a strong relationship and further work is needed in this regard.

The second project focused on diatom assemblage counts to determine the changing relative and absolute abundance of diatom species’ throughout history. *F. kerguelensis*, an open ocean diatom species, is most abundant at this site in general, averaging 80% of the assemblage. The lesser contribution of *Fragilariopsis curta*, a common sea ice species, is surprising given the icy nature of this coastal regime. These data suggest the importance of flow of waters from the more open Southern Ocean onto the continental shelf along the Sabrina Coast. The two species vary inversely with one another, with a sharp shift in dominance of *F. kerguelensis* at 100 cm depth. Also surprising is the very low abundance of *Chaetoceros*, a common spring bloom group, which may reflect the late season opening of this coastal regime, which apparently remained ice covered during the spring through the past 10,000 years. Thus far, this project has yielded intriguing data and the core will be studied further in order to better understand the region’s paleoclimate.
Project Summary:

There are multiple classes of carbonic anhydrases. Beta carbonic anhydrases are found in eubacteria. They contain a zinc ion so are classified as metalloenzymes. Carbonic anhydrases catalyze the reversible reaction of carbon dioxide and water into bicarbonate ions and protons. This reaction is used in metabolic processes that use or produce carbon dioxide or bicarbonate. This research project focused on beta carbonic anhydrase found in *Haemophilus influenzae*. *H. influenzae* is responsible for causing upper respiratory infections such as pneumonia. This particular version of the protein contained a double mutation, where the amino acids 15 and 186 were changed to cysteine, a sulfur-containing amino acid. Cysteine is unique because the sulfur contained in the amino acids can form a disulfide bond with another sulfur. The linking of the new cysteine to form a disulfide bridge was the goal of this project. By linking the two cysteines the protein would be redox controlled. It is hypothesized that in an oxidizing environment the cysteines would form a bridge stabilizing the active R-state, but in a reduced environment the cysteine would not be linked and the protein would be in the inactive T-state.

The double mutant protein was purified by ion exchange column, hydrophobic interaction column and size exclusion column. The samples of the protein at various stages of purification were used to run an SDS-page that was used to determine the purity of the protein. After the protein was determined to be pure, the protein was oxidized in DTNB and then used to make up a 96 well HT crystal screen that would establish good crystalizing solutions for the protein. The best crystallization solution contained 9% isopropanol, 18% PEG 4000 in a buffer of .1M HEPES pH 7.5. This solution was further optimized using hanging drops until crystals appropriately sized for x-ray diffraction was grown. These crystals were frozen in a solution of glucose and x-ray data was collected. The structure of the protein was determined from this data and further work with computer programs. Unfortunately the structure did not reveal the desired disulfide bridge. This might be because the region of this mutation is highly disordered. A new location for the mutation was chosen amino acids 7 and 53. The process to grow cells with this new mutation was started and the cells are currently waiting for purification.

Source of Support:  
- HUMN Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  
- Other (specify):
Research Fellow: Emily Corkum (2015)  
Concentration: Biology

Faculty Mentor: Damhnait McHugh  
Department: Biology

Title of Project: Evolution of Toll-like Receptors in Annelids

Project Summary:

During my internship in the lab of Dr. Ken Halanych at Auburn University, AL on a research assistantship funded by an NSF award to Dr. Damhnait McHugh, I spent 8 weeks learning and applying bioinformatics techniques in evolutionary biology in order to answer my research question – how toll-like receptor proteins that function in the innate immune system in animals have been lost/gained within the phylum Annelida. The toll-like receptors (TLRs) are one of the first lines of defense animals have against microbes and have remained relatively conserved across most animal phyla. Very little research has been done to understand the scope of the TLRs present within the annelids. To address this gap in our knowledge of TLRs, I selected 13 annelid species representing the main branches on the annelid phylogenetic tree to determine where toll-like receptors appear throughout the evolution of this phylum. To accomplish this I used the BLAST tool to search the transcriptomes of the different annelid species (Auburn University data) for toll-like receptor protein sequences, which I obtained from public databases. To train for this research I took a crash course in bioinformatics, which included learning how to access species sequence data, as well as how to use different programs (e.g. Ray, Trinity) to assemble the genome of a species after it has been sequenced. Using these techniques, I examined the presence of toll-like receptors in the transcriptomes of the 13 chosen annelid species. Over the course of my research, I determined that certain toll-like receptors appear to have been lost on some branches on the annelid tree. I am continuing my research, attempting to determine whether these losses are associated with different biomes inhabited by the annelids.

Source of Support:  
- [ ] HUMN Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [X] Other (specify): National Science Foundation
Glycoconjugates are a general class of molecules, usually lipids or carbohydrates, that are attached to proteins. One biologically important glycoconjugate is the O-mucin family of proteins that are embedded on the cell membrane. While typically several linked glycosides are attached, a truncated form with only one galactosamine, known as Tn antigen is detected in cells associated with cancer. Tn antigen is subject to catabolism, rendering its study for therapeutics difficult. Our objective this summer was to explore synthetic pathways towards a more stable Tn antigen mimic.

**Figure 1. Structures of the Tn antigen and its mimic.** The structure on the left depicts the naturally occurring Tn antigen, while the structure on the right depicts our target molecule, the Tn antigen mimic. The instability of the naturally occurring Tn antigen results from the reactivity of the acetal group. From NMR and Xray data, it has been observed that water molecules form a hydrogen bonding network in the pocket as seen above on the left. In order to preserve the hydrogen bonding network while simultaneously introducing stability via the carbon linkage versus the oxygen linkage, we aimed to install the hydroxyl –OH in the specific stereochemistry as shown above on the right.

**Figure 2. Synthetic Route.** In the first step, the α-C-vinyl galactose (far left) undergoes an epoxidation. Hydrogen bonding should facilitate the formation of the epoxide with the desired stereochemistry shown above (middle). Then we plan to introduce a chiral glycine enolate equivalent to open up the epoxide to produce the Tn antigen mimic.

This summer we initially synthesized the precursor for our project, α-C-vinyl galactose (far left). Then we explored various epoxidation reactions, specifically with mCPBA, Mo(CO)₆ catalyst, and VO(acac)₂ catalyst with t-butyl hydroperoxide. Thus far, we have found that the two former epoxidations produced two diastereomers in roughly equal quantities rather than favoring only one. Further, the Mo(CO)₆ catalyzed epoxidation oxidized the benzyl groups to some extent. We also worked towards the synthesis of a Tn antigen mimic with the opposite of the desired stereochemistry via a nitrore cycloaddition reaction to the α-C-vinyl galactose for comparative analysis.
Project Summary:

Crustal extension is an important geologic process that allows the crust to stretch and thin, typically along a series of normal faults, ultimately allowing continents to rift apart. Areas of active crustal extension, such as the East African Rift, provide an opportunity to study the surficial processes of these faults directly as well as how faulting is accommodated in the upper crust (upper ~10 km) through seismic studies of earthquakes. However, such locations do not allow geologists to examine how the mid- to lower crust responds to crustal extension because earthquakes do not occur at these depths. Ancient extensional provinces provide the opportunity to investigate how extensional faulting occurs at greater crustal depths. The Basin and Range Province of western North America is one such region where significant crustal extension occurred, nearly doubling the width of the region during the Miocene (~24.5 Ma)[1]. Within the Basin and Range, a series of extreme normal faults, known as metamorphic core complexes, have exhumed mid-crustal rocks to the surface. This provides an outstanding opportunity to study how the mid-crust behaves during crustal extension.

The goal of my research is to study the tectonic exhumation of the Harcuvar metamorphic core complex of western Arizona by examining the thermal evolution of rocks in the region as they were brought to the surface by faulting. By conducting U-Pb dating of the mineral titanite, it will be possible to constrain when the rocks cooled below 650°C. I will also be employing \(^{40}\text{Ar}/^{39}\text{Ar}\) thermochronology of hornblende and biotite in order to better understand the cooling history of the region between 500°C and 350°C. When combined these analyses will help in understanding the magnitude of exhumation the area experienced as it was brought from deep to mid-crustal levels.

Titanite grains in the samples were identified in thin section samples using optical and scanning electron microscopy. U-Pb geochronology of the titanite was conducted \textit{in-situ} within the thin sections by laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS). Preliminary results suggest that most titanite ages vary between 65–75 Ma, although the cores of some grains yielded 150–160 Ma ages. These results suggest two thermal events, one in the Jurassic and the other in the Late Cretaceous. Preliminary \(^{40}\text{Ar}/^{39}\text{Ar}\) thermochronologic results indicate that hornblende ages range from 45-65 Ma, suggesting that the entire core complex cooled from >650°C to <500°C during the Late Cretaceous to early Tertiary. Additional \textit{Ar}/\textit{Ar} thermochronology is in progress. When combined with existing thermochronological data, these new results should produce a more accurate history of the metamorphism and exhumation experienced by the Harcuvar core complex.

Research Fellow: Salvatore Curasi (2015)  
Concentration(s): Political Science; Geography

Faculty Mentor: Michael Loranty  
Department: Geography

Title of Project: Effects of Landscape Position on Carbon Cycling in Siberian Arctic Tundra

Project Summary:

This past July, with the help of funding awarded by Colgate University, I traveled to the Northeast Science Station located in northeastern Siberia as a member of the Polaris Project along with other students and faculty representing a diverse array of institutions. This was the culmination of the work I had done prior to this both in the lab and preparing by reading literature and familiarizing myself with the environment. From there we traveled north to the arctic tundra located along the banks of the Kolyma River. The Polaris Project is a National Science Foundation-funded project that aims to engage undergraduate students in scientific research in the Siberian arctic, increase public awareness about the specifics of climate change, and engage and educate the coming generation of scientists. In Siberia I both assisted with research being carried out by professors and graduate students and developed and carried out my own research project. The work I did for other scientists expanded my knowledge base and introduced me to many scientific techniques which I was either unfamiliar with or had read about previously but never seen carried out in the field. The opportunity to develop my own research project allowed me to engage with the work of other scientists in my field and apply what I’ve learned to carry out original research as well as surmount the hurdles associated with organizing, developing and carrying out a project in a limited period of time with limited resources.

The project, which I went on to develop and research with the help of group leaders and my peers, investigated permafrost and carbon cycling in the tundra ecosystem. Permafrost is soil that is frozen year round —although some seasonal thawing occurs in the upper active layer within inches of the surface. This frozen soil has locked within it vast amounts of carbon in the form of un-decomposed plant matter. Decomposition of this plant matter as well as the addition of carbon to these soils by vegetation —carbon uptake— is important because shifts in climatic conditions are thawing permafrost and altering carbon uptake in ways that will impact global climate. Within arctic ecosystems variation in slope and topography lead to flows of water beneath the soil surface that increase ecosystem moisture and nutrient availability in certain areas. Consequently, such differences in landscape position often alter the dominate vegetation type, increase vegetation productivity, and more generally alter carbon cycling, relative to adjacent upland areas. Such differences will likely result in altered ecosystem responses to continued climate change. Understanding this variability in ecosystem function will be necessary in order to accurately understand the future of the arctic carbon cycle. The objective of the study was to characterize differences in biological and environmental conditions associated with landscape position in Siberian arctic tundra, and to understand how these differences impact carbon cycling.

To quantify the impact of landscape position on tundra ecosystem carbon cycling, pairs of plots were selected in upland and low lying landscape positions with high and low shrub density. The uptake and respiration of CO2 by this vegetation was quantified using a gas analyzer to measure the change in the concentration of CO2 in a clear chamber placed over the vegetation. The permafrost thaw depth, soil moisture, soil temperature, and meteorological conditions were measured. These variables were compared relative to shrub density and landscape position in order to determine differences in gross primary productivity and ecosystem respiration associated with vegetation type and landscape position. Low-lying wet areas were more productive than adjacent upland areas, irrespective of vegetation type. Shallower permafrost thaw depth, lower soil temperature, greater soil moisture, and higher ecosystem respiration was observed in the low-lying plots. The observation of higher ecosystem respiration despite lower permafrost thaw depths and soil temperatures in the low-lying areas highlights the challenges associated with understanding the arctic carbon cycle under changing biological and environmental conditions. Our results could be combined with data on variability in ecosystem type associated with landscape position across the arctic environment to better understand and model spatial variability in ecosystem scale carbon cycle dynamics.

Source of Support:  
☐ HUMAN Div.  ☑ NASC Div.  ☑ SOGC Div.  ☑ UNST Div.  
☐ Other (specify):
Research Fellow(s): Chelsea Dale (2015) Concentration: Psychology
Victoria Fontana (2015) Concentration(s): Psychology; REST

Faculty Mentor: Julia Martinez Department: Psychology

Title of Project(s): Project #1: “The impact of standard nutrition labels on alcoholic beverages.”
Project #2: “What's your vice?: A combined approach to drugs and other addictive substances and activities.”

Project Summary:

This summer, we worked on two projects. We came under a faculty-initiated project that looked at whether or not nutrition labels would be a good addition to alcoholic beverages. We recruited and consented participants in two forums: at a local coffee shop, and on Amazon’s Mechanical Turk (an online community of individuals who participate in surveys). After that, we learned a lot about data management and analysis. We used both SPSS and SAS statistical packages in our analyses. We then looked at some of the additional data and used it to write up a second project (below). We are both interested in applying to graduate school, and are excited that the two abstracts below are part of manuscripts to be submitted to peer-reviewed journals.

Project #1 Abstract:
The question of whether or not to mandate nutrition labels on alcoholic beverages is a topic of controversy in the U.S., though there is a dearth of empirical work to inform the debate. We examined the effect of nutrition labels on (1) individuals’ plans for alcohol consumption and (2) their alcohol-related beliefs. Study 1 was an experiment in which n=80 underage college student drinkers responded to an image of a beer with either: an accompanying nutrition label or without. Study 2 was an extended experiment in which n=98 community drinkers responded to one of four different types of information (i.e., an accurate label, no label, a label showing greatly enhanced vitamin C, a label showing greatly decreased calories) on the beer image. Study 3 advanced these experiments by surveying n=197 (online) community drinkers who compared the types of information across five items (i.e., beer, wine, vodka, soda, and a slice of pizza). Across the three studies, labels appeared to neither decrease—nor increase—individuals’ explicit plans and beliefs. However, a majority (84.7% to 86.6%) preferred having information to none. Though participants generally wrote that they did not think nutrition labels would affect their drinking, they also largely preferred low-calorie-labeled alcohol. The meaning and implications of this may be important for those undergoing decisional balance. Asking individuals’ opinion on this debate may open some doors to clinically-relevant thought. Although malnutrition is generally associated with extreme alcoholism, a nutrition-related approach may offer fruitful directions.

Project #2 Abstract:
A person's use of addictive substances is generally approached one drug at a time. However, individuals readily report use of many drugs, and interestingly, individuals may also discuss addictive substances or activities (e.g., sweets, sex, gambling, computer use or shopping; ASAs) as problematic. To better understand a possible continuum of severity in addictive behavior, we took a combined approach, asking n=312 individuals to report their “choice” or desired drugs and ASAs, which we termed their “vices,” in a single assessment. Findings showed that individuals readily reported having “vices;” indeed, individuals desired an average of 7.10 (SD=2.67) “vices.” Furthermore, a combined approach yielded adequate inter-item reliability ($\alpha=.77$). Combined drug and ASA assessments may engage and encourage resistant patients to generally think about addictive behaviors, and this may similarly be the case for groups that are being targeted for intervention. Also, the combined approach may direct future investigation into shared addiction processes.

□ Other (specify):
Titile of Project: Factors Affecting the Distribution of Earthworm Species in New York State

Project Summary:

Since glaciation retreats in the Pleistocene era, earthworm species native to North America have been slowly recolonizing forest floors in the northern United States. These forests are also occupied by exotic earthworm species that were introduced from Europe and Asia in recent history. Various ecological implications of earthworm community structure are not well known, such as competition between earthworm species and effects of earthworm community structure on the forest floor. The community structure and dispersal of earthworms in an area are of high importance because earthworms are able to alter major forest ecosystem processes such as soil structure and chemistry, soil invertebrate diversity, and plant nutrient uptake.

To better understand the community structure and biodiversity effects of earthworms in New York state, we sampled over 15 sites in order to bring the total number of sites sampled in Madison County in past summers to 80. Earthworms were collected using mustard extraction techniques and were identified to the species level. To examine effects of earthworm community and distribution on forest floor biota, leaf litter invertebrates from each site were also collected via extraction through Berlese funnels and were identified to the order level. Factors that could affect earthworm dispersal and survival at sites were also measured, including soil pH, slope, elevation, and distance to roads, streams, and clearings.

Collection results have shown that the vast majority of earthworms present throughout Madison County and other parts of upstate New York are indeed native species to Europe, exotic species to North America. These earthworms mostly consisted of the genus Lumbricus, Dendrobaena, Aporrectodea, and Octolasion. There was also one individual of the Asian genus Amynthas collected in the yard of one of our research fellows. Our analysis of soil composition suggests that earthworms are able to inhabit soils with a wide range pH, with the exception of the most acidic or alkaline of soils in upstate New York. Both leaf litter mass and invertebrate biodiversity were high in areas with low earthworm populations, and conversely, low leaf litter mass and invertebrate biodiversity correlated with a high earthworm population. Environmental and biogeographic factors play a role in shaping the distribution patterns of earthworm species throughout New York state, and suggests that high tolerance of these native factors have led to the invasive progression of exotic species. Earthworms also play a significant role in community structures of the forest ecosystem, and are able to determine the most fundamental characteristics of a particular plot of land.
Research Fellow: Jennifer “Jenn” Dias (2016)  
Concentration(s): Biology; Spanish  
Faculty Mentor: Julie Dudrick  
Department: Upstate Institute  
Title of Project: Upstate Institute Summer Field School  

Project Summary:

Madison County experienced devastating flooding in June 2013, which severely damaged over 150 homes in the City of Oneida. The damage put a significant strain on community organizations in the city. Many organizations readily responded to the demands presented, providing significant information to those affected by the incident. However, it was unknown to what degree, and how the necessary information was received and acted on by residents. I was tasked with a community engagement project that sought to enhance the understanding of community structures, networks, and relationships in order to identify organizations that functioned as informed influencers within the community. The project also sought to help improve planning and risk communication strategies for the Madison County Department of Health in future emergencies by engaging community partners and residents involved in the flood.

A key component of the project was its development and implementation. With the oversight and sponsorship of the MCDOH, I developed a timeline, identifying key tasks and activities. I began by conducting research on background information using the Oneida Daily Dispatch and other news sources. After gaining an overall understanding of the event, informant interviews were selected as the primary method to engage participants. Organizations heavily involved in the flood were contacted, including the Karing Kitchen, the Red Cross, and the Church on the Rock. After contacting the organizations, I scheduled interviews with key leaders within each listed organization. I conducted interviews at the MCDOH or the organization’s central location. I also worked through these existing organizations to reach her desired population.

I then developed a 37-question survey tool and attempted to reach out to flood survivors through the Karing Kitchen, Red Cross, Church on the Rock, and St. Patrick’s Food Pantry. The survey tool was used consistently throughout each interview, which lasted for about 15-30 minutes. I also sought to further engage community members using an anonymous 4-question survey using circular adhesives. This survey was conducted at the Oneida Library, the Oneida Farmer’s Market, and the Church on the Rock. Each individual was given 2-3 adhesives to answer two questions on poster paper. The remaining questions were filled out on a piece of paper.

The intern also attended other community events and had the opportunity to engage with community members at these events. Similarly, the intern took and collected photographs related to the flood event. The project was finalized with a summary report.

Source of Support: 

- [ ] HUMN Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [X] Other (specify): Upstate Institute
Acropora cervicornis (Staghorn Coral) and Acropora palmata (Elkhorn Coral) have been important reef builders for at least the last few thousand years. In recent decades, however, the number of healthy acroporid populations has been drastically declining in the Caribbean and Atlantic. Proposed causes include disease, climate change (warmer oceans, severe storms, etc.), and an imbalance in species present on the reef (such as algae, which compete for space with corals). There is some hope of a rebound in coral health based on observations at Coral Garden, Belize, but it is unclear what is driving this healthy reef ecosystem.

Within the last thirty to forty years, a third species of Acropora has appeared in the Caribbean. It is called Acropora prolifera and is strongly believed to be a hybrid of A. cervicornis and A. palmata. There is debate, however, about whether this hybrid represents a genuinely new species, or if it has simply not been identified in the fossil record yet. As my contribution to the overall Belize research project, I investigated the preservation potential of A. prolifera. How likely a coral skeleton is to be preserved in the fossil record is influenced by several factors. Bioerosion, wave strength, skeleton strength and density, surface area to volume, and chemical composition are all important considerations. During the summer samples of A. prolifera were collected over approximately two weeks in various locations around Ambergris Cay, Belize, with a focus on Coral Gardens. Analysis using a scanning electron microscope, photogrammetry, laser scanners and three dimensional models, and stereomicroscopes was then done for the remainder of summer. The project will continue through the 2014-2015 academic year, with a final paper and a poster produced for the Keck Consortium conference in April 2015.
Project Summary:

I worked on two different projects this summer which were both focused on a metal complex. In my first project, I worked with Manganese complexes and in the second, I worked with Platinum complexes. In the Manganese project, I was trying to map the reaction for this manganese complex to bond with a chlorite compound. This research would lead to the removal of these chlorite compounds from contaminated water. I built these models on a computer program called Gaussian. I would then take these models, change them to code, and submit them to a server that ran calculations to optimize the geometry of the models and calculate various energies associated with each step in the reaction. For the second project, I did the same work as for the manganese complex, but with O2 insertion on a Platinum complex. This second project was more for learning purposes and to find the transition states between the reactants, intermediates, and products.

For my project, I made many different models of the Manganese complex. There are different variations of the complexes depending on how the electrons are placed in the orbital. My job was to figure out the lowest possible energy pathway for this reaction to occur. There were many different pathways, however, only one was more plausible than the others. After I built these various models, I submitted them to a server, called Kabuki, which ran these calculations to find the energies associated with different models. I found frequency calculations, stability calculation, and solvation calculations for each species. I stopped my work on this project before finding the transition states and then switched to the second project, O2 insertion on Platinum complexes. This project was similar to the first, but with different species. This project was more for learning purposes and to become familiar with electronic structures, bonding, and other areas of chemistry that I have not had coursework for yet. I optimized the geometries on each species and found the frequency calculations for each step. For this project, I also stopped before finding the transition states since this step was very complicated and I have not taken the appropriate courses for this work. Below are some the reaction pathways that were being tested.

As a freshman who has only taken two semesters of general chemistry as part of my biochemistry major, this was a great opportunity for me to learn new things that were not taught during my first two semesters at Colgate. In order to do my work, I had to learn about some Organic Chemistry topics, and higher level chemistry topics dealing with electrons and the bonding of molecular orbitals. Reaction mechanisms played a significant role in my research, and the specifics of those mechanisms are topics covered in Organic Chemistry, a course I will be taking in the Fall of 2014. Seeing these topics even before I learned about them has given me a better understanding for how reactions take place, the different possible pathways that reactions can take, and how to find some of the energies associated with each step in the pathways. The metal complexes themselves are topics discussed in Inorganic Chemistry, which I hope to take in the Spring of 2015. This was a great experience for me.

□ Other (Specify):
Approximately a billion years ago North America was part of a long-lived supercontinent known as Rodinia. Rocks of this age in the United States and Canada are part of the Grenville Province, which extends from Labrador, Canada to Southern Mexico. One of the rocks associated with the Grenville Province is known as anorthosite, which makes up the entire high peaks region of the Adirondack Mountains. Anorthosite is defined as being composed of at least 90% plagioclase, but within the anorthosite pyroxene megacrysts also occur, and are of contested origin. My research this summer started with about ten days of fieldwork in the Adirondacks examining these megacrysts and their chemistry using a field spectrometer. Now, I am testing these megacrysts for their elemental compositions using laboratory techniques, and looking specifically for trends in Aluminum content.

Aluminum content in pyroxenes can be used as a barometer, and can tell us at which pressure the pyroxenes were formed. If we see a continuous trend in the Aluminum content, it might point towards the megacrysts forming slowly as the pluton moved towards the surface, because, in this case, they would be forming in constantly changing pressure as they rose through the Earth’s crust. Another possibility is that the Aluminum contents will be somewhat consistent, which points to the megacrysts being all formed at a lower depth, and then being trapped in the molten rocks that make up the anorthosite rocks in their deep-crustal source region.
Project Summary:

This research was conducted for an entry of the Oxford Research Encyclopedia in American History about the woman's rights movement. It concentrated on the woman's rights movement from the 1820s-1870s, as well as the relationship between this and other reform movements from the same time period, such as abolitionism or temperance. The encyclopedia entry would also need to include details about other works done on the same topic, so that the reader would understand what about the subject was being discussed in the historian community. Furthermore, it would need a ‘top ten’ list of books and articles that would be the best sources for those who wanted more information. For the most part, my faculty mentor asked me to read a lot about the topic from a variety of sources, to help her to generate a list of relevant articles and books, suggest works for the ‘top ten’ list, and to remind her of what kinds of works were out there, as well to generate my own opinions and thoughts about what was relevant to her work and what was not.

For the first few weeks of my research, I started out by acquainting myself with the topic, and then searching for reviews of books and articles that were relevant to the topic, and might be included in the article. I then organized those reviews, by reform movement and general theme, such as the origin of the woman’s rights movement, or the feminist rhetoric of the woman’s rights leaders. From there, I looked at the works of well-known historians who specialize in this subject, in an attempt to look for books or articles that could work for the ‘top ten’ list. To find these works, I used the direction of my faculty mentor, as well as a number of search term combinations on relevant online article/journal databases.

The next stage of the research began with identifying biographies that could be relevant to the encyclopedia entry, written about the major players in the woman’s rights movement, from its inception to its split in the 1870s. These biographies included those about the well-known activists like Susan B. Anthony and Sojourner Truth, as well as those of lesser fame, such as Angelina and Sarah Grimké. My faculty mentor asked me to read a few of the biographies found, and to decide if any of them could contribute to her encyclopedia entry or even work for the ‘top ten’ list. She then requested that I read as many of the works as possible of a prominent feminism historian, Ellen DuBois, in order to gage what central themes and ideas were shown in DuBois’s work, and if it could be relevant to the project. After reviewing a large amount of DuBois’s work, I found that most of her central themes and conclusions about feminism in the 19th century were very relevant to my faculty mentor’s research.

The research work that I did for Professor Dudden resulted in a number of lists of possible books and articles that could be used to describe how and what historians discuss while researching this topic, a few options that could make the ‘top ten’ list, and, most importantly, the formulating of my own opinions on various works and ideas about the topic so as to actually discuss ideas for and about the project with my Professor. As she would frequently request my own opinions about what I was reading and its relevance to the project, this was especially important.
Title of Project: Ginsberg and Surrealism: A study of Ginsberg’s appropriation of Surrealism and Surrealist techniques

Project Summary:

Although the writers of the Beat generation considered themselves a part of the international avant-garde, it wasn’t until recently that scholars began to study the Beat writers in a transnational context. The Franco-American cultural exchanges were particularly significant to the evolution of the Beats in the post war period. While scholars frequently identify the fact that French Surrealism had an impact on American Beat writers, the dynamics and complexities of that cultural exchange remain unexplored. I researched and studied the cross-cultural exchanges between the French Surrealist writers and the American Beat writers in order to identify the extent to which the Surrealists impact the Beats.

My research focused on the ways in which Bretonian Surrealism originated, spread, and then ultimately was appropriated in the United States. Throughout the 1930s artists, writers, and intellectuals in the United States were inundated with Surrealist practice, technique, and thought; however, Surrealism as it was defined in France in the earlier part of the 20th century changed dramatically in the hands of Americans. The Americanization of Surrealism gave rise to both the method of plastic automatism an aesthetic now known as social surrealism. Social surrealists denied the autonomy of both the unconscious and of psychic processes, and instead produced art that articulated the American social landscape through surrealist techniques. The method of plastic automatism was created out of American artists’ interaction with Breton’s method of psychic automatism. Plastic automatism functions as a process that in of itself generates meaning, whereas Breton’s psychic automatism functioned as a process meant to reveal the contents of one’s unconscious.

I then studied the ways in which the American appropriations of French Surrealist technique, social surrealism and psychic automatism were applied by the Beat poet, Allen Ginsberg. Allen Ginsberg spent a period of time in France, and dedicated his poem, “Howl,” to Carl Solomon, an American writer who taught Ginsberg about French surrealist writers and intellectuals. I primarily studied Ginsberg’s poem, “Howl,” and explored the ways in which Ginsberg employed American adaptations of French Surrealist technique and thought through his poem.

As a French and English major my research project provided me with a means to integrate my two majors into a comparative literature project. I have always been deeply interested in both French and English literature, particularly French and English poetry, and the transnational literary influence. The relationship between the Surrealists and American Beats is particularly interesting, because the nuances of the relationship have only begun to be delineated.

☒ Other (specify): J. Curtiss Taylor ’54 Endowed Student Research Fund
Title of Project: Current and Changing Biodiversity on the Bayside of Fire Island

Project Summary:

In 2012, Hurricane Sandy brought wind, waves, and never-before-seen storm surge to New York’s barrier islands. Fire Island was said to shift landward by 20m due to sand erosion, loss of dunes, and rollover. Bayside salt marshes allowed that rollover to occur, but were also hit hard in the process. When the hurricane landed, nearly all species of fish, macroinvertebrates, and birds that dwell in the marsh already exhibited low abundance in comparison to those on the beach side. Fortunately, the majority of these marshes lay in Federal Wilderness Area, east of the island’s 7km occupied by residential communities. Throughout the summer, I learned about this island and its various inhabitants via extensive research and a short trip to the island itself. Examining Fire Island’s biodiversity from both scientific and human perspectives, I was able to explore the current and future state(s) of its vulnerable bay shore.

The bay side of the barrier islands is often overlooked by the more beloved yet less diverse ocean beaches, but in truth the biggest impact of storms and sea level rise (SLR) is the submergence of flat, low-lying areas in the bay. Salt marshes are the bogs of marine environments – they lay both above and below sea level and are able to transform back into land or sea depending on the movement of the island. Storm surge like that of Sandy’s is what causes quick and unpredictable rollover, an effect often mistakenly thought to occur slowly over time. As the battered island moves landward toward Long Island, it is the salt marshes within the bay that “catch its fall” and allow recovery to ensue, therefore their presence is incredibly important to the long-term health of the island. This movement, however, causes marine habitats and species on the bayside to depress, often severely as has been seen in populations of shellfish whose filtering ability mitigates the potential effects of harmful algal blooms. In 2007, the condition of salt marshes on Fire Island was reported as good, “among the best examples of salt marsh in NY State” according to the NY Natural Heritage Biotics Database and supported rare species including the salt marsh sharptailed sparrow. Their present condition is more difficult to assess, but their importance is crucial.

My visit to Fire Island was focused on hearing about biological concerns of the residential communities, primarily because the short length of my trip and the lack of on-island transportation made it difficult to explore its other sections, including the eastern Wilderness Area. I was surprised to learn from these residents that white-tailed deer, which had been mentioned very sparsely in my research, were spoken of most. I learned quickly that, though the deer were abundant (indeed, I spotted one at nearly every sidewalk corner) and had spread ticks that were now causing an outbreak of Lyme disease, they were also being “preyed on” by police vehicles and local bikers. Signs on the island said little of salt marshes or vulnerable birds and plenty on efforts to protect these deer, 22 of which had been found dead by cars in 2013. This astounded me, and not only because cars were illegal on the island. The deer were thriving, perhaps even too much, and were being both fed and tracked by researchers during the time I spent on the island. The salt marshes, on the other hand, were being given little attention and even less support.

Because my trip expanded my research lens in the last two weeks of my funded research time, I would very much like to continue this project in the future of my Colgate career. I believe that the bayside of Fire Island is most at risk to future storms and SLR, and requires more protection and research than it is currently being given. If researchers like myself could compile a qualitative comparison of barrier island salt marshes along the Atlantic Coast, the Fire Island marsh systems could be better understood and the island’s residents could be better educated on this important part of their home.

□ Other (specify):
Research Fellow: Federico Elizondo (2017)  
Concentration: Undeclared

Faculty Mentor: Julia Martinez  
Department: Psychology

Title of Project: Drinking Strategies Among College Students

Project Summary:

**Background:** Young adults are at risk for heavy alcohol use, particularly college students. Problematically, students may continue to drink heavily despite experiencing a number of negative alcohol-related experiences, making heavy drinking a public health concern. It is possible that students continue to drink despite negative consequences because it is being approached as a “skill” to master, or to gain success with (requiring practice and experience). Thus, we asked a number of students and community members to open-endedly report how they approach—and think about—drinking in an exploratory analysis.

**Methods:** College students from a small private university as well as non-university community members ($n=232$) were asked to answer open-ended questions about what they considered a successful/good night of drinking to be (e.g., “In your opinion, what are the elements that make up a good or successful night of drinking?” and “What do you think makes you successful or unsuccessful as a drinker?”). Part of the work this summer was to consider how to examine individuals’ responses for their content. For example, we examined how frequently individuals said that implementing Protective Behavioral Strategies (PBS; e.g., using a designated driver; Martens, et al., 2005) was what made them a successful drinker (note that most people, when categorically asked whether they considered themselves to be successful drinkers, wrote that they did). We also examined other interesting themes and the usage of particular common words (i.e., “control” and [know my] “limits”).

**Results & Conclusions:** A number of interesting responses emerged. For example, one individual, among others wrote that they set themselves up for a good night of drinking by: “… having a solid dinner but eating it early enough that you aren’t full by the time you start drinking.” Such responses can be seen as a limitation to the concept of Protective Behavioral Strategies as in this case it is being used as a possible deceptive means to enable heavy drinking to intoxication (rather than drinking in moderation). Thus future research may focus on young adults’ motives behind using a set of strategies for drinking. The next step in this research is to see how individuals’ responses associate to their self-reported consequences and whether a person’s definition of “successful” drinking has public health-related implications and utility. Understanding how individuals approach drinking may assist in formulating interventions to address risky drinking behaviors.

**Personal/Professional Gains:** This summer, as a research assistant, I learned more than what I would have ever expected: valuable real-world skills that are practically impossible to learn in a classroom setting. I learned the proper skills and work ethic necessary for a collaborative working environment (e.g. thinking for myself, asking the right questions, taking responsibility for my work, respecting authority, checking-in with supervisor and coworkers, etc.). Specifically, I became familiar with reading and interpreting data tables, charts, and figures. I was able to read fifteen to twenty journal articles within a week, and I was able to discuss the main findings, limitations, and applications of scholarly articles. Personally, I learned that one must be able to adapt to any given situation in order to be an effective worker.

**Source of Support:**  
☐ HUMN Div.  ☒ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Science and Math Initiative (SMI)
Project Summary:

This past summer I worked as the Student Paralegal for the Consumer Bankruptcy Law Project (CBLP) at Legal Aid Society of Mid-New York (LASMNY). The CBLP is a partnership between LASMNY and Colgate University that seeks to increase the number of eligible clients who are able to obtain a financial fresh start through bankruptcy by recruiting student volunteers from Colgate. The students attend classes on ethics, public benefits and how to file for bankruptcy taught by Susan Conn, the project attorney who supervises the CBLP. Upon satisfactory completion of a hypothetical case, the students (usually in pairs) are assigned a real client’s case. Preparing for a bankruptcy means sifting through bills, paystubs and property lists in order to gain an understanding of the client’s situation. The students then prepare various bankruptcy forms and a one page memo summarizing the context in which the client is filing for bankruptcy. All of this information helps the project attorney recruit other attorneys to handle bankruptcy cases pro bono because the most time-consuming and tedious part of the case has been prepared and organized for them.

I spent my early weeks reviewing and correcting the cases that were prepared by students during the previous semester. Some students make simple mistakes, while others make mistakes because they simply don’t have much experience with bankruptcies and have missed something. Some get overwhelmed with school work and end up returning incomplete cases, while others haven’t been able to complete their case because the client failed to provide some requisite information. I spent my time reviewing the students’ work, looking for errors, making sure that all the client’s property has been listed, all their expenses and income have been properly accounted for and that each debt is listed in the correct place. I made phone calls to clients to obtain missing information, and I completed incomplete cases and wrote the summarizing memo for each case. Then, once Susan had found a pro bono attorney willing to take on a completed case, I would draft a cover letter for the attorney that outlined what documents we were sending to them and who the client is. I organized each case file and made sure that the pro bono attorney received a copy of all relevant documents, and that LASMNY retained a copy as well. After all that, the case would finally go to an attorney for filing.

I also put my computer science background to use and worked with the Director of IT at LASMNY to update all the CBLP laptops with the firm’s newest version of the FastCase bankruptcy software, which the students use to generate the bankruptcy paperwork for each case. While this might sound fairly straightforward, it wasn’t. In typical computer fashion, one update required another before the first could be done. In this case we had to update the operating system of each laptop before we could install the new bankruptcy software. I worked on a number of other things this summer as well. I updated and revised the CBLP website for Susan and helped other attorneys with cases from unemployment benefits hearings to mortgage modifications. Working at LASMNY this summer gave me an excellent opportunity to see how the legal process really works, how vastly wide the field is, and how desperately needed organizations like LASMNY are.

Title of Project: The Effect of Grignard Reagents on the Formation of Bipyrrrole Systems

Project Summary:

Bipyrrrole is an organic compound with two five-membered rings, each with four carbon atoms and one nitrogen atom. Bipyrrrole is often paired with itself in a variety of rings. The ring system is polar on the inside and can form a bond with an ion. In nature, these ring systems are found as porphyrin in the hemoglobin molecule, a key element in blood. The porphyrin molecule can bond with an iron ion and transport it around the body. The reaction studied in this research project is part of a pathway that leads to a molecule with a similar structure to porphyrin. The focus of this research project was to use computer modeling to understand two additions of a phenyl ketone group to a bipyrrrole ring. In an experimental laboratory, the first addition of this ketone group was observed to be in one place. The second addition, however, does not appear to be in the predicted location on the other pyrrole ring. Resonance theory also predicts a different location for this second addition than what is observed. Computational chemistry was used to try to understand why the observed product is formed. This was done by first making molecular models of the products and reactants in GaussView. The structures from GaussView were optimized using a program called Gaussian 09. Next, the computer program was used to calculate the energies of the optimized molecules. All isomers of the products and reactants were considered. Another aspect of the reaction is that one of the reactants is ethyl magnesium bromide, which can act as a Grignard reagent. Some literature suggests that the magnesium bromide can bond with the pyrrole rings, replacing the hydrogen atom on the nitrogen. Isomers with this substitution were also considered. After all of the energy calculations were completed, the data confirms the laboratory observations about an addition in a different place. However, this is only true in the presence of the magnesium bromide Grignard reagent. The presence of the magnesium bromide seems to have a directing effect on the addition of the phenyl ketone group.

<table>
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<tr>
<th>Symmetrical Addition</th>
<th>Predicted by Resonance theory</th>
<th>Observed Product</th>
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The research project also looked into the transition states of the reaction. Energy calculations were performed on the transition states to determine which product was the kinetic product and which product was the thermodynamic product. Initial calculations suggest that the observed product has a lower energy and a lower energy transition state energy than the predicted product, but only in the presence of magnesium bromide. Further steps in this research include modeling the NMR for the final product, to see if it matches the NMR spectrum obtained in the laboratory. The energy data so far show that the first addition should occur at a different location from what is observed, in the presence of magnesium bromide. Further analysis must be done to fully understand the mechanism for both additions in this reaction. So far, this research project has provided insight into how a Grignard reagent can have directing effects in the bipyrrrole system.
Title of Project: Investigation of a One-Flask Synthesis of an N-Confused Porphyrin Bearing Pentafluorophenyl Substituents

Project Summary:

Porphyrinic macrocycles with altered core structures are of interest. Structural alterations of particular note include a direct bipyrrrole linkage, the number of core NH groups, and the location of the nitrogen atoms. Among a variety of porphyrinoids, porphyrin, corrole, and N-confused porphyrin are of current interest to our research group. To study these compounds, convenient methodology for their preparation is needed. Recently, we have been exploring a one-flask synthesis of an N-confused porphyrin (NCP) bearing pentafluorophenyl substituents. This is an interesting synthesis to investigate as reaction conditions that afford tetraphenyl NCP in a yield of 39% were reported to work poorly (yield of <0.1%) when applied to the preparation of the pentafluorophenyl substituted N-confused porphyrin (C₆F₅-NCP).

\[
\begin{align*}
&\text{Pyrrole} + \text{C₆F₅-benzaldehyde} \\
&\text{1. acid} \quad \rightarrow \quad \text{C₆F₅-NCP} \\
&\text{2. DDQ} \\
&\text{Porphyrin} + \text{Corrole}
\end{align*}
\]

Previously, a sample of C₆F₅-NCP was prepared and used to develop an HPLC method for monitoring analytical-scale reactions. Initial analytical-scale reactions were also performed (Tori Kensy ’14). This summer, we performed an expanded investigation of the one-flask synthesis of C₆F₅-NCP using five different acid catalysts. We began with control experiments to confirm our group’s previous findings as well as to refine our experimental methodology. Next, we checked HPLC detector response calibrations for C₆F₅-NCP, porphyrin, and corrole, and found the response factors to be largely unchanged from prior measurements. Porphyrin and corrole were included in this study in addition to C₆F₅-NCP to provide broader insights into the effect of reaction parameters on the product distribution. For each of the acid catalysts surveyed, acid concentration, oxidant quantity, and reaction time were examined. Reaction conditions were identified that afford C₆F₅-NCP in a yield of ~10%. This is a substantial improvement over the published attempt at the one-flask synthesis of C₆F₅-NCP, and provides encouragement for the further study of this reaction.

Title of Project: Using Thermocouples to Measure Home Insulation

Project Summary:

Up to 20% of all US energy use goes into the heating and cooling of residential and commercial buildings. However, without an accurate understanding of how well their insulation is currently performing, home- and business-owners are unable to make energy-efficient decisions and improvements. One measure of this performance is known as the R-Value, or Thermal Resistance, of the insulation and wall. Currently, there is no tool for measuring this value; estimation from a contracted expert is the only option available. However, one way to measure this value is through a relationship between relative temperatures around the wall. Made from two insulated wires of different metals, thermocouples produce a small yet measurable voltage that is proportional to the difference in temperature between junctions at each end. Because the R-value is proportional to a temperature difference (not an absolute temperature), thermocouples are a perfect tool for this measurement.

Because output signals from the thermocouples are on the order of 10μV scale, accurate detection requires costly and sensitive equipment. Also, the temperature inside and outside the measured surface are in constant fluctuation, so data must be collected for extended periods of time in order to accurately characterize the conditions. The solution, devised by previous research students, was to amplify the thermocouple signal and feed it to an Arduino UNO microprocessor for storage on a micro-SD card. As these are very minute signals, accuracy is a huge concern. Previous attempts to amplify the thermocouple signal were unsuccessful, so the first half of the summer was devoted to developing an accurate and reliable amplification circuit which would boost the voltage of the signal to the Arduino’s input range. (See the circuit diagram below.)

This summer also allowed for some great hands on experience in product design, machining, assembly, and coding. Once a reliable circuit was developed, I set to work on building four prototype units for use this fall in data collection and further development. With the hardware completed, I dove into learning and writing the derivative of C-based coding used for the Arduino’s processor. With some adjustments to the existing software written for the project, the unit inputs the analog signals from the amplifiers and converts them to digital strings. The Arduino then averages readings every minute and stores a data point in a .txt file on the SD card. An LCD screen on the front panel also provides real-time readings of second-by-second data collection for each of the three thermocouple input ports on the unit.

With the units complete and ready for use in the fall, work began on the next phase of the project: a smartphone-driven system for a more consumer-oriented device. Expanding on the C-based language used for the Arduino, I began learning Objective-C, which is the language used in iOS development. Beyond the App, the project would need an effective method for getting the thermocouple signal into the iPhone itself. The most plausible and cost-effective method seems to be through the combined audio/microphone headphone jack. Many open-source projects have launched to use this as a method to input data to the iPhone, but this application requires both voltage to frequency conversion and signal modulation in order for the software to break apart meaningful data from the incoming signal. Beyond development of signal conversion and temperature measurement to accurately determine insulation R-values from existing project units, this consumer-oriented project is the future direction of this research as a whole, with eventual hopes of commercial implementation.

Nuclear transport is essential for eukaryotic cell viability. All of a eukaryotic cell’s genetic information is located in its nucleus; however, proteins are synthesized in the cytoplasm. Therefore, materials such as RNA and proteins functioning in the nucleus such as transcription factors must have a way to translocate between the cytoplasm and nucleus in order for the cell to survive. The nuclear envelope (NE) defines the border of the nucleus and is structured as a parallel lipid bilayer containing thousands of circular pores. These pores house a complex of ~30 different proteins, which array in 8-fold symmetry to assemble a complex with approximately 600 total proteins known as the nuclear pore complex, or NPC. NPCs are significant because they are the sole space through which the movement of molecules can occur. Furthermore, they serve to regulate the transport of large macromolecules by interactions of their proteins, known as nucleoporins (Nups), with various transport factors carrying cargo in and out of the nucleus. General NPC structure is known to be conserved among all eukaryotic organisms, making it easily accessible for studies with human implications in model organisms such as S. cerevisiae (baker’s yeast). Nuclear transport is relevant in biological research because improper regulation of nuclear transport has known links with tumorigenesis in cancers such as gliomas, osteosarcomas, and leukemias as well as nearly all viral diseases.

This project focuses on investigating the function and structure of one particular Nup known as pore membrane protein (Pom152). Pom152 has previously been characterized as a type II transmembrane protein, with its N- and C- termini located in the NPC and lumen of the NE, respectively. This protein was of interest because cells lacking Pom152 are viable, though further research has shown a potential role for Pom152 in NPC biogenesis. Specifically, I studied the structure and function of this protein’s lumenal domain, as this domain comprises approximately ¾ of its total amino acid composition, yet has not been looked at directly before in relation to proper NPC functioning.

My approach to investigating Pom152 was two-fold. The first aspect of my research involved using a kinetic assay to study how the rate of nuclear protein export was affected in yeast cells selectively mutated for Pom152 and Pom152 related proteins. Using a fluorescence microscope, I tracked the export of transcription factor Crz1-GFP from the nucleus of both wild-type and mutant cells over the course of 20 minutes. The rate of export of Pom152 mutants compared more favorably to export rate in wild-type cells than to the negative control, suggesting that Pom152 is not essential for the nuclear export of Crz1-GFP. Concluding that Pom152 does not play an essential role in the nuclear export rate, I was interested in learning more about the structure of the Pom152 lumenal domain as a means to further understand its importance in NPC structure and function. In two major steps, each of which included various reactions ranging from PCR to ligations and restriction enzyme digests, I have been able to clone target Pom152 gene regions of interest into E. coli. I am currently in the beginning stages of working to overexpress and purify the protein. The end goal of this multi-step process is to perform X-ray crystallography in order to project structures of the Pom152 lumenal domain.

Research Fellow: Jamie Gagliano (2016)  
Concentration(s): International Relations; ALST

Faculty Mentor: Antonio Barrera  
Department: History

Title of Project: Comets and the Universe: Comparing Scientific Thought across the Early Modern Atlantic World

Project Summary:

The history of science is a field which delves into the historical progression of science, including scientific knowledge. Over the course of the second half of the twentieth century, historians of science have come to approach science as a social process which is influenced by cultural trends, and the flow of ideas. The early modern period, which can be defined as the years 1400-1750 (though there are other equally valid date ranges), is a moment in history which is of particular importance in the history of science. The early modern period began the process of experimental science, and in many ways created the scientific process as we know it today. Historians of early modern Europe often focus on England, France, Germany, and their colonies. One important empire of the early modern period, Spain, is sometimes absent. Historians of science such as Jorge Canizares-Esguerra, Edward Collins, and Antonio Barrera seek to address this lacunae. In 2006, Antonio Barrera published Experiencing Nature, which delves into scientific endeavors of the Iberian world. This summer project is born out of the next book, which will put the science of the Spanish Empire in context with other areas of the Atlantic world, especially England and her colonies.

The focus of this project has been on the comet of 1680 and 1681, which will be the topic of the final chapter of the new book. This comet, which appeared from November 1680 to February 1681, could be seen from Peru, to Boston, and to Western Europe. Many well-known scholars of the time wrote on this mysterious object. Some include Carlos de Sigüenza y Góngora (Mexico), Increase Mather (Boston), Eusebio Kino (Mexico), and Pierre Bayle (France). Each had a unique perspective on the mysterious comet. Some, like Bayle and Góngora, took a rational approach to the object. Others, like Kino and Mather, believed that the comet was an omen from God. Superstitious lore of the time often cited comets as an omen of calamitous events to follow. This project began looking at the texts of these men. Since several of these documents are quite long, and this book is focusing on relationships between ideas and identities, some form of sorting needed to be done. In using the MaxQDA system of coding segments of text, these documents have become interconnected. Certain ideas carry across all of these documents, but not all in the same way. In reading and coding these documents, it becomes possible to study these ideas in a succinct and efficient manner. For instance, many of the authors were concerned with the idea of God and religion, though in very distinct ways. Cotton Mather displayed an intense fear of the wrath of God against the sinful Massachusetts colony and man in general. He believes this is why the comet appeared. Kino also believed that the comet was an omen from God, but he was less concerned with correcting the sins of his peers. Pierre Bayle, on the other hand, went on a long digression about atheists and pagans. However, he did not believe that the comet had anything to do with God punishing human beings. It becomes easier to trace parallels between these texts because of using MaxQDA to code the documents.

This project involved a few smaller side tasks, including bibliography building, and hunting for primary sources. All of these tasks were related to teasing out the relationships between scientists in the English and Iberian worlds. In the early modern period, the works of Spanish-American scholars were often ignored. This is partly due to the small number of texts traveling from the Americas to Europe, but it also has to do with the idea that the Spanish empire was scientifically backward. This simply is not the case, as evidenced by Gongora, Kino, and the works of natural historians such as Francisco Hernandez. The Spanish Empire made significant contributions in several fields of science, and this aspect of the Spanish Empire can no longer be ignored. The goal of this project was to lay the foundation for writing the final chapter of Antonio Barrera's book, and this goal has been achieved.

□ Other (specify):
I worked with the Multicultural Association of Medical/Legal Interpreters (MAMI), a non-profit that provides interpreters to immigrants and refugees in the Utica, Syracuse, and Albany regions. My project had two main goals, which were to help MAMI become closer with the greater community and to help MAMI’s interpreters become closer to MAMI and each other. I interviewed 14 interpreters and 6 community members from 10 different national and ethnic backgrounds with these goals in mind. In my interviews I heard about the needs of different national and cultural groups in the Utica and Syracuse areas, and ways in which interpreters can develop a better relationship with MAMI and their fellow interpreters. Outside of these primary tasks, I also did research for grants, wrote grant essays, and improved MAMI’s online presence.

Several themes emerged from the results of these interviews, including MAMI’s relationship with the community and how MAMI could change its internal operations to benefit its employees and the community. Three community oriented themes emerged as well: community education, cultural barriers and ways to help communities. The theme of community education concerns topics about which the community at large should learn more in order to better serve immigrant and refugee populations. These include teaching about the need for a trained interpreter and about cultural differences. The theme of cultural barriers includes cultural differences that provide challenges for immigrants and refugees, including differences in gender roles and generational differences between children who have assimilated into U.S. culture and their parents. While specific communities have specific needs, the theme of ways to help communities includes needs that many immigrant and refugee communities have, such as translations of paperwork.

The two MAMI internal operations themes are improving interpreter training and improving MAMI management. Interpreter training could be improved in ways such as providing more test preparation for certification exams and having patients evaluate interpreters. MAMI management could improve by having its employees that dispatch interpreters inform interpreters about special cultural circumstances.

Outside of conducting interviews, I performed several other administrative and outreach projects. I helped to research social media techniques for non-profits and develop a grant for MAMI to improve its website and social media. I also helped to write several other grants. Additionally, I helped to improve MAMI’s online presence by developing visuals and infographics for its social media pages.

I hope that with my interviews I helped MAMI better understand the needs of the diverse members of the communities it serves so that it may seek grants in the future to meet those needs. I also hope to see that MAMI expands and improves upon its digital representation using the visuals and grant I helped to create.
Research Fellow: Usman Ghani (2016)  Concentration: Physics
Faculty Mentor: M. Beth Parks  Department: Physics and Astronomy
Title of Project: Thz Spectroscopy

Project Summary:

The object of my research was to improve the capabilities of the measurements obtained through terahertz spectroscopy in the lab. This involved working with a femtosecond laser, motion controllers and a current amplifier. By varying instrument settings and by using different data collection methods, multiple sets of data were collected and compared to check for accuracy. The purpose of this process was to determine sources of noise in the experiment and to find a setting which reduced noise to less than 1% of the signal.

Spectroscopy is a process that helps identify the resonant frequency of substances. These frequencies represent the energy gap between different energy levels in the substance. When the substance is exposed to electromagnetic frequencies, the frequencies corresponding to the energy gaps are absorbed and so are identified. NMRI (Nuclear Magnetic Resonance Imaging) is an example of spectroscopy that is used in our everyday life. Terahertz spectroscopy is used when the resonant frequencies lie between infrared radiation and microwaves in the electromagnetic spectrum. As it involves higher frequencies, the setup used is different than the ones used for frequencies belonging to radio waves.

Terahertz spectroscopy can be used to determine the resonant frequency of materials like carbon nanotubes. It does this by measuring the amplitude of the terahertz pulse that is passed through the material. A Fourier analysis is then performed to determine the frequencies that are absorbed. These absorbed frequencies are the resonant frequencies of the carbon nanotubes.

One of the first tasks I had to perform was to update the computer and motion controller used for the experiment. It involved learning how to use Igor Pro (software) and updating the program used to run the motion controller. Another requirement for the task was a basic understanding of C++. As the motion controller had been replaced, all lines of code concerning with the controller had to be re written. This was also because the new motion controller communicated using the USB port rather than the GPIB port which was used by the old motion controller.

Source of Support:  
- ☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
The summer of 2014 was the first time that Colgate’s Psychology Department’s brand new Electroencephalography (EEG) lab was put to use. EEG is a temporally sensitive neuroimaging technique that is used to measure the electrical signals of brain waves during, notably, visual processing. The human visual system is adept at perceiving scene information (ex: determining if a scene is natural or man-made) at an incredible pace – faster than it takes to blink an eye. Understanding scene category recognition has shed light on understanding the overall processes underlying visual perception. Electrical signals recorded via EEG are analyzed for components that are often considered vital in early visual processing. These components include the C1, N1, and P1. The C1 component was of particular interest to us this summer because not as much is known about it. It occurs between 50-100 ms post stimulus onset time (PSOT) in experiments and is known to change sign depending on the location of the stimulus, becoming negative when the stimulus is presented to the upper visual field and positive when the stimulus is presented to the lower visual field. When stimuli are presented foveally, however, little is known about the C1, and this search for new knowledge spurred our experiment. After a comprehensive examination of the C1, N1, and P1 in previous literature, we designed an experiment and learned about programs (MATLAB, Netstation, & E-Prime) that would allow us to expand upon current C1 literature.

In all, we had two rather similar experiments. In these experiments, participants were instructed to focus their eyes on a fixation point in the center of a brand new high-resolution computer monitor. They were additionally instructed to not move their eyes from this fixation point and to only blink at certain intervals, as blinking and eye movements can contaminate EEG data. The fixation mark was followed by a checkerboard pattern (displayed for 100 ms) in one of eleven locations, and this was followed by a letter (a, b, c, or d) that flashed randomly on the screen. In a random task, participants were instructed to report the correct letter that was flashed by pressing a key on a button box. We collected data from six participants, and before we would analyze the data ourselves, we used NetStation to run a high-pass filter and segment the data. Next, we used MATLAB and its helpful feature, EEGLab, to process the data even more. This included bad channel replacement, artifact rejection, low-pass filtering, rereferencing, baseline correction, and finally grand averaging.

While more experiments will likely be conducted in the future, our initial results show that the C1 component in our ERP recordings occurs at about 60 ms PSOT, with fixation seeming to be the summation of both upper and lower conditions. This is consistent with previous research by Hansen, Johnson, & Ellenberg on the C1 component, in which other components may also be acting during the same temporal and spatial interval as the C1. This data supports the theory that when stimuli are presented in both upper and lower visual fields, the positive and negative components sum to cancel out to create a waveform that shows evidence of multiple components existing at the timeframe for foveal conditions.
Project Summary:

At first glance, lighting with 3D software may seem easy because a user has a multitude of control options. However, the amount of controls which seem helpful at first become very overwhelming when working in an infinite 3D space. As Pellacini et al. put it “placing and configuring lights using 3D software is hard and labour intensive.” This is especially true for amateurs with no lighting experience.

In our summer research project, we worked on trying to make the process of placing lights in 3D software less “hard and labour intensive” by improving the illumination controls of a 3D environment. We did this by investigating lighting models provided by Blender, an open-source 3D graphics software, comparing them to the actual lights used in stage lighting. We also examined the methods Blender offers for designing and refining a lighting plan, comparing them to the practices of theater lighting designers.

First, we conducted a quick experiment to demonstrate the difficulties of using 3D software as an amateur. We reproduced a test as illustrated by Kerr and Pellacini in the article “Toward Evaluating Lighting Design Interface Paradigms for Novice Users” in which novice users manipulate lights in 3D software to achieve the same resulting shadows as depicted by a goal image. This confirmed the difficulty of lighting for individuals with no prior experience.

We then found images of theater lighting placement examples that we attempted to reproduce in 3D software by modeling the object and manipulating the lights to create the different effects that we had read about. The first model we lit was a low-relief 3D object of footprints in the sand. But we found that because Blender is optimized for lighting 3D objects, it is difficult to reduce the apparent dimensionality of an object through lighting alone.

Another difficulty in reproducing theater techniques appeared when we worked with colored lights: Blender treated the mixing of colored lights as subtractive (like mixing pigments) as opposed to additive (like mixing real world lights in theater).

We lit more 3 dimensional objects, simulating light shining on an apple bowl, or radiating through a window. In placing the lights on these models we realized it was difficult to extract precise results because there was no sense of scale in 3D software that allows users an infinite space to work in. To combat the lack of scale, we built a theater stage model to scale in order to limit the given infinite space to the size of a theater.

We had more success lighting a human bust in Blender using techniques from theater for lighting faces. Most of these results created the same mood or mimicked the effect of their theater counterparts while a few differed. We locked in parameters like rotation and location, which allowed us to reduce the level of complexity to a new low, which had the trade-off of allowing too little control in some cases.

In conclusion, we have found that it is quite difficult to overcome the limitations of Blender in recreating identical effects of lighting in the physical world, and that Blender did not have the same nuance as real theater lighting has. However, the project is still a work in progress, and there is the possibility of finding or developing other parameters that might aid efforts to recreate the physical world in 3D software.
Research Fellow: Jennifer Godbout (2015)  Concentration: Geology

Faculty Mentor: Richard April  Department: Geology

Title of Project: Watershed weathering and its influence on the chemistry of surface, soil and ground waters at Roger's Glen, Chadwicks, NY

Project Summary:

My research primarily focuses on analyzing the hydrology and geochemistry of Roger's Glen, a small watershed in Chadwicks, New York, by sampling various watershed components, including bulk and throughfall precipitation, soil solutions via lysimeters, springs, tributaries, a major stream and three geographically linked ponds. Clay samples from the ponds and tributaries were analyzed in order to determine the integrated nature of the weathered material derived from the underlying shale bedrock and the glacial deposits that cover this area. Two soil pits were dug and sampled in order to examine the mineralogical and chemical weathering profiles within Roger’s Glen.

Laboratory techniques used in this project include pH analysis, alkalinity titrations, soil sample preparation procedures such as drying, sieving, clay-silt separation, powdering and cation-exchange capacity leaching, atomic absorption spectrometry of water and soil samples, x-ray diffraction of soils and bedrock, loss on ignition, fluxy disc making and x-ray fluorescence spectrometry.

Preliminary findings show increased chemical weathering up profile with decreasing Al, Fe, Mg, and K at shallower depths. Highest loss on ignition (LOIs) was observed at the top of the soil profile due to organic matter accumulation, and in the lake and tributary sediments, which have both high organic matter content and abundant hydrated clay minerals. Cation exchange capacity measurements of the soil profile indicate high concentrations of exchangeable Ca, Mg, and K high in the profile and moderate concentrations at deeper depths. Soil solutions collected with lysimeters show pH values ~4.5-6 with pH and alkalinity generally increasing with depth. Lake, tributary and spring water chemistry show pH values ~8-8.15 and high alkalinities (3975 – 7700 meq/L), suggesting potential carbonate influence. Clay mineralogy of the soil pit shows illite at deeper depths and vermiculite at shallower depths in the sequence. This research project will continue through the 2014-2015 academic year and will represent my senior thesis work.

Figure above depicts LOI (loss on ignition) of soil samples (VS 0-5 to VS 90-95) collected from a soil pit at progressive depth (in cm) and Roger's Glen stream (L1, L2, L3) and tributary clay samples (TBC1, TBC2).

Title of Project: The Extent of Income Disparities Based on the Intersections of Race, Sex, Sexual Orientation, and Education

Project Summary:

My study aims to present a comprehensive analysis of income differences and income discrimination based on race, sex, and sexual orientation. Using pooled cross-sectional data from the 1998 to 2012 General Social Survey, a national survey that randomly samples from non-institutionalized adults in the United States every two years, I examine how one's race, sex, and sexual orientation influences his/her individual annual income, while controlling for disparities between time at work, education, experience, family characteristics, location, and industry. My study occurs in two stages. I initially examine the income differences for single minority groups, nonwhite, female, and queer (which includes all individuals who have had exclusively same-sex sex partners or both male and female sex partners in the past five years), and then study their interaction groups: queer males, queer females, white females, nonwhite females, and nonwhite-queer individuals. By examining the subgroups, I am able to more accurately observe and compare the income disparities observed by different individuals in the labor market, as all individuals belong to more than one group. My study also examines the extent of heterogeneity in terms of education and how different returns to education affect each group or subgroup. By disaggregating each sample by education level, and comparing people across both minority status and education, I am able to observe how differential returns to education for each group or subgroup influence the income of the individuals in those groups.

In my single minority group model, I find that females have the highest income penalty of 24.1%, followed by nonwhite people with 7.2%. However, these results change dramatically when I allow for different returns to human capital accumulation, as each minority group is separated by education level. The queer group without a degree faces the largest income penalty of 46.1%, while all other queer people at higher education levels face either a small income penalty or a small income premium. Females experience a significant income penalty at all education levels, ranging from 6.7% to 39.2%. The nonwhite group does not appear to observe differential earnings, except for those that attain at least a bachelor’s degree, at which point an income premium is observed. In the interaction model, a similar change in results can be observed. Without allowing for heterogeneity in returns to education, nonwhite-queer people face the greatest reduction in earnings of 34.7%, followed by nonwhite females of 27.6%, white females of 27.2%, and then nonwhite males of 13.2%. Once I allow for human capital heterogeneity, however, nonwhite-queer people and white females observe a large income penalty at several education levels ranging from 59.9% to 10.5% and 44.8% to 10.5% respectively. On the contrary, queer people are found to generally experience a small income premium of 4.7% to 8.5%. Similarly, nonwhite females observe an income premium as long as they obtain a college degree of some kind, ranging from 4.5% with an associate’s degree to 18.7% with a graduate degree. Nonwhite males also experience a large premium of 13.7% after obtaining at least a bachelor’s degree, or 22.2% for those with a graduate’s degree. These unexpected results show that although income discrimination may still exist for certain groups, one must examine the income effects at each education level to accurately discern the experiences of minority groups in the labor market.

☑ Other (specify):
Faculty Mentor: Randy Fuller  
Department: Biology

Title of Project: The impact of in-stream and whole drainage basin lime applications as a mitigation strategy for counteracting the effects of acid deposition on stream ecosystem structure and function

Project Summary:

Lakes and streams in the Adirondack Mountains are particularly sensitive to acid precipitation. Due to the local geology, rocks in the region weather very slowly and the aquatic systems receive low calcium carbonate inputs as a result. Calcium carbonate is important because it dissociates in water to create bicarbonate ions, which help buffer against increases in acidity. If a stream has more calcium carbonate, it will better withstand rapid changes in acidity due to acid rain. Overall, increased acidity alters biological communities and that in turn changes a stream system’s structure and function.

The objective of our study was to understand long-term effects of adding lime, or calcium carbonate, to streams and stream catchment basins flowing into Honnedaga Lake in the Adirondack Park. Specifically, we were interested in how leaf decomposition and nutrient uptake dynamics responded to lime amendments. We compared episodically acidic streams, where pH is occasionally below 5, chronically acidic streams, where pH is constantly below 5, and streams with lime added.

For leaf decomposition, we placed leaf packs composed of red maple leaves in plastic mesh bags into the streams at multiple sites along the stream. Every two weeks, 5 leaf packs were pulled from each site and the packs were brought back to the laboratory. A leaf from each bag was incubated in a glass jar with stream water for 24 hours and the loss of dissolved oxygen in each bottle measured the microbial respiration occurring on leaves. The remaining leaves in each pack were rinsed and the macroinvertebrates were identified and counted. This provided a picture of the biological communities present in the streams, as well as the leaf decomposition that resulted from macroinvertebrate activity.

For nutrient uptake, we added ammonium and phosphorus at known rates into the streams and determined how quickly they were utilized by the stream biota. A chloride solution was also added before as a tracer to indicate when the stream was completely saturated with added nutrients. We collected water samples at measured distances from the nutrient source and back in the laboratory, measured the amount of ammonium and phosphorus in each sample. This depicted how efficiently the stream systems are using nutrients.

Though trends in macroinvertebrate communities were noted over the ten weeks spent on this project during the summer, it is important to bear in mind that species composition changes throughout the year and studies are still continuing. A large increase in the trichopteran, Lepidostoma was found, a fluctuation that also happened during the summer of 2012. One stream site that was limed exhibited increased macroinvertebrate activity and improved water chemistry when compared to data from previous years. Phosphorus levels remained low at most stream sites, likely due to the prevalence of granite in the Adirondacks.

Project Summary:

In the heyday of the nuclear era in the United States, there were approximately 100 nuclear reactors throughout the nation, providing electricity for commercial and residential property in over 31 states. Reactors were generally located in proximity to small, rural communities and they quickly became important to local economies. In recent years, nuclear reactors have begun to face widespread criticism from a growing anti-nuclear movement, and many have begun to face technical and safety issues due to aging parts and increasingly strict Nuclear Regulatory Agency regulations. This has led to a series of nuclear plant decommissionings, with little attention paid to the impacts on surrounding communities. The town of Wiscasset, Maine was one such community that was impacted when the Maine Yankee Nuclear Plant began decommissioning in 1997, but research by local organizations has provided little data to suggest that the loss of the plant had negative consequences. To explore this issue further, I conducted a qualitative case study of Wiscasset to examine the patterns displayed by media coverage of decommissioning and the local economic conditions that resulted in order to determine whether or not reporting suggested that the community was impacted by the closure of the nuclear plant beyond that which data can suggest. The analysis included a qualitative content analysis of 85 articles from four key regional and local newspapers, as well as the inclusion of national papers.

The Maine Yankee Nuclear Power Plant was once one of the largest sources of employment in Wiscasset and the surrounding Lincoln County area. During operation, the plant employed more than 600 workers, accounted for more than 90% of Wiscasset’s budget through the property taxes it paid, and helped to create a thriving, prosperous town through direct and indirect contributions. Because Maine Yankee’s taxes funded most of the town’s budget, property taxes were kept very low for residents in the town. The school system was consistently ranked as one of the best in the region, and the town’s large budget allowed it to fund high quality infrastructure and public services. While environmental groups vehemently campaigned for the closure of Maine Yankee, many residents feared what the loss of the plant would cost the community when it was announced that it would close due to major repairs and safety concerns in 1996. My research focused on the impacts of closure and their interpretation by the media.

The framing of the issue within the media was important for analysis. A media frame shapes how the public thinks about the issue, whether they should care, and how they should act. Newspaper sources were obtained from Google News Archives, the Portland Public Library, and the archives of the Lincoln County Courthouse in Wiscasset. Articles were analyzed using MaxQDA software with respect to relevant theory. I determined that media coverage loosely followed Gunter’s (2005) problem frame model, continually constructing and reconstructing the narrative surrounding decommissioning from a broad to a more specific perspective as more information became known over time. This succession of newspaper coverage created the image of a town uncertain of what the consequences of the loss of their nuclear plant would be, followed by a local government and community struggling to maintain their status quo while transitioning to a post-Maine Yankee economy. While not everyone was impacted equally by the closure, and the town is slowly rejuvenating its tourism and service based economy, increases in property taxes and loss of town funding created pervasive first and secondary impacts on public services, the local school system, and residents’ livelihoods. While data can provide a clear measurement of the economic health of the region, I argue that the decrease in quality of life faced by the small town is a uniquely human impact which cannot be ignored. Other communities should seek to consider these impacts when faced with the decommissioning of a local plant.
Crustal extension is an important geologic process that allows the crust to stretch and thin, typically along a series of normal faults, ultimately allowing continents to rift apart. Areas of active crustal extension, such as the East African Rift, provide an opportunity to study the surficial processes of these faults directly as well as how faulting is accommodated in the upper crust (upper ~10 km) through seismic studies of earthquakes. However, such locations do not allow geologists to examine how the mid- to lower crust responds to crustal extension because earthquakes do not occur at these depths. Ancient extensional provinces provide the opportunity to investigate how extensional faulting occurs at greater crustal depths. The Basin and Range Province of western North America is one such region where significant crustal extension occurred, nearly doubling the width of the region during the Miocene (~24.5 Ma)[1]. Within the Basin and Range, a series of extreme normal faults, known as metamorphic core complexes, have exhumed mid-crustal rocks to the surface. This provides an outstanding opportunity to study how the mid-crust behaves during crustal extension.

The goal of my research this summer was to examine the metamorphic history of the Harcuvar metamorphic core complex in western Arizona. Metamorphism likely predated extension but may provide important clues as to how metamorphism and burial may have influenced the subsequent exhumation of the core complex. PT conditions during metamorphism were assessed using mineral assemblages in pelitic schist units from the Harcuvar core complex. I conducted optical and scanning electron microscopy to identify minerals. In addition, bulk major and trace element geochemistry of each sample was conducted using X-Ray Fluorescence (XRF). Important minerals identified include kyanite, garnet, sillimanite, biotite and muscovite. Preliminary assessment of the mineral assemblages suggest burial depths exceeded 15 km during metamorphism and minimum temperatures of >550°C. These results suggest that the core complex was the site of significant crustal thickening prior to extensional exhumation, which may have partly driven extension by gravitational collapse. Additional pseudo-section modeling of the geochemical results is expected to yield more precise constraints on the pressure-temperature history of the core complex.
A classic diffusion demonstration experiment involves two gases diffusing into a tube and reacting in the middle to form a visible ring. The location of the ring is consistent with the predictions of diffusion, since it forms closer to the gas with the lower average speed. However, the time it takes for this ring to be formed is much less than the diffusion time predicted by a simple model. Therefore, it has been suggested that the motion of the molecules is dominated by advection, the bulk movement of solutes. My experiment was designed to determine whether a more sophisticated model of diffusion is sufficient to explain the observed time.

In order to determine whether the motion of the gas is explained by diffusion, a method of measuring the time for a known amount of gas to traverse the tube is needed. A cotton ball soaked in ammonium hydroxide is placed in one end of the tube and the ammonia vapor is allowed to move down the tube until it changes the color of a piece of indicator paper at the other end. The amount of ammonia to change the color of the indicator paper can be quantitatively measured in a separate experiment: a known amount of ammonia gas is placed in a flask and the time required for the indicator paper to change color is measured. Using this measured time as an input to the diffusion model enables us to test whether the time scale of the tube experiment can be explained by diffusion.

Preliminary results show that it is possible that diffusion describes the motion of the ammonia molecules. Precise measurements of the time that the pH paper changes color, and when it begins reacting are needed in order to confirm whether or not the model correctly models diffusion. I worked to develop methods to make this color change more apparent in order to see if it matched the model, and to make the timing more repeatable.

☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Project Summary:

The Philadelphia Educational Longitudinal Study (PELS) followed a cohort of 2000 students in the School District of Philadelphia from the end of their 8th grade year in school into adulthood. I focused on Wave I of PELS interviews, which consists of interviews with 95 of the original 2000 students when they were 18 to 23 years old. The interviews asked respondents questions about a wide variety of aspects of their lives including but not limited to education, family and peer relationships, work and financial status, and whether or not they feel like adults. I read, summarized, and coded interview transcripts to assist Professor Benson with her analysis of the data for a book she is writing on coming of age in an urban context. While doing this, I also began working on my own project using PELS data focusing on how respondents’ exposure to trauma impacts life course outcomes. Below is a preliminary abstract for my own project:

Exposure to high rates of traumatic experiences is inevitable in impoverished urban communities, but individuals influence how they are affected by traumatic experiences through their strategies for coping with trauma. In *Coming Up Short*, Jennifer M. Silva illustrates how working-class individuals develop coping strategies to deal with the many obstacles that they face in transitioning to adulthood. Silva does not discuss how coping strategies are formed through the perception that trauma is normal. My work, like Silva’s, examines how individuals experience, perceive, and cope with traumatic events. I also attempt to explain how perceptions of trauma and coping strategies are formed. I use data from interviews with 95 working-class 18-23 year olds who are part of the Philadelphia Educational Longitudinal Study (PELS). I find that respondents use a wide variety of strategies in coping with trauma, many of which indicate that encountering trauma is normal. I also find that the exposure to trauma of respondents and the coping strategies they develop tend to be intergenerational and normalized. By perceiving trauma as normal and coping with it accordingly, respondents often seem to reduce short-term stress caused by traumatic experiences and situations. However, reducing short-term stress does not typically prevent future exposure to trauma, which induces stress and reduces the probability of having successful life course outcomes.

□ Other (specify):
Faculty Mentor: Julie Dudrick  Department: Upstate Institute
Title of Project: Upstate Institute Summer Field School

Project Summary:

This summer I had the humbling opportunity to work for Young Scholars LPP in Utica, NY, though Colgate’s Upstate Institute. Young Scholars is a not for profit organization dedicated to improving the educational lives of middle and high school students in the Utica City School System. Programs include tutoring throughout the year, a three week long summer program, and general academic and else wise support. Addressing the specific goal of improving student’s chances of attending and completing a college education, YSLPP also provides access to college tours throughout the school year and summer. Because I was only on the job for 5 weeks, I did not conduct the formal research project that others completed, but was more involved in the every day ebbs and flows of the Young Scholars office.

My responsibilities included general office work and support to the summer program. I focused mainly on researching grants and funds that YSLPP may be able to access, as they have seen significant budget cuts from the UCSS in recent years. I created a grant report with several suggestions of how YSLPP should go about applying for and procuring grants in the coming year or even into the future.

It was a great experience for me to see how a not for profit runs and functions. I was particularly inspired by the dedication of the staff across the board to the program and to the students with whom they work.

Project Summary:

Our current understanding of China, Chinese culture, and possibly Eastern culture in general seems to revolve around some ideas, or questions, that have posited the Eastern world as stagnant, regressive, conservative, and etc. Even though it is true that there are some scholarly works that describe the Eastern cultures to be positive, it is an undeniable truth that a majority of scholars still are within the prejudiced boundary of understanding Eastern cultures. This current trend of sinology is not only detrimental to our view in that it constrains our understanding only to one aspect, but also is not an accurate representation of China in general. Facing the status quo, it is an important to task to understand the genealogy of this current trend, and to provide a more complete alternative for the academic endeavor.

On this account, our summer research has been focusing on two different aspects. Simply put, one is focused on what: what is the history of sinology? And the other is focused on why: why did it develop in this particular path?

If I were to elaborate on these two aspects, first, we started looking at different thinkers who have commented on China and her culture. For this, we have looked at a wide range of thinkers ranging from Matteo Ricci to Bertrand Russell; in other words, from 15th Century to 20th Century. And this investigation had two different purposes. One is to specifically understand the views of these different thinkers and the other is to find out whether there is identifiable pattern in the development of these different views on China. In a sense, these two purposes are inter-connected with each other in that understanding one thinker helps us understand other thinkers which in turn, makes us understand the subsequent line of sinological history. And the pattern that we could identify is that there is a certain point of history when Western thinkers turned their back against China and held negative views on her; 19th Century.

Now that we have identified the pattern, the natural next step is to find the reason for this pattern. For this, we have started looking at the matter from a more macro-perspectival view; hence, investigation of a broader context of European intellectual history was required. I specifically looked at the development of the idea of progress. Although it is hard to fully articulate what correlation and causality are there between the idea of progress and sinology here, simply put, we could extrapolate that as the idea of progress changed, people’s views on other societies have also changed; more specifically, the change of the idea of progress in 19th Century corresponds with the change of view on China in the same era.

The research is still on-going and has not been finished yet. More improvements will be made and our theory will be developed more fully, more accurately and more meticulously.

☐ Other (specify):
Research Fellow: Eleanor “Elly” Hilton (2017)  
Concentration: Undeclared

Faculty Mentor: Jason Meyers  
Department: Biology

Title of Project: Effect of HDAC Inhibition on Müller Glia in the Developing and Regenerating Zebrafish Retina

Project Summary:

Zebrafish, following retinal injury, have the remarkable ability to regenerate damaged cell types to restore vision. Müller glia, a retinal cell type found in all vertebrate animal species, is the source of this repair. They dedifferentiate, and then re-enter the cell cycle to divide and repopulate the damaged area, but the specifics of the entire process are not yet known. Acetylation, which modifies gene expression, may be very important in differentiation and dedifferentiation of Müller glia. This mechanism modifies histones using HDAC’s and HAT’s to condense or decondense DNA within the nucleus. Histone Deacetylase Inhibitors (HDACi’s) block the deacetylation process so that DNA remains in a decondensed state and can be readily transcribed.

In my project I studied the effects of two HDACi’s, Valproic Acid (VPA) and Trichostatin A (TSA). In the developing retina, TSA treated retinas exhibited significantly larger numbers of Müller glia than control retinas, almost two fold, when treated at 24hpf (P<0.001, Fig. 1C). In TSA treated retinas at 14hpf all cells express a Müller glial marker (Fig. 1B). This data suggests that deacetylation of histones is required for proper initial differentiation and development of appropriate Müller glial cell numbers.

In the regenerating retinas the number of Müller glia re-entering the cell cycle after injury in VPA (2mM) treated retinas is significantly lower (P<0.001, Fig. 2B). At a VPA concentration of 10mM, no Müller glial cells are activated (Fig. 2C). CMZ division is still present in all VPA treated retinas indicating that deacetylation of histones is required for Müller glial dedifferentiation as normal cell division is not impacted.

Source of Support:  ☑ HUMAN Div.  ☑ NASC Div.  ☑ SOSC Div.  ☑ UNST Div.  ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Research Fellow: Emily Holzman (2015)  
Concentration: Geology

Faculty Mentor: Bruce Selleck  
Department: Geology

Title of Project: Provenance of Emsian and Givetian Clastics, Acadian Foreland Basin of New York State

Project Summary:

This project focused on analyzing Devonian sedimentary rock samples from localities in the Acadian Foreland Basin between Catskill, Kingston and Hunter Mountain, in Greene and Ulster Counties of eastern New York. The samples include the Coeymans, New Scotland, Glenerie, Espous, Schohaire, Union Springs and Mt. Marion Formations, which formed during the Emsian and Givetian time periods (Lower to Middle Devonian). These units are composed of limestone (cherty to non-cherty), siltstone, shale (black and calcareous shale), mudstone, and sandstone.

The samples represent a broad range of depositional environments, from supratidal to deep marine, marine to terrestrial origin, fluvial-dominated channels and floodplain environments. By studying these sedimentary rocks we aim to acquire a better understanding of the provenance of the Acadian orogeny and the continuous evolution of the foreland basin in the Hudson Valley.

Through previous petrographic and mineralogic studies, it is known that the Lower Devonian units have a relatively quartz-rich composition. The quartz found in these samples is dominantly clear and monocrylline. The clastic sedimentary rocks found in this area also contain minor amounts of the following minerals: muscovite, plagioclase, K-feldspars, pyrite, chert, calcite and dolomite. In addition to muscovite, other micas such as chlorite and biotite are also common. Further analyses using SEM-EDS and cathodoluminescence will provide further information about the geology of the source rocks.

This data will be integrated with geochronological data on zircon suites from these same samples. The age spectra of the zircon grains will provide additional information about source areas that provided sediment to the Acadian Foreland Basin.

References:

[☑] Other (specify): Doug Rankin ’53 Endowment-Geology Research
Research Fellow: Yue “Eric” Hu (2015)  
Concentration: Economics

Faculty Mentor: Takao Kato  
Department: Economics

Title of Project: Fair Wage Hypothesis: Evidence from a Field Experiment

Project Summary:

The research was intended to provide new evidence on the Fair Wage Hypothesis by analyzing unique field experimental data collected in China. The hypothesis states that workers tend to exert less effort when they perceive their compensation as unfair. The underlying motivations for the hypothesis are the equality theory in social psychology and social exchange theory in sociology. That the perception of fairness could have impacts on labor market outcomes is not necessarily new. However, with the growing influence of behavioral and experimental economics in mainstream economics, the potentially important role that the perception of fairness plays in economic transactions has been studied extensively, resulting in the development of the Fair Wage Hypothesis. For instance, researchers suggest that fairness perceptions are key in workers’ performance response to a wage increase. Workers who feel they are initially underpaid increase their performance when the wage increases. However, workers who think they are paid a fair wage have no increase in performance when the wage increases.

However, contradicting results have been reported in different studies. In general, lab studies support the fair wage hypothesis and find evidence that workers tend to increase their effort in response to wage increase when they perceive their compensation as fair. However, field experimental studies generated mixed results, and some field experimental researchers suggested that the relevant psychological mechanisms in lab might not apply in the field. The objective of my summer project was to contribute to this ongoing empirical controversy by familiarizing myself with the relevant literature and methodologies and analyzing data from a field experiment in a Chinese manufacturing firm.

Source of Support:  
☑ HUMN Div.  ☐ NASC Div.  ☑ SOSC Div.  ☐ UNST Div.

☐ Other (specify):
Title of Project: Repo and Federal Funds: Before, During, and After the Crisis

Project Summary:

My research this summer was focused on money markets in which financial institutes borrow money to fund their financial activities or meet requirements. The two arguably most important markets were scrutinized. Repurchase agreement (repo) market is where financial institutes borrow money against collaterals. Financial firms get liquidity by selling assets with agreements to buy them back at a higher price at a future date, and thus repo functions as collateralized loans. Due to its security ensured by collateral, repo is the one of the most important way of borrowing in financial markets. The second market is the federal funds market, in which banks and institutions with reserve accounts at Federal Reserve can borrow and lend liquidity to each other. It is important because the Fed directly targets the federal funds rate, and expects the effects to spread out the economy. This research thus was intended to examine the integration of these money markets before, during and after the crisis. It also tried to discover the role repo markets played in the crisis.

First, through literature review and data searching, I examined the role of repo in this crisis. For nonbank financial institutes that do not receive deposits, repo market is where they borrow money from for their financial activities. Mortgage-backed securities are one of the usual assets used as collateral. When the housing bubble burst and subprime mortgage crisis hit, the value of securities involving subprime mortgages plunged. Due to the opaque nature of securitization, investors could hardly tell if the securities involves subprime mortgages and thus were unwilling to provide liquidity in repo market, which created a bank run for nonbank financial firms. Facing a liquidity shortage, these firms had to fire sell their other valuable assets at discount, which created a price drop and devastated other firms balance sheets, and in turn generated a new round of fire sale. Bi-party and tri-party repo markets displayed different patterns: in bi-party repo market the haircut, the ratio of over-collateralized part, increased significantly when the borrowers were facing troubles, demanding more collaterals to secure the loan, which in fact created a bank run. In tri-party market, the haircut rates did not increase remarkably, but the volume of repo decreased drastically, which indicated that lenders simply held back their money and stopped lending in general.

Then I explored the interest rate transmission mechanism and integration of money markets before, during and after the crisis. It turned out that some financial reforms intended to increase financial stability might result in money market disintegration, which might also weaken Fed’s control. I ran a regression to determine the integration among repo market, federal funds market and Libor market. The results showed that integration decreased during the crisis, and then recovered shortly after, but decreased again after the FDIC reform.

□ Other (specify):
Faculty Mentor: Joseph Eakin  Department: Ho Tung Visualization Laboratory & Planetarium  
Title of Project: Digital Animation and Planetarium Work  

Project Summary:  
Over this past summer I primarily performed production work for several of our upcoming shows. At the beginning of the summer I was working with a digital design program called, Maya. In this program one can make three dimensional models by distorting and sculpting basic shapes. In addition, one can apply color and texture to the models, and add lighting and animation to the scenes and objects. Later I switched focus to a program called Digistar which is used to control various planetarium functions as well as create scenes using bodies in the universe which can be added to other productions.  

I began working on a model of the Curia which was a hall in the Roman Forum where senators would meet and discuss different topics. This was an important place in the story of the death of Julius Caesar which is detailed in Colgate’s show “Murder on the Ides”. After I was moved to another project and picked up Digistar. I began my teaching myself the scripting language for the program. I then had to make various scenes for a show called “A Comet’s Tail” which follows a comet on its journey from the Oort cloud to the sun while passing our solar system’s planets and dwarf planets. Some of these scenes included a pan around Olympus Mons, a volcano on Mars and a scene depicting one of the moon landing sites. In relation to this project, I wrote a script that goes out from the sun and lists the distances and shows the orbits of the planets and some dwarf planets of our solar system outward to the Oort cloud.  

I also became more familiar with a function of Digistar where one adds a second camera and screen to the scene. This particular scene demonstrated the idea of parallax by showing the Earth’s orbit pointing to a star and in the inset camera what the motion of the star would look like as viewed from Earth. Finally I did several other small projects such as fixing a few already finished scripts in both Digistar and Maya. Production work such as this took up most of my time while working.  

However, the other major aspect of my job was that I projected films in the Vis Lab and showed people the sky on the dome. This had me teaching myself many different things about the sky, physics, and culture. It also taught me about how to interact with an audience in a formal setting. Between these two aspects of this job I learned a lot about how running a planetarium works.  

Source of Support:  
☐ HUMAN Div.  ☐ NASC Div.  ☐ SOHC Div.  ☐ UNST Div.  ☒ Other (specify): Information Technology Services  

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Project Summary:

While the name of it sounds straightforward, Mathematical Research is a field that a majority of people know very little about. Fortunately, this summer I had the opportunity to discover what research in mathematics is through hands on experience. Under the guidance of Professor Robertson, I conducted research in the topic of Ramsey Theory and successfully proved a proposition that will contribute greatly to future research. As with most math research, my research began with a conjecture that has not yet been proven but would have significant results if proved. Then using a combination of mathematical techniques and theorems in Ramsey theory, I began testing different methods to try to prove the conjecture. In the process I was able to prove an intermediate statement that will be useful in further researching and proving the conjecture. As with most mathematical research, it can take a very long time to prove theorems and that is why proving this proposition is a significant result of my research.

In general, Ramsey theory is the study of structures that are preserved under finite partitions. The language which is used in partitioning is one of colors, where each color class defines the partition.

My specific research project investigated an important conjecture made in the conclusion of the paper, On Monochromatic Sets of Integers Whose Diameters Form a Monotone Sequence (Bialostocki and Wilson):

Conjecture. Let $m \geq 2$ be an integer. If $\Delta$ is a 2-coloring of $[1, 6m - 4]$, then there exist two non-overlapping monochromatic $m$-subsets of $[1, 6m - 4]$, say $A_1$ and $A_2$, satisfying $\text{diam}(A_1) = \text{diam}(A_2)$.

Although this conjecture has not yet been proved, I did successfully prove the following statement:

Let $m \geq 2$ be an integer. If $\Delta$ is a 2-coloring of $[1, 8m - 6]$, then there exist two non-overlapping monochromatic $m$-subsets of $[1, 8m - 6]$, say $A_1$ and $A_2$, satisfying $\text{diam}(A_1) = \text{diam}(A_2)$.

In laymen’s terms, this says: If the integers 1 through 8m-6 are each colored with one of two colors, then there must be two sets of $m$ numbers that satisfy the following:

- The largest element of one set is smaller than the smallest element of the other set;
- Each set is monochromatic;
- The difference between the largest and smallest elements of the first set is equal to the difference between the largest and smallest elements of the second set

The statement that I proved is very similar to the original conjecture except the interval is slightly larger, 8m-6 instead of 6m-4, and therefore this result will be useful in further investigating the original conjecture and other questions in Ramsey Theory.
Research Fellow: Giuliana Kafaf (2015)  
Concentration: Geology

Faculty Mentor: Bruce Selleck  
Department: Geology

Title of Project: Natural Coal Firing in Helper, Utah

Project Summary:

Natural coal fires are common in exposures of upper Cretaceous formations in northern Utah, Wyoming, Montana, Colorado, New Mexico and Arizona (Heffern, E., 2003). Wildfires, spontaneous combustion, lightning and human activities in coal mines cause ignition of coal fires, which result in melting and fusing of surrounding country rock (Heffern, E. 2003). Continued erosion allows fresh coal to be introduced to oxidation, causing the spread of fires. An exposure near Helper, Utah, displays clear evidence of melting of country rock, including downward flow of the melt to form ‘stalactites’ and foamy breccia matrix. The goal of this research is to determine the mineral composition and geo-chemistry of the melts and country rock, to constrain melt and crystallization temperature, and to compare with other studies of similar features.

The glass matrix in the Helper samples, as seen using Scanning Electron Microscopy, contains phenocrysts of early-formed minerals, while the glass has a minimum melt composition. It is still to be determined if the mineral composition of the melt and country rock from the Helper site are the same. The mineral phenocrysts identified using X-ray diffraction and energy dispersed X-ray spectroscopy include margarite, labradorite, an intermediate plagioclase feldspar, indialite, which is a high temperature form of cordierite, and tridymite, a high temperature, low pressure polymorph of quartz. Additionally, minerals in the melilite series including akermanite and gehlenite are also present, and may provide a compositional constraint on crystallization temperature.

References:

Research Fellow(s): Katherine “Katie” Karnes (2017) | Concentration: Astroggeophysics  
Anneliese Rilinger (Williams College 2017) | Concentration(s): Astronomy/Physics  
Faculty Mentor: Thomas Balonek | Department: Physics and Astronomy

Title of Project: Optical Variability of BL Lacertae

Project Summary:

This summer we are studying the blazar BL Lacertae, or BL Lac for short. Blazars are a subcategory of quasars, which are a category of Active Galactic Nuclei (AGN). AGN are believed to be supermassive black holes in the center of galaxies that are accreting mass. As a result of this accretion, the black holes eject jets of particles perpendicular to the accretion disk that emit one or more forms of electromagnetic radiation. Some of this energy is in the form of visible light that we can detect at Colgate’s Foggy Bottom Observatory. When the jet of energy emitted points in the direction of observers on Earth, the source object is called a blazar. Quasars also exhibit variability, meaning that their brightness changes over time; however, no one understands exactly why they vary. By studying the variability of BL Lac, we may eventually be able to learn more about the processes happening inside of quasars. BL Lac has a redshift of \( z = 0.069 \), putting it at a distance of approximately 900 million lightyears from Earth. Because quasars are also some of the most distant and brightest objects we have seen in the universe, they are useful for helping scientists learn about the early universe.

This summer, we observed BL Lac for 26 nights and took 512 images. We used the 16” telescope at Colgate’s Foggy Bottom Observatory to collect our data. The graph below shows how it varied over the summer. The largest variation we saw was a 0.6 magnitude increase and subsequent decline in BL Lac on the scale of a few weeks. The faintest magnitude we observed all summer was 14.24 on June 29th, and the brightest we observed was 13.64 on July 6th. Our data suggests that BL Lac is currently in an inactive state, although not without variation. Even when it is in the lower range of its magnitude, variation on the timescale of weeks is still visible. We hope that this data can be added to the long-term studies of BL Lac to further understand its variability on decade-long timescales.

Source of Support:  
- [ ] HUMN Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [X] Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund  
- Keck Northeast Astronomy Consortium (KNAC)
Research Fellow: Lauren Kasparson (2015)  
Concentration: Neuroscience

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

As an intern at the Kelberman Center, my job was to create and implement an assessment tool to measure social skill development in children with autism. Those being assessed attended a five-week summer program called Awesome Summer Days, designed to increase inter-camper socialization through a variety of fun activities. The assessment tools measured qualitative and quantitative progress and helped document individual camper improvements.

The research opportunity was unique in that it began with a month-long position in an office setting, pouring over books and academic articles about autism and assessment tools for those with developmental disorders. I spoke with a variety of professionals whose expert knowledge also contributed to my final assessment products.

The quantitative assessment tools evaluated campers with respect to five broad categories of skill: behavioral, cognitive, social, emotional, and physical. The overall progress was assessed daily by camp counselors on a scale of one to five. Each of the five values was described at length to ensure the correct assessments were made. The qualitative assessment tool was a progress report also completed daily for each camper and allowed for the collection of more specialized goal-achievement data.

At the completion of the work in the Kelberman Center’s office, I began to implement the assessment tools as a counselor at the summer camp. I discovered, in this position, that spending time in a classroom or in a lab space at Colgate may provide a great conceptual understanding of statistical practices, but this was incomplete without the addition of fieldwork. I believe that this project has given me a push toward a career in autism research, and my experience with Upstate Institute brought practical application to my interest in neuroscience.

Source of Support:  
☐ HUMAN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
Project Summary:

This summer I worked with the Friends of Rogers, an organization which operates and provides community programming at the Rogers Environmental Education Center in Sherburne, NY. As one of the goals outlined in their strategic plan for the next five years, they would like to develop a way to evaluate programming offered by the Center and gather information on ways to increase successful programming at Rogers. As a non-profit organization with few paid employees, the Center relies primarily on the work of volunteers and interns. Recognizing the need for data collection and analysis, the Upstate Institute provided a Colgate Fellow to design and execute this program. In addition, a large part of this work involved understanding how Rogers’ school field trip programs operate and determining ways to increase enrollment in programs for students during the year. This was primarily achieved by contacting school administrators and teachers with a short survey designed to identify obstacles that teachers encounter when organizing field trips.

This summer, I provided Rogers with an initial set of data on their programs and effectiveness, and implement a series of surveys that can be used to continue this project past the summer. This includes quantitative data showing barriers for school trips and participant responses to family/children’s’ programs and the Rogers Adventure Series Summer Camp. In addition, I have worked in conjunction with Colgate’s Grant Office to research possible future funding sources for the Center. This included identifying possible funds, researching the preliminary matches, and passing suitable grant makers on to the executive director.

Throughout this project, I have learned how to evaluate progress made by an organization that does not rely on fiscal gain as a singular sign of success. I have had to think of creative ways to gather and express qualitative data as quantitative. Using this information, I have had to make suggestions for changes to increase the level of programming offered by my community partner. These tasks all required me to expand upon my traditional ways of thinking and reevaluate my standard methods of data collection so that I could provide my organization with the information they needed.

✓ Other (specify): Upstate Institute
Research Fellow: Kidanemariam “Kidane” Kebede (2016)  
Concentration: Physics

Faculty Mentor: Enrique “Kiko” Galvez  
Department: Physics and Astronomy

Title of Project: SLM Calibration for study of C-point singularities

Project Summary:

The polarization of light defines how the electric field in light oscillates with respect to its direction of propagation. As such, depending on the orientation of the electric field vector, there are three different types of polarization: linear (where the magnitude of the electric field changes along a single axis), circular (where the orientation of the electric field vector changes in time but its magnitude remains constant) and elliptical (where both the magnitude and orientation of the electric field vector change in time). An optical C-point polarization singularity is one in which a circular polarization point is surrounded by a spatially varying field of linear and elliptical states. Found frequently in nature, and have been observed in human fingerprints and the polarization of the cosmic microwave background, such structures are formed by the superposition of a circularly polarized mode carrying an optical vortex (a region in a light beam where the amplitude is zero and the phase circulates around it) and a fundamental Gaussian mode in the opposite state of polarization. In order to create such modes, a Spatial Light Modulator (SLM) is used to spatially vary the phase of a regular Gaussian beam. The purpose of this research project was to calibrate this optical instrument in order to ensure precise control of phase, and produce higher-quality C-points for study.

A spatial light modulator (SLM) is an electrically programmable device that modulates the phase/amplitude of light according to a fixed spatial (pixel) pattern. It is a pixelated screen of liquid crystals, whose orientation can be individually controlled using a voltage. When a voltage is applied of a pixel inside the liquid crystal, the index of refraction of the crystal right above the pixel changes and retards the propagation of light through the liquid crystal, thus creating a phase shift. We program the SLM using images, generated in MATLAB, with a 16-bit number per pixel. The SLM takes two 8-bit colors as inputs, and outputs a voltage to the pixels in its liquid crystal to change the phase of light that strikes its screen. The images we program the SLM with are designed to correspond linearly to a phase shift of 0 to 2π. However, a number of factors can prevent this from being the case, such as warps the SLM screen, wavelength dependence, etc. In order to calibrate the SLM, we needed to find out the relationship between the input color (voltage) and phase, which would allow us to correct the input color in order to produce the desired phase shift. To do so required creating a look-up-table (LUT), which maps the original colors from the images used to program the SLM to colors that are actually addressed to the SLM. We programmed the SLM with a series of binary diffraction grating images, whose green-level changed linearly. Each diffraction grating image creates a diffraction pattern where the intensity of light in the first diffraction order is directly proportional to the sine of the phase shift. We took a series of intensity measurements of the first diffraction order that allowed us to relate the input color to the phase change. By manipulating the data obtained using MATLAB programs, we were able to generate a look-up-table which, when used to take intensity measurements, resulted in a linearly relationship between the input color and a total phase shift of 0 to 2π.

Using this new look-up-table, we were able to program the SLM properly in order to spatially vary the relative phase of two beams and create optical vortices that allowed us to generate higher-quality C-point singularities and take images of them at different states of polarizations for further study.

Source of Support:  
☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: Oxygen isotopes in exhalites of the Broken Hill Pb-Zn-Ag deposit, Australia

Project Summary:

The garnet-rich rocks in and around the Broken Hill orebodies are well-suited to stable oxygen isotope analysis because of their general lack of accessory minerals and preservation of isotope fractionations between garnet and quartz. Although a regional oxygen isotope survey of the Broken Hill area has already been completed (Cartwright, Econ Geol 1999) analyses specific to the garnet-quartz lithologies have not been undertaken in depth. Should there be a pattern in isotope ratio or inter-mineral fractionation near orebodies, this research might have a significant impact on exploration geology at Broken Hill, which is the largest Pb-Ag-Zn orebody in the world. Furthermore, analyses of sampled rocks will help further the technique of garnet-quartz stable oxygen isotope thermometry, a method which uses inter-mineral isotope fractionation to estimate equilibration temperature.

Laser ablation mass spectrometry of samples gas was performed at the University of Wisconsin, Madison between August 12 and 14, 2014. Collected data show that garnet isotope ratios (delta values) values range between 7.39‰ and 9.26‰ and quartz δ18O values range from 10.08‰ to 12.93‰. These values are probably indicative of deposition or alteration in a relatively low-temperature seawater environment. The difference between the quartz and garnet isotope ratio (fractionation) for each sample is used to determine the peak temperature the rock reached during metamorphism, which is believed to have occurred on a regional scale at Broken Hill. Most calculated temperatures from these samples are ~650°C. Some variance is observed in calculated temperatures, but this may be due to the effects of differing proportions of garnet, quartz, and other minerals in the analyzed rocks. Calculated temperature variance may also be due to a regional-scale temperature gradient. Further examination of data is required in order to draw conclusions about the nature of the fluids that deposited or affected the garnet-quartz rock protoliths at Broken Hill, and to determine whether and patterns that emerge are useful for ore exploration geology.
Research Fellow: Mallory Keller (2017)  
Concentration: Undeclared

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

For the Upstate Institute Summer Field School, I worked at Pathfinder Village in Edmeston, New York. Pathfinder Village is a residential community for people with intellectual disabilities, with a majority of the residents having Down syndrome. It is a fully functioning village with an inn, bakery, school, church, a farmers market, and many houses that the residents live in. Pathfinder’s mission is to have each life find meaning and to give the residences as much independence as possible. Many of the residents work outside the village in the surrounding community, and several work in the village as well. The Pathfinder community offers many opportunities for their residents, but it was brought to their attention that there are few post-secondary options for students with Down syndrome. In response to these concerns, Pathfinder Village is opening a two-year post-secondary program for students in the fall, Otsego Academy. My role in particular was to research and create an assessment program for the academy.

The goal of Otsego Academy is to create and support independent living skills for their students, and the assessment program has to have the ability to report on the independent living skills. The complete assessment program tracks the students from their entrance in the academy until they graduate, to show growth in each student. The assessments focus on functional living skills, community safety skills, vocational skills, social skills, self-determination skills, and wellness. Through observation, role-plays, and paper assessments, upon entrance to Otsego Academy, the student will have a profile of their skills to develop their curriculum for the next two years. I was able to leave Pathfinder with an assessment program that included assessments, assessment protocol when administering, assessment schedule, assessment reports, and an assessment profile binder.

During the summer I also worked on various tasks involving market research for the academy, event planning, and staffing. I also spent time in a classroom at Pathfinder School, observing the assessments they have in place and gaining experience in a special education classroom. Overall this summer gave me a great introduction into the disabilities field.

Source of Support:  
[ ] HUMN Div.  [ ] NASC Div.  [ ] SOSC Div.  [ ] UNST Div.  
[X] Other (specify): Upstate Institute
**Introduction:**
Movement of macromolecules in and out of the cell nucleus is dependent on the structure of the nuclear pore and protein carriers (karyopherins). The nuclear pore has structures, nucleoporins which are made up of symmetric and asymmetric Nups that interact with karyopherins attached to the protein to be transported in and out of the nucleus. Karyopherins can further be divided into two types: Importins involved in nuclear import and exportins involved in nuclear export. Research so far shows that symmetric Nups are more essential to nuclear transport than asymmetric Nups. My projects investigate further into the concept with concentration on nuclear export.

**Project One:**
This project investigates further the role of symmetric Nups on the Nuclear Pore Complex. My main goal is to identify symmetric Nups other than Nup 100 and Nup 57 that are essential for nuclear export. I specifically investigated Crz1, a transcription factor that attaches to msn5 (exportin) to be transported to the cytoplasm. The experiment involved yeast strains that were transformed with a plasmid expressing Crz1 fused to GFP for fluorescence microscopy. Calcium chloride was introduced in the yeast cells and then viewed under fluorescent microscopy to track the movement of calcium out of the nucleus in intervals of two minutes for a period of 20 minutes. Nuclear export was investigated on wild-type yeast strain and mutants with mutations in symmetric nups. It was observed that the yeast with mutation in msn5 had a slower rate of export while other mutants had a similar rate of export to the wild-type strain. This suggests that other symmetric nups are not essential in Crz1 export. Also, the rate of export in mutant strains in earlier minutes was found to be higher than the rate in wild-type strain.

**Project Two:**
This project examines the role of heat shock proteins (HSPs) in nuclear export. Heat shock proteins are a group of proteins induced by heat shock and other stresses. The most prominent members of this group are a class of functionally related proteins involved in the folding and unfolding of other proteins. One of the major functions of these proteins is to help in transporting proteins across membranes within the cell. In this study, I investigate whether Hsp70 subclasses SSA3 and SSA4 aid in nuclear export of proteins. I used SSA3 and SSA4 plasmids from a different laboratory to transform into yeast cells and observe nuclear export of Crz1 by fluorescent microscopy. I compared the rate of nuclear export in yeast strains with SSA plasmids to the rate of export in yeast strains without the plasmid. There was no significant difference in the rate of export which suggests that SSA3 and SSA4 protein subclasses do not affect the rate of nuclear export of Crz1.

**Source of Support:**
- HUMAN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify): National Institutes of Health (NIH) Grant
Catalytic hydrogenation and dehydrogenation of polar bonds such as C-O bonds and C-N are of great interest as various chemical feedstock can be accessed without the use of stoichiometric inorganic reagents which give undesired byproducts. Of particular interest is the hydrogenation of CO$_2$ since sequential hydrogenation of CO$_2$ to methanol can be used as a mean for hydrogen storage.

Therefore, the following Ru CNC pincer complex was synthesized (Scheme 1) aiming for C-O bond transformation and hopefully, CO$_2$ hydrogenation as well.

![Scheme 1. Synthesis of the Ru CNC pincer complex](image)

Future studies include isolating the Ru complex, obtaining its crystal structure, and then testing its catalytic activities.

**Source of Support:**
- HUMN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify): National Science Foundation
Project Summary:

My project was concerned with the shell hardness of *Balanus eburneus* barnacles. My research consisted of three main parts: sample preparation, hardness testing, and energy dispersive spectroscopy. The goal of my project was to relate atomic disorder to shell hardness, with atomic disorder being a disruption of the normal crystalline structure of the shell. To measure atomic disorder, I looked at energy dispersive spectra acquired with the Scanning Electron Microscope (SEM). From these spectra I could see which elements were present in the shell and what concentrations. The crystalline structure of the *eburneus* shell is ideally made up of carbon, oxygen, and calcium. I often found magnesium and sulfur in the shells in small concentrations. The presence of these other elements possibly indicates atomic disorder. Thus, my project attempted to relate the concentrations of these pollutants to the hardness of the shells.

My barnacle samples were shipped to Colgate from Florida where we kept them alive in a tank, until the time at which they were prepared for experiments. To prepare the samples for data collection I would remove the organism, clean and fix the shell, and set it in epoxy. I would then polish the sample down until the desired cross-section was at the surface. To test the hardness of the shell I used a micro indenter to create small indents in three portions of the shell: exo-skeleton, base plate, and operculum. I then measured the indents with a light microscope and the SEM and used these measurements to determine the hardness (Vickers hardness). After making hundreds of indents across each of the three sections of a barnacle shell, I would then look at the energy dispersive spectra in the area of each indent to see if there was a relationship between the presence of polluting elements and the shell hardness. At the end of the summer we were unable to determine whether there was a firm relationship between the polluting elements and the shell hardness, though there were several positive indications that a relationship might exist. This was supported by the fact that the relative hardness between the three portions of the barnacle shell were significantly different from one another in several of the specimen observed as previous studies have found the three portions to have different levels of atomic disorder as measured by infrared spectroscopy. Further work needs to be done to fully determine whether a correlation exists between atomic disorder and shell hardness.
Research Fellow: Jeffrey Koch (2015)  
Concentration: Geology  
Faculty Mentor: Paul Pinet  
Department: Geology  
Title of Project: Sand Budget Analysis of Fire Island, NY

Project Summary:

Fire Island is one of many barrier islands along the South Shore of Long Island, New York. This island has more than 5 million visitors each summer. Fire Island is located in the central portion of barrier islands. This island extends 50km west of Moriches inlet. Many houses on Fire Island were swept away when hurricane Sandy devastated the area in October 2012. Sandy breached Fire Island in numerous spots, and greatly eroded the barrier island on the bay side. The decision must be made of whether or not to close the breaches, mechanically keep them open, or let nature take its course. This is where major issues come into play. The decision to use engineering on landforms such as Fire Island dictates that a sand budget be available in order to know the amount of sediment the system receives. The system can receive sediment in many ways, but the most prevalent is littoral, or longshore drift. Scientists, engineers, and federal agencies currently still debate this issue. Many of these groups have little to no communication, which is an extremely detrimental aspect for the community on Fire Island. The Fire Island Inlet is currently the only inlet to have bi-annual dredging. This keeps the inlet stabilized and allows for passage in and out of the Great South Bay.

No photo can truly give this barrier island justice. The immense size of the bay and island evoke a sense of paradise. The amount of sediment being transported and where exactly the sediment is coming from is widely debated. Many scientists from the army corps of engineers believe that the only sediment coming into the system is coming from Montauk Point (East of Fire Island). However, there are ridges in deep water, which supply Fire Island with sediment. The amount of this sediment is unknown, but it may reach over 200k m³. This amount of sediment would fill in the unknown gap of sediment being brought to the shores of Fire Island. Scientists from the army corps of engineers disagree that the ridges are bringing sediment to Fire Island because they do not know the process that is occurring. Yet just because the process is unknown does not mean that it is not happening. The army corps of engineers propose to dredge the ridges off the coast and use the sediment for beach nourishment. This would not only be a tremendous waste of funding, but would also disrupt the natural movement of sediment from the ridges to the barrier island.

Most of my research was done by reading academic studies and calculating the Sand-Budgets for Fire Island. Many papers written by the Army Corps of Engineers have skewed data due to their agenda. A lot of questions were answered by visiting Fire Island. In the coming years Fire Island will undoubtedly come under private and public scrutiny. The many communities on the island want their property and beaches to be protected. However, the cost may in fact be too much to bear, for the relatively short time period that engineers can artificially protect the barrier island. The best option for the communities on Fire Island is to adapt to the new changes that rising sea level and increased frequency and strength of new storms.

☐ Other (specify):
Research Fellow: Christopher Krieg (2014)  
Concentration: Biology  

Faculty Mentor: James “Eddie” Watkins  
Department: Biology  

Title of Project: Ecophysiological Cost of Reproduction in Several Dioecious Cycads  

Project Summary:

Sexual reproduction can be a costly evolutionary strategy and remains a major topic of investigation in biology today. In dioecious plant species, where individuals are either male, or female, direct investments are made in the production of reproductive structures such as cones, pigments, nectar, pollen, thermogenesis of pheromones, etc. (Obeso 1998, 2002). These investments are typically paid for with the carbon acquired from photosynthesis. Little attention has been paid to the cost of reproduction in cycads. The work that has been done has only focused on differences in morphology and leaf production (Clark & Clark 1988, Nicotra 1999, 2003). To date, only one publication has examined cycad photosynthetic physiology (Marler 1997) and not in the context of reproduction. Significantly, this is the first study ever conducted to examine the ecophysiological costs of reproduction in cycads and thus represents an opportunity to make a truly novel contribution to the literature. Specifically, I asked: What are the physiological costs of reproduction in dioecious Cycads?

To address this question, the Montgomery Botanical Center in Miami FL was chosen for its world renowned collection of cycads. The species studied were Cycas micronesia, Cycas rumphii, Zamia erosa, Zamia stansleyii, and Zamia portoricensis. In total, 103 individuals were measured with an average of 16 individuals per species and every effort to keep replicates within sexes balanced. To compare photosynthetic physiology, a Licor 6400 photosynthetic system was used to obtain photosynthetic parameters of Amax (maximum photosynthetic rate), Gs (stomatal conductance), and R (dark respiration). Related measures of WUE (water use efficiency), SLA (specific leaf area), leaf nitrogen and carbon concentration were also examined. Potential morphological differences were addressed in measures such as leaf number, cone number, cone height and diameter, cone reproductive status, plant height, stomatal density, and leaf biomass.

Preliminary findings support observations of differential morphology and leaf production between the sexes. Males have much smaller cones, compared to females, but produce many more cones relative to females. Moreover, the female cones appeared to be viable for a much longer duration than male cones. According to Shoen and Ashman (1995) this may impose an additional indirect cost and trade-off between flower longevity and flower frequency. Additionally, males generally produced more leaves than females indicating a further investment in leaf biomass. How are males “paying” for these investments? Significantly, we found that male photosynthetic physiology differed from females. Males typically showed higher maximum photosynthetic rates and more negative respiration rates, indicating a compensatory mechanism to support differences observed in reproductive strategies and morphology such as higher cone production and leaf biomass. This work is ongoing and when completed will provide a truly original contribution to the scientific community to further reveal the ecophysiological costs of reproduction in several dioecious cycad species.

Source of Support:  
- HUMN Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  
- Other (specify): Science and Math Initiative (SMI)
Title of Project: NUTS!

Project Summary:

I worked with Art and Art History professor Penny Lane on her second feature film, *NUTS! The Brinkley Story*. Penny's film chronicles the life of early 20th century quack Dr. John R. Brinkley and his rise to national fame for his “impotence-curing” gland surgery. Brinkley’s story sees him become a renowned surgeon, a radio pioneer, and a gubernatorial candidate before revealing his legacy to be based on fraudulent medicine and delusional sociopathic behavior. The film had been in the making for years preceding my involvement, so over the school year Penny showed me the most recent draft of the film and we began talking about how I could help over the summer.

I primarily acted as an assistant editor on the film, using Final Cut Pro 7 to cut together alternate versions of scenes and extended sequences in the film, as well as creating a sequence to accompany the closing credits of the film. Penny outfitted me with her old Mac Pro for the summer and I worked closely with her each day. This was especially helpful while I helped organize and log the media Penny captured during her archival shooting during the summer. I would receive new raw media and output an organized project folder that played a vital role in subsequent editing sessions, helping them go as smoothly as possible for Penny and myself.

As the summer wound to a close, I helped Penny in creating the media for her Kickstarter campaign, which began in mid-September. This included helping to edit a short trailer for the film, creating GIFs, and pulling stills and clips from our vast store of media to help advertise the film. In fact, I became so ingrained in the workings of this film that we extended my Summer Research into an ongoing Student Research Grant. I am still working on *NUTS!* well into the school year; creating more media for the film’s press releases and continuing to edit the film as we move towards our final draft.


☐ Other (specify):
Title of Project: Differential Privacy of Rank Aggregation Methods

Project Summary:

We focused on analyzing rank aggregation methods and examining their application to private data. Rank aggregation methods combine multiple rankings and produce a single ranking that takes all the rankings into account.

We first implemented the rank aggregation methods introduced in Cynthia Dwork’s paper ‘Rank Aggregation Methods for the Web’ in Python programming language. The paper introduces two techniques of evaluating the performance of the aggregators: Spearman footrule distance and Kendall tau distance. Using these distances, we evaluated how successfully the methods aggregate given rankings. The better the aggregators perform, the smaller the distances. The aggregation methods we implemented include: Borda’s method, footrule optimal aggregation, Markov chain methods, and locally Kemeny optimal aggregation.

We found real data sets online and created synthetic data sets to run our experiments. Our real data sets were multi-criteria rankings of undergraduate programs, graduate schools, Computer Science programs, and countries. With the data sets, we conducted experiments to measure the performance and efficiency of the methods and compared our result to the one in the paper. For larger data sets, we used Colgate’s computational cluster Biomath.

We also examined the sensitivity of rank aggregators. We measured how much one additional ranking could change the result of the aggregated ranking.

In the beginning of the project, I implemented: functions for measuring footrule distance, aggregator methods, including locally Kemeny optimal aggregation and Markov chain sample methods, local Kemenization, which improves the output of any algorithm, and finally unit tests to demonstrate how these methods and functions work.

Then I focused on analyzing the performance and efficiency of the methods. To examine how well the algorithms perform, I applied them to synthetic rankings and computed the distances of their result. Because the synthetic rankings allowed me to predict the outcome, I was able to debug and improve our implementation of the methods. I also measured the empirical runtime of each method to verify its asymptotic analysis.

I repeated these experiments on a wide range of data sets with different number of elements and rankings to see how they would influence the outcome. I also conducted the experiments on larger data sets using Biomath cluster to see if the methods would continue to perform as predicted.

Although the overall result was similar to what we had expected, the experiments revealed several exceptions and limitations of the aggregator algorithms that were not expected nor addressed in Dwork’s paper. After identifying the problems, I modified our implementation of the methods accordingly and repeated the experiments.

After working on synthetic rankings, I applied the methods to real data sets obtained online. To study the behavior of the methods further, I applied the methods on several extreme cases, such as partial lists.

Towards the end of the project, I looked into ways in which these methods could be used in aggregating preference data. Given a certain amount of information on which items are preferred to which other items, some of the methods were able to generate a fairly accurate ranking of all the items.

Title of Project: KIN-20 is Essential for Appropriate let-7 Expression

Project Summary:

C. elegans are nematodes that are about one millimeter in length and are used as a model organism because their genes are conserved in mammals, they have a fully sequenced genome and a short life span of approximately three days. The C. elegans life cycle includes four larval stages each separated by a molt, followed by an adult stage. Larval development is regulated by a pathway of genes that includes some microRNAs, like let-7. A microRNA is a ~22 nucleotide RNA that post transcriptionally silences gene expression. microRNAs are encoded in the genome as primary miRNAs that are transcribed by RNA Polymerase II before being cleaved by the Drosha-Pasha enzyme complex to become precursor miRNAs which are about 70 nucleotides long. Mature miRNAs are produced from the cleavage of the pre-miRNAs by the Dicer enzyme. miRNAs bind to sequences in the 3' untranslated region of mRNAs in the RISC complex and cause either translational repression or mRNA degradation. Loss of let-7 in C. elegans causes the vulvas to burst and is therefore lethal, while loss of let-7 in humans is associated with various cancers. KIN-20 is a Circadian kinase homologue that is hypothesized to regulate circadian rhythms by phosphorylating the period protein homologue, LIN-42, to trigger its degradation. Both LIN-42 and KIN-20 play roles in the developmental timing of the cell fates in C. elegans as they prevent precocious development to the adult stage. The goal of this project was to examine how KIN-20 affects LIN-42 and let-7 expression.

In order to find the effect that KIN-20 has on let-7 expression, mature miRNA let-7 levels were measured in WT N2 and kin-20(-) worms at multiple timepoints during the 3rd and 4th larval stages. RNA was extracted from both sets of worms at each timepoint, turned into cDNA, and analyzed by qPCR. There was found to be a significant decrease of ~10-fold in mature let-7 levels in kin-20(-) worms relative to WT N2 worms. Primary levels of let-7 were also analyzed and although inconclusive, suggest that there may be an increase in primary let-7 in kin-20(-) worms. These results suggest that KIN-20 may help regulate primary miRNA stabilization or Drosha processing to ultimately promote let-7 production.

Source of Support: HUMN Div. NASC Div. SOSC Div. UNST Div. Other (specify): Michael J. Wolk ’60 Heart Foundation
Title of Project: Upstate Institute Summer Field School

Project Summary:

This summer I worked on several projects that allowed me to intertwine my Environmental Studies and Studio Art majors. Through my work I was able to garner a better understanding about local politics, the not-for-profit sector and community betterment. My work this summer also informed my career path and gave me a better understanding of my long-term goals.

First, I worked with the Madison County Planning Department. The Planning Department assigned me to work on the Heart of New York Adventure Quest. This Quest is intended to begin in the summer of 2015 and is aimed at generating local economic growth through use of our local historic features and natural amenities. The Adventure Quest, which is based on similar challenges in other towns, will run throughout the Summer next year in the Village of Hamilton and in subsequent years will move to other towns throughout Madison County. Based on historic people and places in our very own Hamilton New York, the Quest will lead visitors/participants around the town and village and encourage them to patron the shops, restaurants and inns. I was a part of the initial planning stages of the Quest and focused mostly on generating promotional materials (such as a logo and informational video) and assessing as well as attaining stakeholders and interested parties. I was able to utilize my knowledge of FinalCut Pro, Photoshop and other graphic design programs to fill the needs of the Planning Department. My work with the Planning Department illuminated the importance of inter-organization partnerships and cooperation in order to achieve end results—a valuable lesson I will take with me.

Next, I worked for the Cazenovia Area Community Development Association (CACDA). Every year CACDA takes on a Signature Project. In 2013 this project was GoCaz.com, a cohesive website that assembled all of the natural amenities and historical sites around the Cazenovia area to allow community members and visitors alike better access/knowledge to them. The 2014 project, a spinoff of the 2013 project, was BikeCaz(.com). This project included not only a website that assembled resources and information about bicycling in Cazenovia, but also infrastructure to make the town more bicycle friendly. CADA aims to make Cazenovia a greener community and safer community for bicyclists through the promotion of bicycling as a means of tourism, transportation and recreational fun. Initially, CACDA hoped to apply for a Bicycle Friendly Community designation from the League of American Bicyclists, but it was later decided that establishing programs and groundwork relating to bicycling would better help their chances of receiving the designation when they applied in the future. My task for CACDA was to figure out what would help most with this goal. I was in charge of creating a Bicycle Rack Design Competition, writing the application and sourcing out interested people/organization. Furthermore, I researched and looked into developing a BicycleBenefits program in the Village of Cazenovia. Lastly, I wrote and designed content for the BikeCaz.com website. Again, I was able to exercise my graphic design skills as well as my writing and research abilities. This experience taught me the importance of actively and effectively utilizing community volunteers in getting a job done on time.

Lastly, I worked with the Cazenovia Preservation Foundation (CPF). CPF owns and maintains a network of trails in and around the Village of Cazenovia. Additionally, they assess and maintain preserved farmland and upkeep easements on properties—though, my work focused on the trail systems. I used my knowledge of GIS (Geographic Information Systems) to create updated trail guides of several of their largest and most highly used trails. I used GPS (Geographic Positioning Systems) to more accurately depict the trails as well. It was important that CPF get revamped trail maps so that both visitors and members of the community could locate and access the trails more easily. The trails are an important part of the Cazenovia community and are highly used by a select subset of people, but better marketing and signage will make them more widely available and known. This is an important mission to CPF because it means that in the future they can apply for more funding to continue their significant and beneficial work. CPF taught me how to successfully relay information and messages via publications to the community, and in return take feedback in an effective manner.

Source of Support:

☐ HUMAN Div.  ☐ NASC Div.  ☐ SOCS Div.  ☐ UNST Div.
☒ Other (specify): Upstate Institute
Title of Project: Determining the Structural and Functional Effects of a Missense Mutation on the Canine IGF1 Receptor Protein

Project Summary:

Years of artificial selection by breeders seeking to express and perpetuate certain traits have transformed dogs into an incredible genetic model with which to study complex traits, or traits that are controlled by multiple genes and the environment (such as height, risk of acquiring certain diseases, etc.). This is because the continual pursuit of various breed standards has ultimately resulted in the creation of minimal genetic variation within breeds and maximal variation between them. Thus, genetic differences between breeds that differ in a complex trait can suggest which genes may be playing an important role in contributing to the expression of that trait. This information can then be applied to organisms in which studying complex traits is not so simple, including humans. Size, for example, is one complex trait that has previously been studied in dogs for which six major genes have been found to be responsible for just over half of all observed variation. However, identifying these genes is only the first step; our study has sought to continue moving forward by examining one of these six genes associated with size, known as “Insulin-Like Growth Factor Receptor” (IGF1R), to elucidate why a mutated form of the gene causes dogs to be smaller. By the end of the summer, we have gotten close to concluding that the protein can be successfully produced in bacterial cells, which means that we should soon be able to proceed with isolating it from larger bacterial cultures and finally begin to analyze its structure.

The IGF1R mutation of interest changes a guanine to an adenine, which in turn changes an arginine into a histidine in the amino acid sequence of the protein for which it codes. It is thought that this causes an increase in flexibility in the protein by disrupting key hydrogen bonding, which could either affect the receptor’s affinity for one or more of its ligands or its ability to transmit a signal once a ligand has been bound.

Our study began with sequencing plasmids that other students created in the spring. These plasmids theoretically had IGF1R inserts, but the sequences for the plasmids were analyzed to ensure that they had them and that the sequences were correct. Once we had established that two plasmids were correct (one containing wild-type IGF1R and one containing the mutated version), we proceeded to cut the gene out of the plasmids using restriction enzymes EcoR1 and Nde1. The digests were then inserted into PRRX plasmids containing an ampicillin resistance gene, and these new plasmids were used to grow transformed E. coli cultures. Once grown, the DNA was isolated from the cells and digested, and gel electrophoresis was performed to confirm that the insert was actually there. Sequencing was also performed once again to ensure that no changes or significant mutations had occurred during the subcloning process. Finally, having verified that the isolated DNA was still correct, we ran a polyacrylamide gel for proteins and found a band showed up for induced bacteria that was not present for uninduced cells (Figure 1). Because this band was approximately the correct size for the IGF1R protein, this suggested that the bacterial cells are capable of expressing the canine version of IGF1R (Figure 1). Future directions include inducing bacterial cultures on a larger scale, isolating IGF1R protein crystals, and performing x-ray crystallography to determine structural differences between the wild-type and mutated forms of the gene.

![Figure 1. Unique bands from induced bacterial cells do not appear in uninduced cells (t = 0), suggesting that E. coli are capable of successfully producing it (t = time of induction, hrs).](image)

Understanding the arctic tundra ecosystem is important in order to fully anticipate and comprehend climate change. Utilizing high-resolution satellite images of northern Siberia, this project aims at automating the process of classifying water tracks, a critical feature of arctic landscapes. Water tracks are areas of subsurface water flow that facilitate the growth of vegetation in the tundra. The process of developing image analysis algorithms and programs accelerates detecting and identifying water tracks and enables the study of wider regions. As a computer science major my job was to code a way for a computer to recognize water tracks and higher vegetation regions based on their reflectance values in the satellite images. Algorithmically segmenting out these regions and quantifying them was my main area of focus.

More formally, accounting for the spatial variation of landscape features is critical to creating carbon budgets for ecosystems and regions, and for forecasting the effects of climate change in the tundra. Water tracks and other areas that feature channelized subsurface water flow are landscape features with distinct differences in carbon stocks and fluxes relative to adjacent upland tundra areas. Numerous studies have shown that water tracks and flowpaths have greater water and nutrient availability that leads relatively high carbon stocks and rates of carbon uptake. However a clear understanding of the relative proportion of tundra ecosystems that are comprised of these landscape features is lacking.

Recently developed fine-scale remote sensing technology allows for the spatial analysis of tundra landscapes and specifically water tracks. This study automates process of distinguishing water tracks through the use of image classification and segmentation techniques on high-resolution satellite imagery. Both supervised and unsupervised classification techniques identify water tracks as distinctive and tundra landscape features. Unlike the unsupervised classification, edge detection and region-thresholding algorithms in the supervised classification differentiates water tracks from locations with high productivity by assessing connectivity shape. Depending on the area of inquiry, water tracks comprise roughly 10%-25% of the landscape. Field observations indicate that water tracks have greater plant productivity, and rates of carbon cycling. Failing to account for these landscape features will lead to errors in regional carbon and methane budgets.
Title of Project: Digital Art: Machine Learning, Interaction, and Sound Recognition

Project Summary:
In this project, machine learning techniques were combined with JBox2D physics library to create a digital artform that interacts with the audience not only through vocal actions themselves but also through the contents of the actions, using the same method as humans recognize them. Vowels in speech are recognized by humans through "formants", or amplitude peaks in resonance. Certain conformations of the mouth and vocal tract result in unique combinations of formants, which are perceived as corresponding vowels.

Human voice is comprised of many different harmonic waveforms. Voice samples can be broken down to its component waveforms and analyzed with computer using Fast Fourier Transform (FFT) algorithm. With diverse vocal samples, a computer can learn to distinguish vowels from formants probabilistically to define the interaction with the artwork. Naive Bayes classifier is the machine learning algorithm applied to this project. The algorithm counts the number of features present during an event, and later check the features to determine the presence of the event. This classifier suits this project because it is lightweight, easy to implement, and works well even when number of samples are small. This is an ideal classifier that allows the computer program to work with limited samples and short response time during a real time voice recognition process.

Vocal samples of vowel [a], [i], [o] were recorded from a randomly chosen group of 20 people including both native and non-native English speakers. A few low quality samples were taken out, and the rest were amplified and edited into separate files ordered by their vowel type. The samples were analyzed in a 17 milliseconds time-frame. The program, Processing and Minim FFT library, finds the three highest peaks in frequency components. The processed data was then used for training the Naive Bayes classifier algorithm. Due to the limited availability of samples, the training used high-bias Laplace smoothing. After all samples were processed and the algorithm training completed, the resulting classification data was used for the code for the actual visual work, which uses JBox2D physics library.

The product worked reasonably well with good sensitivity and fast response rate. Choice of vowel helped due to distinctiveness of each vowel (such as a front open vowel [a], front closed vowel [i], back middle vowel [o]). Unfortunately, the limited availability of samples and the limitation of audio processing library prohibited the systematic trial on test data independent from the training data for meaningful numerical analysis.

The following improvements could be made to the current implementation to address limitations. First, Naive Bayes classifier is moderately reliable with the limited number of samples, but it cannot recognize complex interactions or the order of formants. Decision Tree-based classifier with more samples would scale better. Second, the current implementation applies Hidden Markov Model to improve accuracy based on the hypothesis that it is difficult for a person to change between very different vowels many times within a fraction of second, but a more flexible application would allow diphthongs and complex combinations. Third, on audience experience level, the more variety of sample to recognize would make the work more interactive and immersive.

Source of Support:  
[ ] HUMN Div.  [ ] NASC Div.  [ ] SOSC Div.  [ ] UNST Div.  
[ ] Other (specify):
Title of Project: Food choice conformity in Zebra Finches

Project Summary:

Social conformity is highly investigated in humans and in primates. Conformity is defined as an individual’s behavior that is demonstrated based on the most frequent behavior that is observed in others. Evidence of conformity in humans was investigated by Asch in 1957. Van de Waal and colleagues (2013) also found conformity in primates. Van de Waal and colleagues set up four groups of wild vervet monkeys and conditioned two groups of monkeys to prefer the blue corn and two groups to prefer the pink corn by adding a distasteful ingredient to one color. They found out that most male migrants chose the previous distasteful food that was preferred by the locals. This suggests a type of social conformity within primates. This summer research project seeks to further investigate conformity through zebra finches by examining the food preferences between each finch group. This study attempts to address the question whether or not zebra finches will conform to the social norm by eating the undesirable food that is preferred by finches from the unfamiliar cage. This project consists of four experiments.

My project attempted to address the question whether or not conformity is driven by sex differences (female versus male). Finches were separated into two cages; one cage that contained eight female zebra finches and the other cage with eight male zebra finches. Eggs were used as a food source; hard boiled eggs were crushed into pieces and then separated into two containers. One container consisted of eggs with pink dye and the other with green dye. During the training phrase, I made sure that each finch preferred both colors equally. Then finches were trained to dislike one color over the other. The female finches were conditioned to like the green food and to dislike the pink food by adding methyl anthranilate (a substance that acts as a bird repellent). The male finches were conditioned to like the pink food and to dislike the green food. Before the experimental phrase, the finches were trained so that each finch has sampled the distasteful food at least once. After the finches were conditioned, two male and two female finches were switched from their home cage to the unfamiliar cage. Observations were done in six five-minute intervals (30 minutes total). The finches were identified by their foot band colors. Feeding activity was recorded and then analyzed.

For female finches, the average proportion of eating home food compared with the away food in the away cage was statistically significant, indicating that there was a difference between eating the home food and eating the away food when females were in the away cage. The average proportion of eating away food in the home cage compared with away food in the away cage was also statistically significant, indicating that there is a difference in eating the away food in the home cage and eating the away food in the away cage. For male finches, average proportion of eating home food compared with the away food in the away cage was statistically significant, indicating that there is a difference found in the likelihood of eating the home food and away food when the males are in the away cage. The average proportion of eating away food in the home cage compared with away food in the away cage was not statistically significant, suggesting that there was no difference found in the likelihood of eating away food in home and away food in the away cage. Each finch’s individual difference can be taken into account to examine their feeding behavior. Although some finches did not show conformity between groups, some showed conformity within their groups (i.e. female – female conformity). There are some limitations to this study which includes color biases (male finches seem to have a strong preference toward the green food over the pink), the fact that taste aversion might not have been fully developed, and the degree of hunger. This experiment was very interesting and I highly recommend investigating this study and topic further. I am interested and looking forward to see the future results.
Title of Project: Investigating the role of Kruppel-like factor 4 on the process of autophagy, and an elucidation of the connection between KLF4 and mTOR as it relates to autophagy regulation

Project Summary:

Background: Autophagy, or “self-eating,” is a mechanism by which the cell recycles energy under nutrient deprivation. In addition, it also removes dysfunctional cellular components such as misfolded proteins and damaged organelles. It has been shown to suppress cancer development by limiting genomic instability as it removes these abnormal components and prevents them from inducing reactive oxygen species. However, the role of autophagy in cancer is context-dependent, as it can also confer survival advantage to cancer cells by allowing them to survive starvation. Krüppel-like factor 4 (KLF4) is transcription factor that has been shown to prevent the development of various types of cancers. It functions as a tumor suppressor by mediating the transactivation of p53 on p21, thus regulating cell cycle checkpoints. Furthermore, KLF4 maintains genomic stability and cells lacking Klf4 showed increased DNA damage and chromosomal abnormality. Mouse embryonic fibroblasts (MEFs) lacking Klf4 are also more prone to apoptosis. In addition, previous studies in vascular smooth muscle cells demonstrated that KLF4 negative regulates mammalian target of rapamycin (mTOR), which suppresses the induction of autophagy and is often overexpressed in many cancers.

Aim: The present study attempts to understand if KLF4 plays a role in regulation of autophagy and the molecular mechanism thereby.

Methods: Mice heterozygous for the Klf4 alleles (Klf4+/−) on a C57BL/6 background were crossbred. MEFs that are wild type (Klf4+/+) or null (Klf4−/−) for the Klf4 alleles were derived from day-13.5 embryos. MEFs were passed every three days following the 3T3 protocol. Western blot analysis was performed to assay the effect on protein expression by rapamycin treatment, transient Klf4 silencing or overexpression. The levels of autophagy were indicated by LC3BII, an established autophagy marker and Actin was used as a loading control. P70S6K, which is a downstream target of mTOR, was used to indicate the activity of mTOR pathway. PCR was performed to assay autophagy-related gene expression.

Results: Klf4 overexpression results in increased autophagy levels as indicated by LC3BII. Furthermore, Klf4 transient silencing of Klf4 leads to decreased autophagy and increased p70S6K level. Furthermore, the expression of autophagy related genes Atg 3 was examined, and no difference in gene expression was found between Klf4+/+ or Klf4−/− MEFs, indicating KLF4 does not regulate autophagy through Atg 3.

Conclusions: Results from this study indicate that KLF4 is important for the induction of autophagy and it partially regulates the induction of autophagy by suppressing mTOR pathway. However, since inhibition of the hyperactive mTOR pathway does not restore autophagy level, it may indicate that KLF4 is a necessary downstream target of mTOR or there may be other mechanism by which KLF4 regulates autophagy.
Project Summary:

When a laser beam encounters a certain grating pattern, the reflected beam has a doughnut pattern known as a Laguerre-Gauss mode. The goal of the setup is to differentiate between the regular laser beam and the doughnut pattern beam using a single-mode fiber. A single-mode fiber is an optical fiber designed to only let regular laser light through while restricting any Laguerre-Gauss mode light from getting through. By being able to distinguish between these two kinds of light, we can get information out of the light by calling one light a 0 and the other a 1 (in binary terms, like how computers today operate).

In practice, we found that it was difficult to prevent what was supposedly l≠0 light from getting through the fiber. Across a few l values, there was still light intensity being measured at the end of the cable. Most of this problem was thought to occur because the laser was not being focused precisely into the single-mode fiber. Adjusting the setup was then the main focus of the experiment for the duration of the summer. A series of lenses was implemented to ensure that the beam was converging at a point at the head of the single-mode fiber (as opposed to the beam diverging), as well as precision positioning equipment.

After careful alignment, the Spatial Light Modulator (SLM), which provides the grating patterns, was shifted and intensity data was recorded. We found that at certain places, the intensity indeed dropped to practically zero; there was no difference in intensity when the laser was turned off. This could be simply a matter of precision: at that very precise combination of SLM and single-mode fiber positions, the light is being focused at the right point in the fiber head and the laser consists of a pure Laguerre-Gauss mode (one without any l = 0 component to it).

Moving forward, the experimental setup would need to be tweaked a bit more. The mount for the SLM was a bit unwieldy and not very stable. The position adjustments were also not necessarily isolated to one axis at a time (one knob moves the SLM face in two axes due to the angle) so it is hard to say what exactly was being adjusted.

The work this summer has been important to the eventual execution of the quantum information side of the project. Once the setup has been perfected, we can confidently encode and transmit photons with qubits.
Title of Project: Accurate and Lightweight Simulation of Network Flows

Project Summary:

Large data centers are often looking for ways to improve performance, however it is difficult to estimate how potential upgrades will affect performance. A network simulator should be able to provide an estimate. However, existing network simulators are extremely accurate and unscalable or scalable but wildly inaccurate. Our research was focused on developing an accurate and highly scalable network simulator.

Data is sent over the Internet in small pieces called packets. The best way to visualize this is to think of a table you might order from IKEA. The table isn’t shipped to you in one piece, but instead is shipped in small pieces and is assembled once all of the pieces have arrived. A file is transmitted across a network in the same way. This is an important notion for network simulation because sending a single file across a network is thousands of simulation events.

Our simulator aims to improve scalability through the use of “flowlets.” Flowlets are designed to reduce packet level computation while still realistically simulating traffic. A flowlet is a “super packet” that is handled by the network as a single packet but is the size of 10 or 20 packets. Using flowlets reduces the number of simulation events significantly while still representing traffic flow fairly well. A nice feature of flowlets is that they are completely adjustable. The user can decide how large to make a single flowlet depending on his or her personal preference for accuracy or efficiency.

Our simulator also aims to improve scalability through the use of XCP instead of TCP. The use of XCP was motivated by the difficulty of implementing flowlets in TCP. For instance, TCP requires packet loss to tell the sender to reduce traffic but figuring out how to drop a flowlet is difficult. A nice feature of XCP is that it does not allow for packet loss. In addition, XCP is more scalable from a simulation standpoint than TCP. XCP calculations are done on switches, not at the end user. This means that the number of calculations scales with the number of switches and not the number of end users.

Project Summary:

I had three main projects. The first project was to create tools that help the Hospice staff to work more efficiently. I wrote a program to generate a network diagram as part of the compliance to HIPAA. A nurse used to generate this diagram using free online software, which was difficult to use. And she would spend two weeks of her time after visiting patients in the morning to complete the task. With the help of the new software, I was able to complete the task in about an hour. In addition to this, I completed a prototype spreadsheet for a quality assurance report that can automatically update the graph for the nurse to use.

My second project was to create a new website prototype for the Hospice. The executive director felt the current website is outdated and costly to maintain and make changes. I used WordPress to build a prototype that can reduce the cost and updated new features such as a slider, a Facebook plugin, a dropdown menu, a new donation page, and video embedment to the website.

My last project was to create some infographics and poster templates to promote the Hospice and attract donations. I created them in a way that they can change the numbers in the infographic or poster for future use.
Research Fellow: Emily Luba (2016)  
Concentration(s): Geography; Peace and Conflict Studies

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

Through the Upstate Institute Summer Field School, I worked at two different local non-profit organizations: the Horned Dorset Colony and Waterville First. The Horned Dorset Colony is an artist-in-residence program located in Leonardsville. Waterville First is a community development organization based out of Waterville. I've been interested in the non-profit sector for many years, and through both of these opportunities, I was able to gain an understanding of the industry and become more familiar with the areas which make up Madison County.

The Horned Dorset Colony was established in 2012, but has been a dream of founders Kingsley and Roberta Watten for nearly forty years. The Colony's goal is two-fold: first, to give artists a chance to work independently and have the opportunity for interdisciplinary conversation for the duration of their respective stays. Secondly, they want to rejuvenate Leonardsville, which is a tiny, rural, hamlet which has decreased in prosperity as the years have passed. Painters, writers, composers, photographers and other artists have all stayed at the Colony, and I was able to witness collaboration and communication between them during my time as an intern. For example, over the summer alone, Kingsley and Roberta held Open Studio events for the community, took the artists on a tour of a neighboring residency, provided wonderful meals, hosted the artists at their home, offered yoga classes to the artists (and myself) and provided a peaceful, welcoming and quiet environment, perfect for creation. Specifically, I assisted with social media management, photography of the events, the grounds and the artists, logistical tasks and, most predominately, a grant application. I began by spending many hours searching for foundations that would be willing to fund the Colony using the Foundation Directory Online, other searches and the guidance of Bruce Moseley, the associate director of corporate, foundation, and government relations at Colgate. After the research portion, I began to piece together a letter of inquiry which will be able to be modified and adjusted to send to a wide variety of foundations. I also helped at a fundraiser dinner concert for the Colony and had the chance to meet community members, discuss the Colony's goals with attendees, take donations and interact more with the artists. From working at the Colony, I've been able to see Kingsley and Roberta's passion for art and artists translated to action through the growth of a community of artists in an isolated, small area. Art can benefit Leonardsville by bringing in new faces, particularly as the artists typically are very interested in exploring the area, and developing a need for businesses and more local products. Additionally, the art community creates a hub of conversations through events and other interactions.

Waterville First is also a relatively new organization, having gained 501c3 status in 2013. Its goal is to develop Waterville for residents and visitors through the promotion of and increased accessibility for consumers to shop at local businesses. I worked under director Steve Murphy on a variety of tasks. My biggest role was assisting with the creation of a website. This website includes a business directory with accessible information, an events calendar, images, and history and other descriptions. I also filmed informal interviews with business owners, which I then began editing into short promotional clips, which will be featured on the website. Additionally, I attended a town meeting and was able to meet and speak with interested community members, as well as get some feedback on the website.

Source of Support:  
☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
Title of Project: Marine Sedimentary Records from the Antarctic

Project Summary:

Over the past several decades, large environmental changes have been taking place in Antarctica, with that Antarctic Peninsula in particular, facing rapid regional warming that has resulted in ice shelf disintegration on both sides of the Peninsula. We look to the proxy record of climate contained in marine sediment cores in order to gain a better understanding of our past environmental change and integrate this information into our present understanding of climate change and sea level rise. Paleoenvironmental data from cores taken along the western side of the Antarctic Peninsula provide information about Holocene climate and oceanographic changes. In our lab, interpretations of the sediment are based upon diatom abundance and assemblages. Our specific study examines a single species of polar marine diatom, *Eucampia antarctica*, which exhibits consistent changes in morphology throughout the Holocene in marine sediment cores that span a wide geographic range. The observations presented by this single diatom taxon have the ability to influence our understanding of changes in sea ice, the westerlies, the Antarctic Circumpolar Current, and coastal upwelling during the Holocene.

Our work this summer focused on two cores, LMG13-11 JGC6 and LMG 13-11 JGC4 that were collected from the mid and outer continental shelf of the Hugo Island Trough. Recovering cores on the mid and outer shelf has been problematic in the past due to rough seas that make over-the-side marine operations difficult. During LMG13-11, a broad expanse of slushy ice over most of the shelf resulted in an unusually calm sea state, allowing strategic coring in sites that previously were inaccessible for this kind of work. The data collected from these cores allow us to trace paleoceanographic signals from the open ocean, across the self, and to the coast. The cores are 446 cm and 600 cm in length respectively and were sampled every 5 cm at the Antarctic Marine Geology Research Facility at Florida State University. Subsequently the samples were sent to Colgate University where they were dried at <50°C. Quantitative slides were made via a standard settling method which produces a random distribution of diatoms. Each sample was placed on a slide and fitted with cover slips using Norland 61 adhesive. The diatoms were subsequently counted along transects under 400x magnification using an Olympus microscope.

Two morphologic features for the diatom *Eucampia antarctica* were recorded. First, the shape of the *Eucampia* valve can be either asymmetric or symmetric. Chains of asymmetric *Eucampia* have been documented in water characterized by natural iron fertilization, while straight-chained symmetric forms occur in waters without iron fertilization. Second, valve horns can be either pointed or flat, a feature dependent on whether the valve is at the end of a colony or in the interior. The ratio of terminal (pointed) to intercalary (flat) valves is a proxy for colony length, with longer colonies reflecting greater open water (less sea ice) in the autumn and fall. The information gained from tracking changes in the morphology of *Eucampia antarctica* valves in these two cores provides a reference point for understanding paleoenvironmental climate and oceanographic conditions in the Southern Ocean.

Source of Support: □ HUMN Div. □ NASC Div. □ SOSC Div. □ UNST Div. ☑ Other (specify): Hackett-Rathmell 1968 Memorial Fund; National Science Foundation; Norma Vergo Prize
Research Fellow: Roxanne Maduro (2017)  
Concentration: Undeclared

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

For the Good, Inc. is a non-profit organization founded in 2002 to benefit the Utica community by providing low-income residents and their neighborhoods with programs to overcome poverty through their own means. One of the first programs For the Good started was The Study Buddy Club. The purpose of this club was to help tutor children in subjects in difficult subjects through the help of Hamilton College volunteers.

This year, For the Good, Inc. expanded its Study Buddy program to include not only important lessons on academics, but healthy diets as well, something that has become increasingly overlooked and virtually inaccessible to inner city youths and their families. Through an Environmental Justice Grant of $48,126 for a span of 3 years, For the Good, Inc. was able to begin building a new program, aptly named the ‘Study Buddy Community Garden Program’.

The main purpose of this Community Garden Program was to educate children in the Utica area about healthy eating with the help of a professional nutritionist, provide basic gardening knowledge, engage them in an active environment, and provide them with fresh, organic local crops from For the Good’s community garden. This was in an effort to combat the growing unhealthy eating habits that many children, especially in inner city neighborhoods, have become accustomed to.

As an intern for For the Good, one of my main tasks was creating an agenda, time frame, activities and advertisement for the new program. Through some inquiry, I saw that many students did not end school until late June, and did not begin until mid-September. With this information, it was decided that the program would run for 10 weeks, from July 7th through September 10th to accommodate the students. The nutritionist was given 200 hours total through the grant to teach lessons to the students about crops, nutrition, dietary changes necessary for healthy living, and cooking lessons with the garden crops. Therefore, it was decided that the nutritionist would meet with the children twice a week every week. Field trips were also planned to enrich the students’ knowledge of the culture in Madison County. I researched ten Utica sites that encompassed a vast range of fields and would appeal to many different areas of interest: The Utica Zoo, Broadway Theater League of Utica, Munson Williams Proctor Arts Institute, Oneida-Herkimer Recycling Center, SUNY IT-Nano, Utica Memorial Auditorium, County Legislature, Root Glen Hamilton College, City Hall. I was also responsible for contacting parents of the Study Buddy Members, both through phone calls and a letter, describing what the program entailed in great detail. I made flyers and distributed them to local churches promoting the program. Of course I did other things unrelated to the project such as managing the organization’s local newspaper's website posts, answering and fielding phone calls, and updating contact information for local banks, but a large portion of my attention was devoted to this program.

Although difficult, creating and managing the small nuances that go unconsidered for a new project was very rewarding. I was able to learn what goes into starting up something as large scale as a grant funded project, and saw that even from a non-profit perspective, a large variety of skills go into making a project run successfully. I learned that organizational skills are crucial, especially when you are in constant communication with at least ten different people in subjects varying from questions about the program and press releases for the newspaper, to requests for adding more squash blossoms to the garden! I had to constantly be very flexible because although the program was a big priority, there were also bigger, more urgent tasks that would appear within a day's time, and I would sometimes have to drop everything I was doing to work on something else, while still finding time to finish my first task. Working with a non-profit was a hectic, unpredictable but eye opening experience, and I am very grateful to have had the opportunity to do it.
**Title of Project: Flow of Flexible Filaments**

**Project Summary:**

The flow of flexible filaments occurs in many situations and on many length scales, but it has not been carefully characterized. For example, experiments have observed the formation of biofilm streamers in curved microchannels. These elastic filaments of bacteria and polymer develop in the flow right after each turn and following the accumulation of biofilms on the walls of the channel. The formation and the development of streamers are strongly related to flow patterns, yet the underlying hydrodynamic mechanisms are worthy of further investigation. Most of the researchers who have devoted their time to study this want to find out how and why flexible filaments or granular matter takes the shape it does when they go around a bend or a corner, the time intervals that it takes to change from one shape to the next, and comparing viscous and elastic effects. Since experiments on such small filaments are hard to observe, I set up an experiment in which the flow of flexible filaments can be modeled by larger flexible plastic strands in order to track movement around a barrier.

The first step in the project was designing the apparatus and building it at the machine shop. The apparatus was a wooden frame that would hold three basins; the first two basins had drains that were connected to a polycarbonate rod that was connected to Tygon tubes to allow water to flow from the first two drains to the third basin. I designed the apparatus, drawing a front, side and top view, and adding all the necessary dimensions needed for all the wood pieces to fit together. Then I proceeded to the machine shop to build the apparatus which also included plastic hose fitting, Tygon pipes, ball valves, and polycarbonate rods.

When not working in the machine shop, I worked in the lab to design a video system to observe the filaments. I started by looking at the photo and video features of Logitech webcam software, and I used the webcam to see if I could detect a filament’s movement in water. I determined that the filaments were not visible from above the surface, so I needed to make transparent windows through the basins through which I could observe their motion. I tested different methods of making windows and found a combination of clear plastic and epoxy that did not leak. The next steps in the project will be to add tubing to transport water between basins and then implement the video software to observe and characterize the motion of the filaments.
Research Fellow: Dong Mai (2016)  
Concentration: Computer Science

Faculty Mentor: Michael Hay  
Department: Computer Science

Title of Project: Differential Privacy of Rank Aggregation Methods

Project Summary:

Introductory paragraph:
We focused on analyzing rank aggregation methods and examining their application to private data. Rank aggregation methods combine multiple rankings and produce a single ranking that takes all the rankings into account.

We first implemented the rank aggregation methods introduced in Cynthia Dwork’s paper ‘Rank Aggregation Methods for the Web’ in Python programming language. The paper introduces two techniques of evaluating the performance of the aggregators: Spearman footrule distance and Kendall tau distance. Using these distances, we evaluated how successfully the methods aggregate given rankings. The better the aggregators perform, the smaller the distances. The aggregation methods we implemented include: Borda’s method, footrule optimal aggregation, Markov chain methods, and locally Kemeny optimal aggregation.

We found real data sets online and created synthetic data sets to run our experiments. Our real data sets were multi-criteria rankings of undergraduate programs, graduate schools, Computer Science programs, and countries. With the data sets, we conducted experiments to measure the performance and efficiency of the methods and compared our result to the one in the paper. For larger data sets, we used Colgate’s computational cluster Biomath.

We also examined the sensitivity of rank aggregators. We measured how much one additional ranking could change the result of the aggregated ranking.

Individual report:
I implemented functions to measure the distance between lists, including the Kendall tau distance, induced footrule distance, induced Kendall tau distance, and scaled footrule distance. After that, I implemented the aggregators: Borda method, our own version of footrule method not described in the paper, scaled footrule (SFO) method, and Markov chain power method. Finally, I created some unit tests to check the correctness of the aggregators on small inputs.

To prepare input for the experiments, I then used a Python web scrawling framework called Scrapy to download the data from webpages, parse the data and generate datasets. The sources included Usnews.com (rankings of graduate programs), Aneki.com (rankings of countries in the world), Princetonreview.com (rankings of undergraduate schools), and a spreadsheet containing information about graduate computer science programs.

At the end of the project, I focused on running several experiments on biomath cluster to analyze the sensitivity of each aggregator. I came up with several different methods of computing one ranking to be added, including reversing the aggregate ranking, separating adjacent elements in the aggregate ranking apart, dynamically calculating the worst-case ranking, or even exhaustively searching for the worst-case for the smaller datasets.

I applied those methods to numerous synthetic datasets of different number of rankings and elements. The result was, unsurprisingly, when the number of rankings in the dataset increased, the influence of a single ranking decreased. However the number of elements did not seem to have any clear effect on the aggregate ranking.

Source of Support:  
☐ HUMN Div.  ☑ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
Research Fellow: Benjamin Mandell (2014)  
Concentration: Theater  

Faculty Mentor: April Sweeney  
Department: Theater  

Title of Project: Assistant director/translator on project titled “LONEtheater”  

Project Summary:  

LONEtheater is a unique theatrical performance that incorporated both of my academic concentrations at Colgate. I majored in Theater and minored in Spanish, so this was the perfect first project to tackle post-graduation. The script of the play was written in Spanish by an Argentinean director named Matías Umpierrez. It involves five separate, unrelated scenes that each took place in their own locations: an apartment in Brooklyn; a subway car on the way to Grand Central Station; an abandoned school building; Bethesda Fountain in Central Park; and the basement and backstage of a small theater. In a typical theatrical production, the performance occurs on a stage in front of a seated audience of multiple people. In the case of LONEtheater, each performance is to be seen by one audience member at a time. When I applied to this research position, my proposed duty was as an assistant director. My job was to assist the director, Matías, in developing the artistic concept of the production and to translate between him and the actors in the scenes, since he is not fluent in English and I am proficient at speaking Spanish. Additionally, because the script for each scene was in Spanish, I helped Professor Sweeney translate the text to English.

This project provided stimulating challenges in both academic foci. I had read different varieties of Spanish literature and learned to speak in both class and a two-month trip to Granada, Spain, but I never tried my hand at translating an entire text into English. Often times when learning a language you find yourself translating words, phrases, and sometimes sentences, but an entire scene was unfamiliar to me. Translating a scene from Spanish to English exposed nuances in linguistic differences of which I was previously unaware. Soon after starting the translation, it was easy to see that a literal translation of the text would yield a clunky and in some cases nonsensical dialogue. I was lucky enough to work with Professor Sweeney, who has lived and performed in Argentina, and her experience was invaluable in discovering the real meaning in the text and putting it into English. One of the most interesting parts of the script was the scene in the Brooklyn apartment, which involved an exasperated mother and her resilient daughter. The interplay between the two is intellectual and snappy, with lots of sophisticated pop culture and art references. To accurately capture the interplay between the two characters, we had to examine the language line by line and make sure that they all made sense to the actors saying them. In some cases, more than one translation technically conveyed the proper meaning of the words written in Spanish, but the feeling of the scene was improved if we replaced a word or phrase with a more commonly used colloquialism. Working through translating each scene shed a new light on dramatic text. Reading it in one language and writing it out in another allowed me to understand it and interpret it from two different perspectives. One language influences how you read it in another and you constantly discover more layers that you didn’t notice on the initial reading.

Helping Matías at rehearsals required me to use what I had learned from my directing classes, only this time I was explaining my ideas in English to the actors and then in Spanish to Matías. Explaining ideas as a director is very difficult because you have to be able to convey your ideas in a clear way so the actors understand them, but not in such a way that smothers the opinions of the actors. It was very stimulating to work toward achieving that balance in Spanish. It so happened that there was an available part when we started working on the project, so I was given a chance to perform in the piece as well. It was great having Professor Sweeney for this portion of the project, since she was my first acting teacher and knows me well as a performer. She knows how to guide you into your best performance. In summary, I interpreted a script, translated it from English to Spanish, assisted Matías in directing our actors, and performed my part to the best of my ability. All the while using the Spanish, directing, and acting techniques I learned during my time at Colgate. Below I have attached a link to the YouTube video of the trailer for LONEtheater.

https://www.youtube.com/watch?v=xR1wvZmZ864


☐ Other (specify):
Research Fellow:  Alexandra Marrone (2016)  
Concentration: Molecular Biology

Faculty Mentor:  Julie Dudrick  
Department: Upstate Institute

Title of Project:  Upstate Institute Summer Field School

Project Summary:

The Partnership for Community Development aims to foster economic opportunity and community vitality in the Hamilton town and village. The three sponsors of the PCD are the town of Hamilton, the village of Hamilton, and Colgate. The PCD runs several programs and communications that benefit the Hamilton Community, including The Great Chocolate Festival and the Hamilton Highlights.

The Cazenovia Chamber of Commerce works to develop commerce and encourage investment in the Cazenovia area. The chamber sponsors many community events and plans events that foster relationships between businessmen/women and Cazenovia residents.

At the Partnership for Community Development I aided in the planning of The Great Chocolate Festival. The festival is an event commemorating The Great Chocolate Trainwreck of 1955 that happened right in Hamilton, NY. For the past 6 years the PCD has worked to plan the festival and it has been growing every year! Last year over 2000 people were in attendance. To help out, I researched chocolate vendors of all sorts in the Hamilton/Syracuse area as well as train hobbyists and exhibitors in Central New York. I then reached out to all potential vendors and exhibitors that I researched to see if they were interested in participating in The Great Chocolate Festival. I also assisted in the set-up of a T-shirt presale management of the festival’s website and social media pages.

I also helped the PCD with the distribution of Hamilton Highlights to local businesses and organizations, as well as the collection of print material from local places in order to update the Visitors’ Center the PCD manages.

At the Cazenovia Chamber of Commerce I worked to improve their community events calendar, develop a social media presence, and create a proposal for a new website. Through implementing Google analytics on their website and looking at the analytics provided by Facebook I worked to target the new website toward their audience as well as plan Facebook posts around what followers respond best to. I scheduled Facebook posts for the chamber about local events for the rest of 2014 and also began a “like” campaign to try to get more local “likes” from community members. A large portion of my time was dedicated to inputting events into a new, streamlined, online community events calendar that allows for easier viewing of the calendar by community members and features a simplified community event submittal form.

Overall, I hope that I aided in making access to community events easier for the members of the communities whose organizations I worked for this summer.

Source of Support:  
[ ] HUMAN Div.  [ ] NASC Div.  [ ] SOSC Div.  [ ] UNST Div.  
☒ Other (specify):  Upstate Institute
Research Fellow: Alexandra “Alex” Maulden (2016)  
Concentration: Biology

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

This summer I worked as an Upstate Institute Field School Fellow. I was placed with Fiver Children’s Foundation and my project was to perform a sustainability audit on their camp in Poolville. Camp Fiver wanted me to research their current practices and to evaluate in what ways they can make changes to become more sustainable while at the same time saving the camp money. I identified the areas of camp where Fiver was already making positive steps towards becoming more sustainable and possible areas of improvement. This project took place in three phases. First, education about what a sustainability audit was through the Sustainability Office and understanding what Camp Fiver were expected me to produce. Second, research and data collection and finally recommendations on what they could do better to be sustainable.

In the audit, I focused primarily on five areas: Energy, Water, Purchasing, Food, and Recycling & Composting. Within each of the areas I would evaluate the current practice and decide if they was opportunity for improvement in sustainability practices either through technology changes or behavioral changes of the staff and campers. While Camp Fiver had a lot of current practices that were sustainable, I was able to suggest a few different changes such as more efficient light bulbs, aerators for faucets, and safer and healthier purchasing practices. In each of these areas, the camp had areas to improve and continue what they were currently doing. In addition to doing my own analysis of the current practices, I was also able to contact and have a company come out and give a cost estimate of solar panels to be installed. As a result, the audit had a mix of possible opportunities to improve sustainability ranging from major products to small behavioral changes.

In addition to producing a sustainability audit, I also had the opportunity to go to Camp Fiver and help with Environmental Education classes. This allowed me to get to know the kids at Camp Fiver and teach them how some of their direct actions could positively help the Camp become more sustainable.

While my project primarily focused on improving the camp’s sustainability, I greatly enjoyed the opportunity to work with the sustainability director and learn more about sustainability while also improving my research and analyzing skills. This project allowed me to use and develop many different skills.

Title of Project: Assessing the effects of Nutrient Deposition on epiphytes in the rainforest canopy at La Selva Biological research station in Costa Rica

Project Summary:

As climate change continues to occur, the atmosphere will experience an increase in its concentration of nutrients, specifically carbon, nitrogen and phosphorous. Epiphytic plants in the rainforest canopy will be among the first species to experience the impact of the atmospheric changes; epiphytes are plants that grow (non-parasitically) on another plant, and are not rooted in the ground, and therefore do not have access to the nutrients that are found in soil. Due to the fact that many epiphytes acquire their nutrients from the atmosphere or from rainwater, it makes sense that they would be among the first taxa to experience the effects of nutrient deposition. The goal of this project was to investigate how the growth, abundance and functional traits of epiphytic plants in the canopy are being impacted by the increase of nutrients that will occur as a result of increased nutrient deposition. This summer marked the fifth year of the study. Set up in 9 trees at La Selva were experimental conditions that mimics the projected effects of nutrient deposition. In the canopy layer of each of the 9 trees there were 5-6 experimental branches, each of which were exposed to a different added nutrient (Nitrogen, Nitrogen and Phosphorous, Phosphorous, Water, control and an additional Water Exclusion branch in 3 of the 9 trees). In order to collect samples from the trees, we utilized a free rope and pulley system to ascend into the forest canopy. Once in the canopy, specific plants (which were tagged with ID numbers in previous years) were measured for longest leaf length, longest leaf and petiole length and leaf samples were taken. Canopy humus samples (a layer of soil that is on the canopy branches) and plant samples were taken back to the lab. The specific leaf area and biomass for the plant samples were calculated, and the soil samples were homogenized and nutrients were extracted using a soil filtration method. Fungal Hyphae extract slides were created from the soil samples in order to look at the microbial make-up of the soils, and some samples were preserved in RNA later in order to be analyzed for genetic shifts in the microbial community of the canopy soils.

All of these processes were replicated for a shade house experiment that was run in tandem with the canopy study; the shade house contained 6 of the most common epiphyte species that were found in the experimental trees; replicates of each plant species were divided into 6 groups, and exposed to the same 6 experimental nutrient treatments. This replicated experiment served to eliminate the effects of neighboring plants, which could change the way in which they take up and utilize the nutrients.

When back at Colgate, plant and soil samples were subjected to a series of chemical tests in order to analyze for available phosphorous, nitrogen and carbon content in each sample.
Title of Project: It's not just about children: Contesting the normative claims of “child development”

Project Summary:

Our preliminary research suggests that developmental psychology does not recognize the correlation between social inequality and the absence of conditions deemed necessary for the growth and development of healthy children. We are asking why the field does not see a responsibility to challenge the status quo of economic and political systems that make healthy growth unlikely for so many children. We are questioning how any “healthy” human beings in the fields of child and adolescent development cannot object to the status quo once they understand the threats to young people’s development in poverty, war, and related wide-spread deprivations. Related, it is dangerous to continue to raise children who become socially uncritical adults. The goal of this research is to put these social concerns in the context of child development so we can gain some insight as to how to raise children who will challenge the status quo (can) and reshape our society.

I began by exploring how the origins of the field are implicated in the ways the field of child and adolescent development has been shaped. Although we want to believe that this field grew out of love for children, what we find instead is how the field evolved from adult concerns about controlling the attitudes and behavior of children: concerns were: children competing with adults for jobs (Cole, Cole, Lightfoot, 2005), children stealing when they were desperately poor and living on the streets; the possibility that their human rebelliousness would take the shape that it actually tended to take and that was alliance with other oppressed people to threaten the status quo and to build movements for change and (Lesko, 2001).

After doing preliminary research I began to question, who is the child in child development theories? Child development theories, especially those rooted in ego psychology and developmentalism tend to reflect a small minority of families who are white, middle class, heterosexual and who tend to represent the nuclear family, thus excluding people of color, different cultures, working class families, single parents and families of different cultures (Lesko 2001). Those who do not “fit” into those models are then framed as deviant; researchers in the field are preoccupied, then, with defining normalcy.

This research was personal for me: I began to question what purpose it served for the literature to suggest that my mother and myself were deviant? I thought if I, Melissa Meléndez, were included in the pool that provides data for typical developmental theory then the developmental psychologists would have to take a stand against poverty war and the privatization of public resources because the tensions in my upbringing were not about potty training. Rather, they were about how to get me a decent education in the inner city and how to protect a young child from the effects of too much violence in the environment. The norms created (using the limited pool of people) have historical significance because of the way these norms were and are still used. I came to understand that the groups of people who needed to be controlled changed over the years, from poor children who steal to anyone who threatens the status quo, including radical queer people, black people, new immigrants etc. The field of child development has impacted motherhood and families but also institutions. It has helped legitimate movements, laws and labels that perpetuate racism, homophobia, sexism and classism. It aided in legitimization of the discourse: which bodies are worth more than others? What groups of people are more deserving of human rights and certain opportunities? What groups of people need to be controlled? Imprisoned?
Research Fellow: Joshua Miller (2017)  Concentration(s): Neuroscience; Computer Science/Mathematics
Faculty Mentor: Bruce C. Hansen  Department: Psychology
Title of Project: Identifying the properties of the C1 component during early visual processing

Project Summary:

The human visual system is able to perceive scene information rapidly, from being able to determine whether a scene provides concealment to if it is an ocean or lake, in less than the time it takes to blink an eye (Greene & Oliva 2009). Understanding scene category recognition is considered one of the first meaningful steps toward understanding the processes underlying visual perception. Studies are usually done via electroencephalography (EEG) to measure the electrical signals of the brain waves occurring during visual processes. These electrical signals are recorded as waveforms and analyzed for specific components (i.e. peaks and troughs) which may serve as markers for specific visual processes. Three of these components are considered crucial in early visual processing, and are often referred to as the C1, N1, and P1 (Clark, Fan, & Hillyard 1995, Hansen, Johnson, & Ellemberg 2012). To contribute to the understanding of scene category recognition, my colleagues and I ran a series of experiments to determine the nature of the C1, because of its unique properties. Occurring between 50-100ms post stimulus onset time (PSOT), the C1 is known to change sign, being negative when the stimulus is presented to the upper visual field, and positive when the stimulus is presented to the lower visual field (Clark, Fan, & Hillyard 1995, Hansen, Johnson, & Ellemberg 2012). However, little is known about the C1 when stimuli are presented foveally, and as such this was our primary focus this summer.

Previously in our lab, we have expanded on research of the foveal C1 to show that when large field scene stimuli are presented (covering both upper and lower visual fields), the C1 may cancel out and allow foveal components, presumably the N1, to signal information. To add to our data, I began this summer with a comprehensive investigation of the C1, N1, and P1 using a modeling technique in the MATLAB interactive development environment (IDE), which added to the understanding of how the C1 and P1 are related and how the C1 sums with the N1 when stimuli presented cause a negative C1. When we had learned what we could of this relationship, our team was prepared to run a complete study of the C1.

Our experiments would display a fixation mark followed by a checkerboard pattern in one of eleven locations, followed by a letter presented randomly on the screen, which the participant would then report via a button box. Each location or pattern was tested through 100 trials. After data were collected from six participants, the data collection software (Net Station) would run a high-pass filter and segment the data. Lastly, using MATLAB again, I wrote a graphical user interface (GUI) to finish processing the recordings. Aided by the MATLAB addon toolbox EEGLab, this processing consisted of bad channel replacement, artifact rejection, rereferencing, low-pass filtering, baseline correction, and grand averaging.

Our results both confirm previous research by Hansen, Johnson, & Ellemberg on the C1 component and offer preliminary data for other components which may be acting during the same temporal and spatial interval as the C1. The C1 component in our recordings occurs at approximately 60ms PSOT, with fixation seeming to be the summation of both upper and lower conditions.

The new data continue to support the theory that when stimuli are presented in both upper and lower visual fields, the would-be positive and negative components sum to roughly cancel out but create a waveform that shows evidence of multiple components existing at that timeframe for foveal conditions. More data are needed and will be collected this coming fall semester by the Colgate EEG Lab.

and social media communities provides sustained support for their non-conventional child-raising efforts. If gender is to be undone, resistors and innovators when it comes to gendering their children may find that regular social media contact with feminist blogging parenting bloggers are activists employing consciousness-raising tactics, fostering community and social change. Parents who are Feminist parenting blogs are important sites to study everyday equality and social attempts at dismantling rigid gender roles. Feminist with the proper organizing and drive, online communities can have major social impact. The format of the online feminist parenting community may be shifting from blogging to other media, such as Facebook and Twitter, online feminist community is not disappearing, just changing platforms as the mobile internet infrastructure expands. A particular cohort of college-educated individuals seem to be part of this cultural moment; this mostly white, middle class, group of 20 and 30-something millennial generation parents have been shaped by third-wave feminism and exposed to Women’s Studies as a discipline. The bloggers we studied became parents during a time when online blogging was becoming a new platform for community and discovery, and they utilized that opportunity to start a movement. Their online feminist parenting blogs helped start a new era of mindful, conscious parenting. Our research may have caught a moment in this movement, but it was a moment with a lasting impact. The Internet is a fast-paced and quickly changing place, and the first generation of feminist parenting bloggers may be moving on, as their children grow up. Almost one-third of the bloggers we followed had stopped posting by 2014, some of them explicitly retiring, others simply disappearing. We did not find any feminist parenting blogs started after the year 2012, so it appears that there is not a balance of incoming and outgoing blogs. These trends reveal that the peak of feminist parenting blogs may have already passed, and the feminist parenting community may be moving on to other forms of communication such as Facebook, Twitter, and Instagram, especially as busy parents shift from computers to smartphones. When asked about this, feminist parenting bloggers argue that the online feminist community is not disappearing, just changing platforms as the mobile internet infrastructure expands. The format of the online feminist parenting community may be shifting from blogging to other media, such as Facebook and Twitter, but it seems that the community itself is still gaining strength and revolutionary potential. Whether or not blogs are still the main platform for this community or not is debatable, but the blogging community started the conversation about feminist parenting and first connected this community. Blogging communities can indeed have immense influence if they gather around a political issues, and with the proper organizing and drive, online communities can have major social impact. Feminist parenting blogs are important sites to study everyday equality and social attempts at dismantling rigid gender roles. Feminist parenting bloggers are activists employing consciousness-raising tactics, fostering community and social change. Parents who are resistors and innovators when it comes to gendering their children may find that regular social media contact with feminist blogging and social media communities provides sustained support for their non-conventional child-raising efforts. If gender is to be undone for future generations, enabling parent activists to connect with one another is a crucial step.
Research Fellow: YeonJu Mok (2015)  
Concentration: Computer Science

Faculty Mentor: Joseph Eakin  
Department: Ho Tung Visualization Laboratory & Planetarium

Title of Project: Educational 3D Animation Production

Project Summary:
Ho Tung Visualization Laboratory is utilized by several classes at Colgate as a means to provide students with a visual learning material which helps them to grasp core concepts of the class more effectively. Under the guidance of Joseph Eakin, Senior visualization Lab designer/technician, each year a group of students with various backgrounds forms a student production team to produce educational/recreational full dome 3D animations. This summer, total of five students (YeonJu Mok ’15, Matt Johnson ’15, Arjun Bhuptani ’16, Daniel Galvez (Hamilton High School), Cameron McKenzie (RIT) have gathered together to work on both editing/revising previously produced shows and creating new shows. The list of the shows that has been worked on by the student producers this summer is: The Making of a Star (Department of Astronomy), Flight into the Cell (Department of Biology), Murder on the Ides (Department of Classics), Chemistry Show (Department of Chemistry), Life on the Hill (Colgate virtual tour), and Halloween Show (seasonal recreational show for Halloween). The process of the student production is usually 1. group meetings to decide the concept of a new show, or to find parts to be fixed in previously produced shows, 2. sketching storyboards with the detailed idea of each scene, 3. 3D modeling using softwares such as Autodesk Maya, and Adobe Photoshop, 4. Rendering and editing mainly using Adobe After Effects, Premier and Autodesk Maya, 5. final evaluation before publicizing the show.

Although Vislab summer producing team usually focuses on 3D animation producing, we are also in charge of dome management, which requires familiarity with the dome management software “Digistar 5,” and also assist with various events held at Ho Science center such as science outreach programs and Colgate’s reunion events. As a part of Ho Science center community, Vislab students work closely with the Colgate Greenhouse, Robert M. Linsley Geology Museum, and Colgate Department of Astronomy.

Contribution
As a part of Vislab student producing team, I have mainly participated in modeling molecules for chemistry show (fig.1), cell model for Flight into the cell (fig.2), creating Vislab independent website (fig.3), and helping with science outreach program (fig. 4).

Source of Support: □ HUMAN Div. □ NASC Div. □ SOSC Div. □ UNST Div. □ Other (specify): Information Technology Services
Title of Project: Constraining Dust Properties in Dense Molecular Cloud Cores

Project Summary:

The first stars were formed from primordial clouds of Hydrogen that collapsed into massive stars. As these stars evolved and underwent supernovae, they enriched their environments with Hydrogen and other elements they had fused into existence. These regions cooled, condensed, collapsed, and formed subsequent generations of stars, which led to the continual chemical evolution in the interstellar medium (ISM). Today, we observe the presence of dense molecular clouds, several of which contain young stellar objects (YSO’s) embedded within. We understand these clouds to be the sites of imminent or current star formation.

These dense molecular clouds are cold -- < 100 K – conglomerates of gas and dust, which can sometimes be coated in a mantle of ice. The majority of analyses on dense molecular clouds focus on the dust. To analyze this dust component, we can observe a source with a known spectral distribution (SED) located behind a molecular cloud along a given line of sight. Dust and gas absorb and scatter incident light at discrete wavelengths. The resultant SED is dependent upon the composition of the clouds according to various extinction laws. Extinction laws can be empirically derived or modeled based on physical parameters such as the size of the dust grains. Making accurate determinations of the original source characteristics can be difficult, due to the effects of visual extinction. The clouds are very dense, causing up to 30 magnitudes of extinction in the visual band. It is for this reason that we observed our sources using Near-Infrared (NIR) equipment; in the NIR, the dust is transparent enough (A ≈ 3) to allow sufficient starlight through for detection and good signal-to-noise, but opaque enough that its effects are readily detectable.

Our targets were observed over two half-nights at Apache Point Observatory in New Mexico, using the 3.5m telescope and TripleSpec (a cross-dispersed Near-Infrared spectrograph) with a 1.1”x43” slit. The stars were evenly distributed between the two clouds, which were chosen from a group of clouds that had already been observed and studied with Spitzer. The data were reduced using APO’s TSpexTool, a modified version of the SpexTool IDL package. The spectra were first traced and extracted from the images after flat fielding and background subtraction. Due to the strong atmospheric absorption still present in the data, spectra of A0V standard stars were used to calibrate and to remove telluric features.

The main goal of our analyses was to establish reliable spectra types for each of our sources. As such, we wrote coeds in IDL, Python, and MATLAB to estimate the spectral type from two different methods. Our first method was an attempt to artificially redden the spectra of late-G to late-M standard giant stars downloaded from the IRTF Spectral Library. These standard spectra were interpolated to match the spectral resolution of our data. We then reddened the standards using various extinction laws and a reduced $\chi^2$ test was performed to determine an appropriate spectral type and visual extinction. The equivalent widths of three temperature-sensitive diagnostic lines that fell within the range of wavelengths where we had good spectral coverage were compared to the same lines in the standard spectra. Our measurements are independent of any extinction; however, the determination of the continuum height and the individual features were hard to constrain, and thus far, our estimates on spectral type are only being used to corroborate the results of our analysis of the spectral shape.

Carbonic anhydrases are a type of metalloenzyme that catalyze the reaction in which carbon dioxide and water interconvert to bicarbonate and hydrogen. There are currently five known forms of this metalloenzyme. The beta form that we studied is found within bacteria, yeast, and plant chloroplasts. They are also an important protein in several types of bacterial infection such as pneumonia. Carbonic anhydrases are hypothesized to have two conformations, an active R-state conformation and an inactive T-state conformation. The N terminus of HICA (Haemophilus influenzae β-carbonic anhydrase) is important in determining the conformation that the enzyme takes, and both of these variants are believed to affect the conformation and activity of HICA. The delta 5 variant is created with a truncation at the fifth amino acid in the protein. The loss of the first five amino acids removes the enzymes catalytic activity. The other variant, D44N, involves a single point mutation in the protein at the 44th amino acid. In the wild type HICA protein, the 44th amino acid is aspartic acid, but in this variant the amino acid at that location in the polypeptide chain is asparagine. This difference causes a change in the structure of the protein. In the wild type protein, the amino acids from 44-48 form a pocket in which the bicarbonate can bind in order to catalyze the reaction. In the D44N variant, the valine 47 moves into the area that would have been the binding pocket in the wild type protein, preventing the bicarbonate from binding. Thus it is expected to remove the enzyme’s catalytic activity.

I have been attempting to further our knowledge of the delta 5 variant by crystallizing it in order to determine its structure. I screened the protein with many different crystallization conditions in order to determine the condition in which the protein will most readily crystallize. Ultimately, I used a solution consisting of sodium chloride and ethanol in order to grow crystals in hanging drop wells. Then we attempted to use X-ray diffraction in order to obtain an electron density that would be refined into a molecular structure of the protein, but none of the crystals had yet diffracted well enough to be used for molecular refinement. I also worked on producing a D44N variant of HICA this summer with cobalt instead of zinc as the metal so that it could be examined using spectroscopy and kinetics that are possible with cobalt but not zinc. In order for the cells to use cobalt instead of zinc as the metal, they were grown in a minimal media culture to prevent zinc contamination and were infused with cobalt before overexpression. When the protein did not grow well initially, I produced a new plasmid using polymerase chain reaction (PCR) methods to generate the point mutation at the 44th amino acid and then insert it into a template of the HICA plasmid. Competent E.coli cells were transformed with the plasmid. The DNA was subsequently recovered and sequenced using the biology department’s ABI 3100 sequencing machine and the cells transformed with the plasmid were determined to include the mutation. I repeated the protein growth, overexpression, and purification procedures with these newly produced cells, but the protein still did grow. Next, I attempted a more nutrient rich culture, with TB media and 0.5 M MOPS buffer. The cells were flooded with cobalt before protein overexpression was induced to obtain a mix of zinc and cobalt protein. Protein was produced from this method, but unfortunately it was lost during purification, suggesting that the protein including cobalt may have different properties and need different purification procedures from the zinc wild type.

☐ Other (specify):
Research Fellow: Monica Murphy (2016)  
Concentration: Religion

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

This summer I had the privilege of working with two local non-profits, the Chenango Canal Association and the Chenango Greenway Conservancy, through the Upstate Institute. Both organizations are focused on maintaining the canal and the historic trail that runs beside it. The Chenango Canal Association is specifically dedicated to preserving the history of the Chenango Canal, and their museum, which sits on the corner of Route 20 and Canal Road in Bouckville. The museum is filled with photos and documents that tell the story of the canal. I was able to assist the Chenango Canal Association with a wide variety of projects during the course of the summer. I participated in many community events that were aimed both at raising money for the Canal Association and educating the local community on the history of the region. The Chenango Greenway Conservancy focuses primarily on maintaining and developing a recreational trail that runs through the city of Norwich. My project with the Chenango Greenway Conservancy was to create a series of historical signs that will eventually be placed along the trail. These signs tell the history of Norwich by describing the people and businesses that have made Norwich successful. Topics include the O&W Railroad, Avery Power, and the Chenango Canal.

Source of Support:  
☐ HUMAN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
The β-Carbonic Anhydrase is a catalytic protein that promotes the reaction between carbon dioxide and water into bicarbonate and a hydrogen ion:

\[ \text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{H}^+ \]

The enzyme has two distinct forms: the t-state (inactive) and r-state (active). Although the active state is the state in which the enzyme catalyzes the reaction, the protein has never been crystalized in this form. Protein crystallization is a process in which a solution of protein and precipitant are mixed and suspended in a sealed system over a larger concentration of precipitant solution. When crystals form from the super saturation of the protein from this solution equilibrium, X-Rays may be shot at the crystals in order to determine the way in which the protein crystal lattice structure lies. Because protein crystallography conditions of low pH and unhindered protein facilitate the t-state, achieving protein crystals in the r-state has been challenging. In order to attempt crystallization of the \textit{Haemophilus influenzae} carbonic anhydrase (HICA) enzyme in the active state, I have attempted to bind an inhibitor into the active-site pocket of the r-state in order to prevent reconversion back into the t-state. By binding this inhibitor, I have attempted to isolate the r-state in crystal form and thus subsequently determine its structure.

The first objective of this study was finding the best inhibitor for this protein. An inhibitor is a molecule, often small, that can bind to a protein’s active site in order to block catalytic function. Every protein has a unique active site, and thus a unique inhibitor that can block activity. In HICA’s case, I hypothesize an inhibitor can prevent conversion from the r-state to the t-state by blocking an aspartic acid from binding to the metal ion. The challenge of my project was finding the strongest inhibitor for the HICA enzyme so that small volumes of it could be added to a protein mixture in order to completely saturate the solution with protein/inhibitor complexes. I began by using kinetic experiments to measure the change in the reaction rate when both no inhibitor was present and 10 mM inhibitor was present. This change in reaction rate was measured by absorbance and the disassociation constant, or measure of an inhibitors binding tightness to the enzyme, was subsequently calculated. Of all the inhibitors attempted, cyanate was the strongest binder to wild-type HICA with thiocyanate close behind. The stronger the binding, the less inhibitor needs to be added in order to bring the protein/inhibitor mixture to supersaturation, and therefore the more likely crystallization of the complex will occur.

Another method I used to determine the disassociation constant was inhibitor titration. I began with a solution of Cobalt HICA, HICA enzyme that is spectroscopically active, and buffer, which controls the pH of the solution, and added increasing concentration of inhibitor in order to bring the solution to saturation. Between each addition, I measured the absorbance with a nanodrop in order to understand the molar absorptivity of the mixture. When these absorbivities are plotted against wavelength (Figure 1), the decrease in molar absorptivity as a function of inhibitor concentration can be seen. When one wavelength is chosen (in this case 611 nm) and the change in absorbance is plotted as a function of the ratio of inhibitor to enzyme concentration, the disassociation constant can be calculated. In the future, I will be doing crystallography screens in order to crystalize a HICA/inhibitor complex.

![Figure 1: Thiocyanate inhibitor binds to the metal ion of Co-HICA at pH 8.0. Increasing concentration of thiocyanate decreases the molar absorptivity at wavelength 611 nm, which is the wavelength where Co-HICA absorbs. This decrease in absorptivity signifies that the inhibitor is binding to the metal ion in the ligand-binding pocket. Because of this, I hypothesize that the inhibitor prevents an aspartic acid from binding to the metal ion, and thus can “lock” the HICA enzyme in the r-state for crystallization.](image)

**Source of Support:**

- HUMN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify): National Science Foundation (RUI)
Research Fellow: Christiane Olivero (2016)  Concentration: Molecular Biology
Faculty Mentor: Priscilla Van Wynsberghe  Department: Biology

Title of Project: The \textit{dpy} gene downregulates primary \textit{let-7} transcription

Project Summary:

\textit{Caenorhabditis elegans} is an excellent model organism due to their short generation time and fully sequenced genome. The appropriate expression of genes in the heterochronic pathway is crucial to ensure proper developmental timing in \textit{C. elegans}. The heterochronic pathway is composed of regulatory genes that control development; mutations that affect this pathway can cause severe developmental defects or death. A mutation in the unknown \textit{dpy} gene results in “dumpyness,” or a short and fat phenotype in comparison to wild type worms (Fig. 1A-B).

MicroRNAs are ~22 nucleotide non-coding RNAs that play a role in regulating gene expression post-transcriptionally in various organisms and are an important part of the heterochronic pathway in \textit{C. elegans}. \textit{let-7} is a miRNA involved in regulating the transition from the L4 to adult stage and its misregulation has been associated with precocious or retarded development in \textit{C. elegans} as well as cancer in humans. The purpose of this research was to investigate the effect of the \textit{dpy} mutation on \textit{let-7} and \textit{lin-4} levels and localize it within the genome.

To determine if \textit{let-7} levels were affected by the \textit{dpy} mutation, primary, precursor and mature \textit{let-7} levels were analyzed by qPCR over various timepoints. \textit{Dpy} mutants displayed a premature increase in primary \textit{let-7} prior to the increase in wild type worms. This increase was reflected in a corresponding rise in precursor and mature \textit{let-7} levels, suggesting that the mutation affects the transcription of primary \textit{let-7} in order to cause an increase in mature \textit{let-7}. The \textit{dpy} gene may be responsible for downregulating primary \textit{let-7} transcription until the appropriate time when \textit{let-7} accumulates to initiate the L4 to adult transition (Fig. 1C).

To determine if the \textit{dpy} gene interacts with other miRNAs, a similar investigation into how the mutation affects the miRNA \textit{lin-4} was undertaken. \textit{lin-4} is another component of the heterochronic pathway and is involved in the L1 to L2 transition. There was no significant difference observed in \textit{lin-4} levels at the L2 stage between \textit{dpy} and wild type worms, suggesting that \textit{dpy} is not a universal miRNA regulator, but instead affects a specific subset of miRNAs during development.

Previous research has localized the \textit{dpy} gene to a region between 12.1 and 12.6 Mbps on chromosome 1. To narrow this region further, \textit{dpy} worms were genotyped at various SNPs within this range of nucleotides. The results suggest that the \textit{dpy} gene is between 12.1 and 12.4 Mbps on chromosome 1. This investigation revealed that the \textit{dpy} mutation downregulates primary \textit{let-7} transcription but does not affect \textit{lin-4} levels. In addition, the mutation was localized within a 300 Kbp region of chromosome 1. This research provides insight into how miRNA regulators, such as \textit{dpy}, control development in \textit{C. elegans}, which can help us understand how miRNAs function in higher organisms.

![Fig. 1: The \textit{dpy} gene affects primary \textit{let-7} levels. A) \textit{dpy} worms at 40X magnification. B) wild type N2 worms at 40X magnification. C) Proposed mechanism for the effect of the \textit{dpy} gene on miRNA \textit{let-7}.]

Source of Support:  
☐ HUMN Div.  ☑ NASC Div.  ☑ SOSC Div.  ☑ UNST Div.  ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation

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Title of Project: **Superbus and Subiectus: Establishing the Status of Turnus**

Project Summary:

Even two thousand years after its creation, the denouement of the Aeneid, in which the eponymous protagonist brutally slays the native prince Turnus, still serves as the arena for some of the most intense debate among Classical scholars. Barbara Boyd summarizes its controversial nature succinctly when she states that, “No single scene in Latin literature has proved to be as great an ideological battleground as the end of the Aeneid.”1 In the climax of the epic, the protagonist Aeneas and the antagonist Turnus finally meet face-to-face, from which the Trojan prince, having dealt a decisive but non-lethal blow to his opponent, emerges as a victor. Turnus, “submissive and suppliant,” as described by the author (ille humilis supplic, 12.930), subsequently begs for his life, appealing to the Trojan’s pietas (dutiful conduct), Clementia (mercy) and his moderation (12.930-8). Aeneas gives these pleas their due consideration as “various feelings are turned over in his heart,” (tum pectore sensus vertuntur varii, 12.914-5). It is only after Aeneas spots the baldric of his slaughtered protégé Pallas on the defeated Turnus that he slays the native prince in a “terrible fury” (juris accensus, 12.946).

The climax of the epic can be and in fact has been studied from myriad perspectives, ranging from moral and philosophical to religious to pragmatic. Some commentators emphasize the bellicose nature of the native prince, suggesting that any kind of meaningful peace between the Italians and the Trojans would be ephemeral, while others attempt to study Aeneas’ journey and growth as a stoic hero. However, one particularly underappreciated fountainhead from which the climax of the epic has been analyzed is the juxtaposition of the events of Book XII with Anchises’ advice to his son in Book VI to “spare the defeated and conquer the haughty” (Parcere subiectis et debellare superbos, 6.853). This interpretation is particularly supported by the high degree of symmetry present between the last instance in which Anchises appeared in Book VI, which occurs at the end of the “Odyssean” portion of the Aeneid, and Turnus’ appeal to the hero’s father by name (Anchises genitor, 12.934) at the conclusion of the “Iliadic” section of the epic.2

In the final scene Turnus is described as humilis supplicaque, terms which denote the exact opposite of superbus. These descriptors would seem to imply that Turnus is not an enemy to be destroyed but rather the victim of circumstances beyond his control.3 Immediately before the fated battle between Turnus and Aeneas, the former finds that he cannot give a cogent account of his recent conduct. This is largely due to the fact that for nearly six books of the epic he was operating under the direct or indirect influence of the fury Allecto.4 Therefore there exists a certain degree of skepticism concerning the degree of responsibility which Turnus must bear for actions which he may not have desired or even brought about willingly.

References:
1Boyd (2002), p. 80
3Burnell (1987), p. 189
4Small (1959), p. 249

My summer project involved a partnership with two local not-for-profits: BRiDGES in Canastota and the Earlville Opera House in Earlville. My overall goal while at BRiDGES was to revamp their annual walk in September into a fundraising event that would draw more people and sponsors to the walk. As for the Earlville Opera House, it was my job to create short videos to promote more youth involvement in the various workshops and classes specifically aimed for younger generations.

At BRiDGES, I created various materials for the walk, which included registration forms, team rosters, invitations to local SADD programs at high schools, and save the date postcards for people who have regularly been involved with BRiDGES events. I also wrote letters to local businesses requesting either monetary or food donations, designed a t-shirt for the day of the event, and reviewed finance figures to make sure that the event will make a significant sum. Over the course of the ten-week period, I attended two separate fund development meetings. While at these meetings, I represented myself in front of the board members present and we discussed and edited the walk’s plans as a group.

At the Earlville Opera House, I filmed and photographed various performances at the Opera House and in the village of Hamilton. As I collected footage and photographs, I worked on creating a storyboard and conducting personal research to create the storyline of the videos. Part of this research included visiting the Quincy Square Museum in Earlville. I searched through different stockpiles of photocopied newspaper articles and used the clearest photos for sections in my informative video. In the end, I created two videos. The first consisted of using the vocals from a group performance and overlaying bits of their set-up and various shots from around the Opera House. This was meant to serve as a general advertisement for the great capacities of the Opera House as a venue. The second video was informative and was made with the help of a local youth who is a regular visitor of the Opera House. To organize this teamwork, Patti Lockwood-Blais suggested that I host a workshop. While ultimately only one person ended up signing up, we were able to work closely together to develop our storyline, capture film of the circus workshop going on that week, and learn how to use Final Cut Pro X back at the Colgate Case Library.

I believe that my experience this summer was one that will continue to help me in my final semesters at Colgate. I think the most important experience out of the entire summer was being placed into situations where, though I was unfamiliar with the exact nature of these specific not-for-profits and their fields, I was expected to be professional and communicate my ideas and plans with confidence. I was nervous coming into this internship, because I had only ever worked on different horse farms previously, but I now feel confident in my ability to expand my work capacities.
Research Fellow: Alexandra Pfiffner (2015)  
Concentration: Spanish

Faculty Mentor: Alexander Nakhimovsky  
Department: Linguistics

Title of Project: Corpus-based Online Dictionary of Jamaican Creole: A Study in Theoretical and Practical Lexicography

Project Summary:

English is the official language of Jamaica, but Jamaican Creole (JC) is the national language de facto spoken by approximately 3.2 million people. JC is an English-lexified creole language, meaning that its core vocabulary is derived from English. It exists mainly as a spoken language, but recently it has begun to gain literary merit. However, no standard exists to dictate orthography.

In September of 2002, the Jamaican Language Unit (JLU) was established within the Department of Language, Linguistics and Philosophy at the University of West Indies in Mona, Jamaica. Its mandate was to develop a standard writing system and support non-English-speaking Jamaicans with bilingual education programs. Thus far, they have standardized the Jamaican alphabet, but there still remains much to be done, especially in the area of dictionary support. A couple of dictionaries exist, but they tend to contain the definitions and etymologies of unusual words and phrases instead of common, everyday words. The purpose of this project was twofold: first to analyze the current situation in standardization, and then to contribute to the efforts of the JLU by documenting words and transforming the collected data into an online dictionary.

I) First, I examined the evolution in phonologic and orthographic practices of the basilect variety of JC. In creole studies, the acrolect refers to the most prestigious variety of a language. The mesolect is an intermediate variety, and the basilect is the less prestigious variety and furthest from the acrolect. The issues with standardization stem from the fact that JC exists on this post-creole continuum, and the boundaries between the acrolect, the mesolect, and the basilect cannot be easily defined by a given set of characteristics. Speakers tend to command a portion of the spectrum, and thus conflicts arise when attempting to classify the phonemic inventory. The JLU recently standardized the alphabet, setting precedents regarding disagreements over the number of long vowels and diphthongs as well as the palatal plosives /kj/ [c] and /gj/ [ɟ], the palatal nasal /nj/ [ɲ], and the glottal fricative /h/ [h]. I also examined the effects of co-occurrence restrictions, palatalization, labialization, and consonantal variations in regards to orthography.

II) Prior to this project, I had analyzed, documented, and compiled over 800 words written in JC from a corpus of texts provided to me by the JLU. Each source was examined word-by-word as I documented every translation along with its part of speech, notes, and any examples. This project continued my previous work, concluding with a total of over 1,200 words. I then took this data and created an online English–JC dictionary. This Internet resource will be useful in the JLU’s work towards establishing a written standard, as well as assisting students learning the Jamaican Creole and scholars studying it.

Source of Support:  
☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☑ UNST Div.  
☐ Other (specify):
Fern understory species have long been shown to operate as a filter, controlling the growth and survival of tree seedlings in Northeast deciduous forests and thus, have a major impact on the forests they inhabit (George and Bazzaz 1999). This project took this established phenomenon in the Northeast and set out to explore a vibrant understory fern species in the California Redwood Forests. The understory of California’s Redwood Forests are dominated by *Polystichum munitum* (Western Sword Fern) (Ellyson and Sillett 2003). More interestingly, the Redwood Forests range climatically from the dry-South to the wet-North with *P. munitum* dominating the understory throughout. This natural habitat experiment allows for scientists to observe ecotypic (ecosystem-specific) differences amongst populations of *Polystichum munitum* throughout the storied California Redwood range. Some ecotypic differences have already been observed by ecologists examining foliar uptake capacity and leaf morphology but this work is minimal and there is much room to build upon it (Limm and Dawson 1998). Before delving into the specifics of experimentation and the questions asked it is important to address why this is relevant. The California Redwood gradient is an important natural representation of how climate change may affect ecosystems. If the climate warms and the dry-Southern conditions persist North, it will be crucial for ecologists to know if specific forests can survive in their new climates. Critical to this survival, we believe, is *P. munitum* due to its understory presence. In short, by determining how specific populations of *P. munitum* differ and whether or not Northern species can survive in Southern habitats we can learn a lot about how this species and these forests may do in the face of a changing climate. To address this issue we asked if there were ecosystem-specific differences amongst populations of *P. munitum* sampled from across the California Redwood range. As there are a large number of relevant biological characteristics of ferns, the experiments run during the summer were merely a start to the large body of work needed to fully investigate this question. We started by looking at gametophyte development rates, gametophyte morphology, and soil growth factors amongst the *P. munitum* populations. The results, generalized, show there are statistically significant differences in the characteristics of *P. munitum* populations but far more work is needed to understand the implications of such differences.

**Figure 1:** Average spore germination percentages of *Polystichum munitum* populations from multiple Coast Redwoods ecosystems with standard errors. Spores were sown on plates of Bold’s Media agar and spore counts were recorded. After 12, 15, and 19 days, plates were analyzed for germination (denoted by significant rhizoid growth). Not shown in the figure due to no germination are spores from populations: Big Basin, Big Creek, Grove of Old Trees, Redwoods regional, and Jedediah Smith.

Figure 1 is a good representation of some of the project’s initial findings; in the gametophyte development stage there appear to be statistically significant differences between *P. munitum* populations. There are multiple ongoing experiments in the lab that hope to increase our understanding of this species. These include cross-growing *P. munitum* spores on soils from the varying Redwood Forests as well as precisely measuring characteristics like glandular hairs and overall gametophyte size. It is our hope that these experiments will better shape our understanding of *P. munitum’s* ability to survive in the changing climate.
Faculty Mentor: Julie Dudrick  Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

Through the Upstate Institute Summer Field School, I was placed with the Oneida County Historical Society in Utica, which consists of a research library and museum focused on preserving, collecting, and making accessible the history of the Oneida County and Mohawk Valley Region. During my time there, I completed a number of projects, including digitizing information, developing an online exhibit, and organizing their collection.

My main project was organizing, cataloguing, and accessioning roughly two hundred advertising and marketing artifacts in their collection. First, I created an inventory report, researching the provenance of each artifact and ensuring that they were properly documented in the Past Perfect software. However, many of the artifacts were not technically accessioned, so my next task was to create a proposal that advised what should be accessioned and what should be moved elsewhere. This involved more thorough research of each object using primarily the society’s archives. Eventually I accessioned roughly seventy new objects into the collection. I photographed, measured, and input all necessary information into Past Perfect. I also went through the process of officially marking the objects with accession numbers, which involved learning about the various techniques for different materials as to not permanently damage the artifact.

For my research project, I developed an online exhibit that explores the history of department stores in Utica. Using information from the society’s research library and archives, as well as Colgate’s databases, I looked at how the department store developed in that region, focusing on aspects such as store design and advertising. This allowed me to tie in my work with the collection by showcasing some of my finds on the website. Links to the website were published on their various social media platforms and allowed both society members and other interested parties to browse it.

Lastly, I continued the work of last year’s Upstate Fellow by creating digital copies of 19th century newspapers, making them more easily accessible for people doing research and aiding in their preservation by reducing the amount they are handled. I also contributed to their social media through Facebook and Twitter, as well as wrote bi-weekly blog posts that explored the provenance of objects in the collection of my choosing.

☑ Other (specify): Upstate Institute
Elevated levels of cytokines, small molecular weight proteins involved in the regulation of the immune system, are associated with depression. The molecular mechanisms of the selective serotonin reuptake inhibitors (SSRIs, Prozac, etc.) in relieving depression are unknown; however, these drugs reduce plasma levels of cytokines in depressed subjects. Activation of the immune system is also accompanied by an increase in the production of reactive oxygen and nitrogen species (ROS and RNS). Nitric oxide (NO•) is produced during inflammation by inducible nitric oxide synthase (iNOS) and nitrate, a by-product of NO•, is elevated in depressed patients.

In the central nervous system (CNS), NO• is synthesized by two constitutively expressed forms of NOS, endothelial NOS (eNOS) and neuronal NOS (nNOS). Microbial infections that cross into the CNS can activate microglia, the resident immune cell of the brain. Activation of the microglia results in an increase in cytokine production as well as in the induction of iNOS. Also, astrocytes, another neural cell, synthesize iNOS and can regulate the activity of microglia.

Mixed glial cultures containing primarily microglia and astrocytes were prepared from 2d rat cerebra. Treatment with lipopolysaccharide (LPS) stimulated the synthesis of iNOS in microglia and astrocytes. Nitrite release, an indirect measure of NO• production, was increased when LPS was added to the cultures. Fluoxetine (Prozac) at 15µM did not affect basal release of nitrite but significantly enhanced release of nitrite by 2-fold when cultures were treated with LPS compared to those cells treated only with LPS. Western blot analysis indicated the levels of iNOS expression increased in cultures treated with LPS and fluoxetine compared to those treated with LPS alone. Nortriptyline, a tri-cyclic antidepressant, also augmented nitrite release stimulated by LPS to a similar magnitude as fluoxetine. Purified cultures of microglia were treated with LPS resulting in release of nitrite. In contrast to what was observed in the mixed glial cultures, the addition of fluoxetine reduced release of nitrite stimulated by LPS. Nortriptyline also reduced the release of nitrite from purified microglia treated with LPS.

Two different classes of anti-depressants, SSRIs and tri-cyclic, were able to reduce nitric oxide production from mixed glial cultures stimulated with LPS. However, when microglia were treated with LPS in the absence of astrocytes, the antidepressants inhibited the release of nitrite. In mixed glial cultures, astrocytes secrete factors that inhibit iNOS synthesis in microglia. Our results suggest that the anti-depressants may inhibit the release of these factors increasing the level of nitric oxide production.
Research Fellow: Natalie Pudalov (2017)  
Concentration: Undeclared

Faculty Mentor: Anthony Chianese  
Department: Chemistry

Title of Project: Bifunctional Catalysts for the Hydrogenation and Dehydrogenation of Polar Bonds

Project Summary:

The research described herein supports the PI’s goal of developing catalysts for the hydrogenation and dehydrogenation of bonds to find a more sustainable method of storing chemical energy. Given the depletion of fossil fuels and humans’ dependence on energy, the development of catalysts that allow for chemical energy to be stored and retrieved is important. Currently, researchers and industrial corporations have mainly utilized Milstein’s PNN-pincer catalyst developed in 2005 to develop variants that hydrogenate esters to alcohols and dehydrogenate alcohols to esters.

The ligand that I began working on this summer was denoted CNN-1 to indicate that the metal binding sites include carbon, nitrogen, and nitrogen. This ligand has previously been synthesized and isolated in the Song & Sanchez labs in the literature, although it had never been purified in the Chianese lab. I was able to successfully synthesize, purify, and metalate this ligand by following the literature procedure as well as adjusting variables such as temperature, stoichiometric equivalents, and time. Although the literature cited a method of isolating the metalated complex, I was unable to use the described ratio of solvents to precipitate out a pure, metalated complex.

Previously, another individual in the Chianese lab had successfully synthesized the CNN-2 ligand and conducted preliminary catalytic trials. With more experience, knowledge, and a set of technical lab skills, I moved on to developing a variant of the CNN-2 ligand. By modifying the procedure utilized for the synthesis of CNN-2, I was able to synthesize, isolate, and purify the metalated complex of the CNN-2 variant. Future research in the Chianese will entail beginning catalytic trials on the CNN-2 variant.


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Figure 1. The scheme followed for the synthesis of CNN-1.

Figure 2. The scheme developed and followed for the synthesis of the CNN-2 ligand variant.
Research Fellow: Danielle Putur (2016)  

Faculty Mentor: Ahmet Ay  

Department(s): Biology; Mathematics  

Title of Project: Highly Multiplexed Quantitative Imaging with Combinatorial Fluorescence Probes  

Project Summary:  

For my project, I worked with Marc Birtwistle at the Ichan School of Medicine at Mount Sinai. The overarching goal for this project was to develop a new cell imaging technique using combinations of fluorescent proteins. Cell imaging is an integral part of systems biology research and single cell imaging technologies are currently limited because they predominantly require cell fixation and/or specialized and expensive equipment and reagents.  

This work is based on the hypothesis that combining combinatorially varied tandem fluorescent protein probes with multi-channel excitation spectral imaging allows for highly multiplexed quantitative imaging. A linear least squares model (Figure 1) that contains the reference spectra for each probe in each excitation channel and the emission spectra of a mixed sample should allow inference of the levels of each probe present in a sample containing unknown levels of each probe.  

Previously, an experiment with seven probes and three excitation channels has been done. During that experiment, the linear least squares model produced predicted levels of probes present with an error of ±0.0004 at 95% confidence. Because seven probes does not allow much more imaging ability than is currently available, this project aimed to build a large scale pilot experiment using eighteen probes at four excitation channels by first expressing and characterizing individual & tandem proteins.  

Due to varying levels of brightness and concentration for each protein, it was important to determine the amount of each probe needed to produce a signal in the mid-range of the plate reader (50,000 RFU). For each protein, emission spectra of varied concentrations of a protein were collected to determine optimum concentration. Once the optimum concentration was determined, a normalized reference spectrum was created for use in the reference matrix (Figure 2).  

We were able to conclude that (1) for each protein, a concentration that produced a signal intensity around 50,000 units was found; and (2) the emission spectra of tandem proteins results in a combination of emission spectra of the two individual proteins.  

We plan to continue the large-scale pilot experiment by testing if the model can correctly predict the levels of each fluorescent protein present based on the emission spectrum of the mixture. We plan to do this by adding known amounts of fluorescent protein to a sample, measuring the emission spectrum of the sample, and running it through the model, solving for the “levels” vector. We will know that the model works if the values in the “levels” vector are equivalent to the amount of fluorescent protein added to the sample.  

Source of Support:  

☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify): Systems Biology Center New York (SBCNY) Grant
Project Summary:

Over the summer, I served as Professor Lesleigh Cushing’s research assistant, compiling information relevant to her book. Professor Cushing intends to write a book entitled \textit{Reading the Bible from the Left}. In today’s political realm, the conservative right appeals to the Bible in order to justify its positions on social issues. The political left typically finds its justification in secular reasoning. Professor Cushing’s book aims to demonstrate how the left can also appeal to religious sentiments in order to defend its social positions, thereby reclaiming the Bible from the right. In conducting preliminary research, I covered a wide variety of topics, spanning from church-state relations to the problem of media bias.

During my time as Professor Cushing’s research assistant, I read nine books that had different areas of focus but were all loosely related to the topics of Biblical interpretation, political affiliation, social issues, and religious movements. Because the summer stage was the preliminary portion of her research, I was tasked with taking extensive and organized notes, which she would then use to guide her subsequent research. I read thousands of pages and condensed my findings into an approximately 100-page document, categorized by topic. By sifting through my compilation, she can now discover what is relevant, compelling and worthy of further exploration.

I was most surprised by the extent to which religious beliefs influence governmental policies. In reading about the connection between Biblical interpretation and political affiliations, I recognized how deeply ingrained religion is in America. Although not everyone identifies as religious, all Americans are subjected to the laws and policies of the nation, many of which were created for the purpose of maintaining religious influence or upholding biblical principles. While this in itself is not surprising given the biblical foundations of our country, I was astonished by the intensity and expanse of the intersection between religion and politics. Because of this strong connection, it is imperative that the left recognize it and, if they wish to garner political power and popular support, learn to frame their social positions in a religious context.

Professor Cushing’s book addresses the nature of politics, the influence of Biblical interpretation, the diversity of religious groups, and the complexity of social issues. Consequently, I had to familiarize myself with all of these topics, which allowed my research to comprise books ranging from \textit{Big Christianity: What’s Right with the Religious Left} to \textit{The Bible in Politics: How to Read the Bible Politically}. From minute details of the religious right’s political platform to general trends of religious demography in the twenty-first century, the books Professor Cushing assigned me allowed me to compile a comprehensive overview of relevant topics that will help inform her book’s direction. This project has also benefited me personally, reinforcing my interest in Religious Studies, sparking a passion for social justice, and directing my potential career path into the “Common Good network.”

\textbf{Source of Support}:  

\begin{itemize}
  \item HUMN Div.
  \item NASC Div.
  \item SOSC Div.
  \item UNST Div.
  \item Other (specify):
\end{itemize}
Title of Project: An Exploration of Supernova Light Curve Production Methods

Project Summary:

A type Ia supernova is a significant cosmic event in which a white dwarf star accumulates mass and material from a companion star to the point where the dwarf can no longer withstand the gravitational force pressing inwards, causing it to violently explode. Because all type Ia supernovae occur by this mechanism, and therefore all reach about the same luminosity, they act as useful astronomical distance calibrators. However, there is a difficulty which is inherent in photometric analysis of supernovae in that as a supernova fades, it becomes more and more difficult to detect and measure what little light is still being produced from the event. Though faint, this data is important, as the decay rate of a type Ia supernova light curve is related to the peak luminosity. Thus, by observing the peak brightness and inferring the luminosity from the decay rate, we can determine the supernova's distance from Earth. Standard methods of supernova photometry in the Image Reduction and Analysis Facility (IRAF) involve using pixel-by-pixel flux measurements across a circular aperture to define the centroid of this flux, which should be the center of the object. However, once a supernova is sufficiently faint, this process may fail due to weak measurements. Therefore, this project explores the use of a user-defined template as a rigid designator of the centers of objects rather than the result of an automated centroid calculation. This method was tested on type Ia supernova SN 1991M in the galaxy IC 1151, and the light curves produced were compared to previously published results.

The data used in this project is comprised of 144 images through V (visible), R (red), and I (near-infrared) filters that were taken from March through June of 1991 using two CCD cameras on the Ferson 16-inch f/14 Schmidt-Cassegrain reflecting telescope at Colgate University's Foggy Bottom Observatory. These images were processed for this project using IRAF, and photometry performed using both the “standard Colgate” aperture of 10 arcseconds in diameter and an aperture of 6 arcseconds in diameter as defined in a previously published paper (Ford et al, 1993). This second aperture was used to determine if our results were comparable to their work, while the first aperture was used for the comparison of our light curve production methods. From the “standard Colgate” aperture, light curves were produced using the “phot” command in IRAF using a nearby bright star as a comparison object to the supernova, and locations of the supernova and other stars determined by eye estimate. The results showed that the centroid fitting method generally produced measurements that were slightly brighter (lower magnitude) than the rigid template method once the supernova became sufficiently faint that it could not be seen in the images. This is expected, as the centroid method attempts to find the brightest point as the center of the object while the template can only be fit to each image frame by eye. However, the difference was sufficiently small that the centroid method was within the error range of the rigid template method, and so it ultimately would make no difference which method was used to produce scientific results in the future.
Remote sensing data taken of glacial ice in East Antarctica show rapid ice volume loss in recent decades. Though recent change is documented, the climate history of the region remains understudied and poorly understood due to the remoteness of the location, and lack of ship-based accessibility due to heavy sea ice concentration. During cruise NBP 14-02 to the East Antarctic margin marine sediment cores were collected off the Moscow University ice shelf with the aim of developing proxy climate records from the past several thousand years. The development of our proxy records is based on diatoms, microscopic marine algae sensitive to changing oceanographic conditions. In Southern Ocean sediments, the siliceous tests created by diatoms are well preserved, providing a history of environmental conditions, including past sea surface temperature, nutrient conditions and sea ice cover.

In this project, development of paleoclimate proxies relied on quantitative microscopic analysis of absolute diatom abundance, as an approximation of paleo-productivity and assemblage composition, related to a suite of paleoceanographic variables. Quantitative microscopy requires identifying and recording the abundance of approximately 55 diatom species, and analyzing change in these abundances throughout a sediment core. This summer, I began work on three cores from the same location, each recording a specific range in time. Core NBP14-02 MC 45 is a 45 cm core capturing the youngest, most recent sediment history by preserving the sediment-water interface. Core NBP 14-02 KC 27B is a three-meter core that captures some of the sediment-water interface as well as deeper sediments that record the history of the more distant past. NBP 14-02 JKC 53 is a six-meter core, which captures the older, deeper sediment records. Analysis of this series of cores that was taken from the same location allows for the development of a climate record that spans the past several thousand years. So far, the data document an unusual assemblage for a continental shelf site, with open-water diatoms dominating a system that has been inaccessible due to heavy sea ice. The anomalous assemblage is influencing our understanding of the presence of Circumpolar Deep Water, the Circumpolar Current, and how these oceanographic features interact with glacial ice on the Antarctic continent.
Research Fellow: Miri Reinhold (2015)  Concentration(s): Art and Art History; English
Faculty Mentor: Lynn Schwarzer  Department: Art and Art History

Title of Project: Modifications of the Self: An Exploration of the Unattainable Ideal through Self-Portraiture

Project Summary:

The portrayal of women in the media has become a topic of much controversy in recent decades. Movies, television, and magazines are full of heavily modified and excessively Photoshopped women, advertising an unattainable ideal image and body type to women around the world. Today, the internet is full of articles about the prevalence of eating disorders in society, exposés about the reality behind excessively modified media images, and a burgeoning movement to redefine society's definition of real beauty. My goal this summer was to explore, through self-portraiture in the forms of drawing, photography, and a combination of the two, the history, reality, and impact of the media’s portrayal of women. It was also intended as an act of artistic self-exploration, as I weaved my own experience with eating disorders into my work. I ended with six related but separate complete projects, and I will outline the three most successful here.

I began the process by researching image manipulation in the media, and confirmed that a majority of the women portrayed in advertisements today represent a body type that qualifies as anorexic and, for most women, is not attainable without pursuing unhealthy lifestyle choices. I also researched the history of ideal beauty, and I found an astonishing progression of ideal body types that has changed more or less every decade of the past century. I discovered that for each decade, there seemed to be only one concept of ideal beauty, despite the fact that female bodies are naturally more diverse. This led to the completion of one of my projects, The Photoshop Diet, a series in which I recreated six iconic images from the 20th century by photographing myself in the proper costumes and then using Photoshop to alter my figure to the correct proportions.

Further research into the use of women in advertising led me to the realization that the ideal sizes of women's bodies as portrayed in the media are directly correlated to that which is considered most attractive by the opposite sex. More specifically, the media presents an ideal in which women are pressured to shrink every body part except those which are considered sexual, such as breasts. At the same time, the fashion industry conveys an ideal body type that is almost synonymous with that of a child, with shapeless, boyish limbs, flat chests, and an overall emaciated figure. Therefore, in another project entitled Double Standard, I photographed a series of self-portraits demonstrating these contrasting expectations and illustrating the lengths to which women will often go to attain such ideals, such as liposuction, plastic surgery, bra-stuffing, etc.

The project I found to be most successful was one in which I explored my own experience with eating disorders in relation to the prevalence of eating disorders in society that I have found to be so greatly influenced by media images. This project was conceptual, and revolved around the emphasis women place on numbers and measurements: weight, waist circumference, etc. For this project, entitled Numbers, I photographed a series of images in which I wrapped a measuring tape around my legs, to emphasize the fixation on body size, and my mouth, to represent the oppressive and silencing experience of struggling with an eating disorder. Then, in Photoshop, I removed all the numbers from the measuring tape. My hope is that anyone viewing this project will be encouraged to think about why society places such a heavy emphasis on numbers when it comes to women's bodies.

My other projects included a series of drawings illustrating the emphasis on the negative space of a woman's body, namely, the much-coveted “thigh gap,” a self-portrait photograph that I then drew on top of to demonstrate my own tendencies in self-editing, and a series of portraits of my own denim shorts, one pair that I can wear now, and another that is too small from when my eating disorder had made me severely underweight. These projects are less successful, or less complete, but are still heavily grounded in my exploration of the topic.

Title of Project: Examining the Structure and Chemical Composition of the Crassostrea Virginica

Project Summary:

Crassostrea virginica create a biomineralized adhesive material to aggregate into colonies. This adhesive material is similar to that of other mussels. By examining the Crassostrea virginica's shell and cement hardness, we acquired a greater understanding of the structural components of the cement and shell and their chemical interactions. We investigated how the cement and shell structure influences the hardness value of one another. Projecting our research into the future, if the structure and elemental composition of the cement is understood well enough, it could be synthetically recreated and used as a biomedical adhesive and in many moist environments.

In our experiments, we examined both cross sections and flat down samples of Crassostrea virginica. Samples CVCS1, CVCS2, CVCS3, CVCS4, and CVFD1 were used. These samples were all chiseled from a larger organism, Crassostrea virginica. Using furenledyhe these samples were preserved embedded in epoxy using ten parts ULTRATHIN 2 Epoxy Resin (Cat. No. ULTRA-3000R-32) and one part ULTRATHIN 2 Hardener (ULTRA-3000H-08), and polished using the Nano-1000T Grinder Polisher.

Data Acquisition: We used three different methods to acquire hardness values for each sample. For each sample we used a digital microhardness tester at a force of .098 N. Indents were made in both the cement and shell of the four cross section samples. Indents were made approximately 10 um from each other. Each indent’s average diagonal value was measured using the digital microhardness tester, visual light microscope, and scanning electron microscope. When utilizing the microhardness tester, we measured the indent immediately following the indentation. When using the visual light microscope and scanning electron microscope to measure the indents, we took pictures of each indent and then used ImageJ to measure the two diagonals of each indent. In addition to using the SEM to image the samples, we also used the SEM to use EDS and the INCA program to analyze the chemical composition of each indent.

Calculation Methods: By measuring the mathematical average diagonal length for each indent, we calculated a hardness value, or HV using a formula: HV = Force/Area = .098 N/[(Diagonal 1 + Diagonal 2)/2]; where F is .098 N and d is the average of the diagonals. Then T-tests were run comparing the hardness values, specific to each apparatus, of the cement and shell separately. Standard deviations of T-tests were found. After acquiring the chemical composition of each indent, we found the average weight percentage of each element present in both the cement and shell. We found the standard deviation for each element.

Results

<table>
<thead>
<tr>
<th>Apparatus</th>
<th>P-Value</th>
<th>Null hypothesis rejected?</th>
<th>Cement Indents</th>
<th>Shell Indents</th>
<th>Indent Totals</th>
<th>Samples Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM</td>
<td>1.55E-28</td>
<td>Yes</td>
<td>78</td>
<td>26</td>
<td>182</td>
<td>CVCS3, CVCS4</td>
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<tr>
<td>Light Microscope</td>
<td>1.65E-39</td>
<td>Yes</td>
<td>107</td>
<td>59</td>
<td>166</td>
<td>CVCS3, CVCS4</td>
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<tr>
<td>Microindenter</td>
<td>1.5741E-37</td>
<td>Yes</td>
<td>126</td>
<td>133</td>
<td>259</td>
<td>CVCS3, CVCS4, CVCS1</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>607</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis (that there is no difference between the hardness of the cement and shell of the Crassostrea Virginicia) is rejected. 607 indents support this.


Research Fellow: Christian “Hunter” Robertson (2016)  
Concentration: Geology

Faculty Mentor: Karen Harpp  
Department: Geology

Title of Project: Preferential Weathering of Carbonatite Lava at Ol Doinyo Lengai, Tanzania

Project Summary:

Although carbonatites have been produced since the Archean and are preserved in the geologic record, the East African Rift is home to the only active carbonatite volcano, at Ol Doinyo Lengai. It has long been known that the natrocarbonatites become strongly weathered the first time they are exposed to rain. We studied the weathering patterns in the field and have determined the mineralogical transformations via petrography and XRD. Mass transport is assessed by XRF and ICP-MS analyses. Water preferentially dissolves specific minerals in the pristine lava, permeating through earlier layers of flow to form stalactites, which have differing mineralogical composition. These hang both from the host flow and from the bottom of underlying earlier flows. The weathering product is characterized by trona, a hydrated carbonate mineral, as well as the sodium sulfate mineral aphthitalite. Data from XRD analysis of the carbonatite lava confirm transformation of its original minerals, nyerereite and gregoryite, into secondary hydrated carbonate minerals gaylussite and pirssonite (e.g., Zaitsev and Keller, 2006). This transformation is attributed to the instability of the erupted minerals at atmospheric conditions. Data from XRF analysis indicate a 4-fold increase in the amount of sodium present in the stalactite as well as a 8-fold increase in potassium. Trace element analysis by ICP-MS indicates significantly elevated levels of vanadium, copper, and rubidium in the weathering product, whereas strontium, barium, lanthanum, and cesium are left behind in high concentrations in the carbonatite lava. Our results provide further evidence supporting the proposal by Dawson et al. (1987) that calcium carbonate dominated lava flows result from extensive weathering of sodic carbonatite flows.
Title of Project: Living Writers Intern

Project Summary:

The Living Writers program at Colgate University aims to study the questions facing contemporary writers and explore the complexities of their creative processes. The Living Writers class is an upper-level English class offered each fall semester to Colgate students. The students enrolled in the course study the works of ten award-winning authors who are selected by Professors Pinchin and Brice and visit campus over the course of the semester. Each author interacts with the students by visiting their class and also connects with the Hamilton community by giving a public reading and Q&A. All lectures given by Living Writers authors are also filmed on live stream to enable members of the Colgate and Hamilton communities to watch remotely.

As the living writers intern and research assistant, I read the ten works selected for the upcoming fall semester class and created in-depth research packets on each author and book. My research included a comprehensive list of all reviews, profiles, speeches, interviews and podcasts that were available online. In addition, I also collected sources that would contextualize the historical period and culture that the novels were set in. This research came from online databases, newspaper articles and encyclopedias, among other sources. I was also involved in literary analysis of the novels, including form, content, plot, narration, character development and major themes. After completing my research on a single author, I would meet with the professors to discuss literary analysis and critic responses.

The other integral part of my job was designing and uploading content to the Moodle and Edge.edX platforms for students, alumni, Hamilton residents and friends of the college. Used by the 60 Colgate students who were enrolled in the class, Moodle features a list of resources on each writer, including reviews and current events. Edge.edX, a MOOC platform, was launched this summer as the newest platform for Living Writers materials open to the extended Colgate community, alumni, Hamilton community and friends of the college who were interested in participating in the program.

Working with the IT department, communications department as well as the Living Writers team, I helped to craft the look of the Edge.edx site and fill it with the appropriate resources. While all ten writers were featured on the website, the site focused most on four of the most noteworthy authors visiting in the fall. The online course featured additional materials, including speeches, reviews and various pieces of multimedia, like playlists and TedTalks, about the authors. The online learning course also contained original video content created by Professors Pinchin and Brice discussing major themes within the novels and the live stream of each reading given by the visiting authors.

The final element of my internship was marketing-based work with the Colgate communications department. I helped to create Twitter and Facebook campaigns that would garner interest in the program as well as conduct a Twitter interview with one of the authors. The work of the marketing team, IT department and Living Writers team was directly responsible for the 700+ participants of the online course.

Project Summary:

This experiment on food choice conformity in zebra finches explored whether the birds, after being trained to prefer one color food over another, would switch their food preference when placed in an unfamiliar environment with birds that had learned the opposite preference. The Minority of One variation examined whether moving one bird at a time, as opposed to two (the number moved in the comparison experiment), would lead to higher rates of conformity. A study by van de Waal, Borgeaud, and Whiten (2013) found that this food choice conformity to a local group norm occurs in wild vervet monkeys, and the present four-part project sought to examine the same in finches. This study found overall significant evidence of food choice conformity in zebra finches. However, these results did not entirely hold up among all conditions of the experiment due to an apparent preexisting food color bias, and there was no significant difference between rates of conformity in the Minority of One condition as compared to the traditional study. Despite these inconsistencies, these results offer significant results to suggest that social conformity does exist in zebra finches.

As can be seen in this graph, across averages of both cages, there was significant aversion to the away food at $p(15)<.001$, significant decrease in home food consumption in the away cage at $p(15)<.001$, and significant increase in the consumption of away food in the away cage, at $p(15)=0.006$. These results suggest that zebra finches conform to social norms much like primates do, and future studies will hopefully provide a clearer picture of this phenomenon in zebra finches.
Project Summary:

This project involved analyzing the largely unpublished correspondence between Transcendentalists Ralph Waldo Emerson and Caroline Sturgis from the middle- and late-1800s in order to better inform a historical introduction of the published version of the correspondence which Professor Wider will be co-editing. While Emerson and American Transcendentalism are often considered synonymous, poets like Caroline Sturgis have received far less attention. Though feminist scholarship has flourished in the past 40 years, much of women’s contributions to American Transcendentalism have yet to be truly delved into and studied. The work on the Emerson-Sturgis correspondence is part of this larger endeavor to evaluate the roles played by the many women involved in Transcendentalism.

The project required additional research into each writer’s life as well as the larger societal context of the Transcendentalist movement. I focused on Sturgis’s and Emerson’s shared reading, the literary and classical allusions they made, and the local events in their area as well as beyond the New England area. In addition, I researched the other members of the Transcendentalist circle to understand the connection between Emerson, Sturgis and their mutual friends. I was also reading the letters in order to identify what needed footnoting and to work on the preliminaries for those footnotes.

Throughout the summer, Professor Wider and I met twice a week. By looking at the letters through a gendered lens, we discussed the different tones and personas that Sturgis adopted in conversing with Emerson, and the ways in which this shaped their relationship. Often, personas involved a master-and-apprentice (or child) dynamic between Emerson and Sturgis (respectively). This allowed Sturgis to speak more directly, as an unruly child. However, this was also limiting at times, because unlike the “young man in training” perspective, Sturgis could not express her ideas with the assumption that her words would be taken seriously and with room “beginner’s error”, but rather that her ideas were the folly of a child which need not be heeded, because she is incapable of being intellectually equal to a man. Though Transcendentalists challenged these societal norms, they also were products of them and often had to work within them.

On the other hand, Sturgis also adopted a persona as Emerson’s “Muse” and wise “Sybil”. Through this persona, Sturgis advised -and often criticized- Emerson’s writing and ideas. Cleverly, if Emerson did not respond positively (or did not respond at all) to Sturgis’s comments, she had the ignorant child persona to fall back on. Most of the time, however, Emerson accepted her ideas, and even integrated a few of them into his lectures. One of these ideas was that of Nature’s distinct features (clouds, mountains, rivers, and especially the ocean). There was a plethora of Nature imagery in Sturgis’s correspondence. Whereas Emerson had always focused on Nature in the context of (and subordinate to) human beings’ behavioral Nature, Sturgis differed in her literal approach to the idea. Throughout her letters she emphasized the importance of direct observation and description of natural phenomena, listening and attuning oneself to Nature itself, rather than our own (destructive) human impulsions. Perhaps some further questions to research are how often this woman changed such an influential man’s mind on certain topics, and to what extent he actually disseminated these ideas through his lectures and works.
Title of Project: Chronic Low-Level Exposure to Fluoxetine Affects Orconectes Rusticus Behavior, Molting, and Growth

Project Summary:

Pharmaceuticals such as SSRIS like fluoxetine are present in the water supply due to improper disposal and the inability of the drugs to be broken down by either the human body or the sewage system (Metclafe et al, 2009; Stryishave et al, 2010). These low concentrations of drugs can have varied physical and behavioral effects on aquatic life forms, including their locomotion habits (Mesquita et al., 2011; Thomas et al., 2012; Bossus et al., 2013). In this study, we focus on the effects of low concentrations of the SSRI and commonly prescribed antidepressant fluoxetine (Prozac) on the behavior, growth, and molting of crayfish.

The neurotransmitter serotonin has been shown to regulate molting, growth, and various aspects of behavior crayfish. Fluoxetine is thought to act by increasing the levels of serotonin at the synapse in the nervous system. Previous research has shown that the presence of fluoxetine in the water supply increases locomotion in several species of aquatic life (Mesquita et al., 2011; Thomas et al., 2012; Bossus et al., 2013). Other studies of crayfish behavior indicate that the animals experience anxiety-like behavior due to increases in serotonin (Fossat et al., 2014). Therefore, we hypothesized that higher fluoxetine concentrations would cause an increase in crayfish locomotion, and that this locomotion may indicate a higher presence of anxiety in the crayfish. Previous work in this lab yielded qualitative observations of potentially lessened growth after molt upon exposure to fluoxetine, leading us to also predict reduced growth post-molting in higher concentrations of fluoxetine.

We collected 75 male crayfish from Payne Creek in Hamilton, NY. Each crayfish was weighed and measured for claw and torso length upon capture. We housed each crayfish in separate tanks filled with dechlorinated water. We let them acclimate to their new environment for seven days. We then filmed each crayfish in an activity arena (Figure 1) for one hour. We coded the first and last 15 minutes of these tapes for four behaviors: the number of external squares crossed, the number of internal squares crossed, the time spent inside the shelter, and the time spent “cornering” (Figure 1).

The number of external squares crossed represented the general activity level of the crayfish, and their tendency to explore the new environment of the tank. The number of internal squares crossed was a measure of boldness, as crayfish typically only explore the perimeter of new environments. The amount of time spent in the shelter indicated habituation to the arena. Cornering—when the crayfish moved his claws back and forth one of the corners—indicated a cessation of exploration and a possible focus on a route of escape. It also allowed us to quantify active movement that was not shown through the number of squares crossed. This round of filming allowed us to observe the crayfishes’ behavior before drug administration.

After the first round of filming, we placed the crayfish in water that contained concentrations of fluoxetine—0 μg/L, 2 μg/L, 200 μg/L, and 500 μg/L. We gave the animals 7 days to acclimate. We then re-filmed the crayfish and coded for their behavior in the previously described manner.

Analysis of these videos indicated that crayfish were in general more active with higher doses of fluoxetine. We found a significant increase in the number of external squares crossed in several concentrations of fluoxetine (Figure 2). We also found a significant decrease in time spent in the shelter in the 2 μg/L concentration in comparison to the control (data not shown). Additionally, we also found a general trend of more time spent cornering for higher concentrations of fluoxetine, though this did not reach statistical significance (data not shown).

We completed a third round of filming after each crayfish had molted. We expected all the crayfish to molt from their non-reproductive to productive form around the same time (Tierney et al., 2008). However, some crayfish molted earlier or later than expected, making it difficult to get clean data on the behavior crayfish after molting. We saw no significant results from any of the coded behaviors. However, we did have an unexpected result of an increase in growth for higher concentrations of fluoxetine. More research is necessary to fully understand the effects of fluoxetine on molting, growth, and behavior in crayfish.

□ Other (specify):
Title of Project: A Conflicted Narrative: Textbook and Monumental Representation of the Korean War in South Korea

Project Summary:

Remembrance of the Korean War differs in different countries. In the US, the war was commonly referred to as the “Forgotten War,” for its relative obscurity compared to the Vietnam War. In North Korea, the war is called the “National Liberation War” to celebrate the nation’s efforts to free itself from foreign powers. In South Korea, the Korean War is officially termed the “June 25 War,” a name that highlights the date of North Korea’s invasion that started the War. My research studied the remembrance of the Korean War in South Korea by looking at textbooks and Korean War monuments to see how the Korean War had been and continues to be represented.

The Korean War was central to defining South Korea’s identity as a nation. The Korean peninsula had been divided in two in the aftermath of World War II. Military governments of the US and the Soviet Union governed the southern and northern parts of the peninsula until 1948, when separate elections resulted in the founding of two different nations. With the backing of the respective military governments, Syng Man Rhee rose to power in South Korea and Kim Il Sung came to rule North Korea. In South Korea, the Korean War was used to justify the legitimacy of South Korea. Emphasis was placed on the illegal nature of North Korea's invasion of South Korea and the atrocities committed by the communists. South Koreans after the Korean War emerged with a shared antipathy toward North Korea, the North Korean regime, and North Korean communists. In this sense, the Korean War solidified divisions between North Korea and South Korea.

I traced the development of such a “Cold War narrative” of the Korean War, paying specific attention to textbooks that were published in the wake of the conflict. A narrative that emphasized South Korea as a victim of North Korean aggression emerged in the Syng Man Rhee administration, and this narrative was perpetuated and solidified during the military regimes that followed. These narratives present a decidedly biased representation of the war by neglecting to mention violence committed by both sides. With the democratization of South Korea in the 1980s and 1990s, the official narrative incorporated other aspects of the Korean War, paying attention to the victims of the Korean War. I also looked at monuments that remember the Korean War, such as the Imjingak Resort, No Gun Ri Peace Park, the Third Tunnel of Aggression, and the Osan UN First Battle Memorial, paying attention to how the spaces changed over time and were repurposed to portray different aspects of the Korean War. The change in the narrative tended to mirror the change in textbooks. These memorials tried to distance themselves from previous narratives of the Korean War by primarily emphasizing the need for peace, at least on the surface. The emerging narrative seems to be a conflicting one. The Korean War technically is not over. It was an armistice, rather than a peace agreement, that ended the War. For this reason, the official narrative created during the Cold War tensions frames the recent emphasis toward peace. The continuation of memories in Korean War monuments and a textbook narrative that employs tactics borrowed from an earlier time seems to suggest that the current narrative of the Korean War is still inextricably tied to its Cold War origins.

Research Fellow: Crystal Sawh (2015)  Concentration(s): English; Environmental Studies
Faculty Mentor: Julie Dudrick  Department: Upstate Institute
Title of Project: Upstate Institute Summer Field School

Project Summary:

Interning at the Legal Aid Society of Mid-New York as an Upstate Institute Fellow has been a rewarding experience that I will take with me for the rest of my life.

In brief, the Legal Aid Society of Mid-New York is a not-for-profit organization that provides legal services to low-income individuals. My summer at the Legal Aid office primarily consisted of assisting a paralegal who specializes in divorce proceedings, with a wide array of duties. My weekly schedule included everything from assisting in the completion of no-fault divorce packets to contacting clients and scheduling meetings. While a significant portion of my summer was designated to these tasks, I also organized the Advocates Network’s first training event for the year.

The Advocates Network is an alliance of not-for-profits and governmental agencies that strives to maximize and improve the services provided by local agencies that assist marginalized communities. Everyone at the involved agencies, from frontline workers to board directors, receive training on various topics through a series of workshops. The Advocates Network was developed after the community identified a pressing need for stronger communications between organizations that assist the poor. Therefore, coalition building is central to the success of the Advocates Network.

In order to assure the success of the first Advocates Network training, I contacted over 100 agencies in the mid-New York area to build a database of potential supporters of the Advocates Network. Aside from creating the database of contact information, and learning the ins and outs of excel, I assisted in the creation of a “save the date” memo and formal registration form. These processes have given me a greater understanding of the amount of preliminary work and attention to minute details that planning an event demands.

I can confidently state that after interning at the Legal Aid Society of Mid-New York this summer, I am more equipped for life after Colgate and a profession in the legal field.

Research Fellow: Simone Schenkel (2014)  
Concentration: Peace and Conflict Studies

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Upstate Institute Summer Field School

Project Summary:

This past summer I worked in the city of Norwich at the Chenango United Way. Throughout the summer, I gained exposure to a wide range of activities within the context of a nonprofit organization. As a forum for local non-profit partners to gather and address significant issues stemming from widespread poverty across Chenango County, the Chenango United Way is at the center of promoting community impact, conducting needs assessments, and facilitating communication across the public and private sector. My position with the Chenango United Way allowed me to work directly with a variety of stakeholders from around the community who focused their efforts on mobilizing limited resources to make a wide impact. Additionally, I had the opportunity to be extremely hands on in both day-to-day operations as well as long term organizational goals as an integral member of a dynamic three-person office.

My main project was to organize and oversee the mid-year site review process. As the mid-year site visit coordinator, I worked with 21 programs within 14 nonprofit organizations across Chenango County throughout the summer in preparation for site visits with directors from each respective program. This included oversight of the scheduling process and visit logistics, revision and distribution of post-site visit evaluations, and the compilation of a comprehensive Community Impact Report to assess each organization. Additionally, I worked closely with Chenango United Way’s vibrant Board as well as a Review Panel Committee of board members, whom I consulted for valuable input on each organization’s mid-year visit. In this capacity, I spearheaded the effort to increase the accountability of agency and program directors by facilitating open communication of program updates. This resulted in high levels of director engagement leading up to all 21 Mid-Year Site Visits, increasing efficiency and transparency among a spectrum of stakeholders. Additionally, within my function I also edited various communication materials and research federal and state policy changes for potential local opportunities. Through this experience, I have been able to solidify my organizational and programmatic skills while also providing general office support.

[ ] Other (specify): Upstate Institute
Title of Project: Deformation Structures and Fluid Chemistry in a Subsurface Decollement Zone, Marcellus Formation of New York State

Project Summary:

The Alleghanian orogeny caused regional deformation in the Appalachian Foreland, in particular a series of layer-parallel décollement zones in the basal Marcellus Formation in southern and central New York State. A rock core taken from the lower Marcellus in Tioga County, NY shows evidence of fluid migration during deformation, synchronous with hydrocarbon maturation. The core includes depths of 4048 ft to 4252 ft and consists of black carbonaceous, fine-grained siltstone with a section of grey fossiliferous, fine-grained limestone that is part of the Cherry Valley Member of the Marcellus. The décollement zone is a 10-15 ft interval at the bottom of the core; other intervals higher in the core also show evidence of low angle shearing and minor deformation. The major zone of deformation is characterized by steeply dipping slickenlined surfaces, as well as calcite-filled fractures formed during brecciation.

The décollement zone includes an isoclinal fold that is detached from the lower region by thrust surfaces. The calcite in the veins is used to compare stable isotope data to surface outcrops of this unit. Resistivity logs are also being used to find the orientations of the fractures and slickensurfaces to predict movement and compare this movement to other localities.

Chips from varying regions of the core are analyzed using the Scanning Electron Microscope in order to document the habit of pyrite, calcite, organic material, and other minerals present. Hydrocarbon found in micro-fractures is also being documented. Thin sections of the calcite fractures are used to find fluid inclusions to determine the temperature of the fluid during precipitation. We can also determine the salinity of the fluid, and use gaseous inclusions to determine the abundance of hydrocarbon in the fluid during deformation.

Our research project aimed at looking into the social and political lives of African Americans in New Jersey. I had the privilege to work with two other research assistants, Warren Dennis and Li Jiang, for the project. We amassed a large collection of African American newspapers from around in order to look into the subject. We used collections from both New York and New Jersey in order to find a breadth of sources. Using microfilms, we were able to read the original newspapers and collect any relevant information.

Our project spanned from 1902 through 1974 and covered the issues of segregation, political advancement, and economic diversity. We fished through information of riots, political upheaval, and backlash from white supremacy groups such as the KKK. Our research combined many different aspects of life – we looked into sports, politics, economics, judicial issues, and national news stemming from New Jersey. By combining all of these sectors we were able to truly understand how life was changing for minority groups in the north. The implementation of African American troops at Fort Dix was a major moment of change and called for desegregation. Petitions over segregated beaches brought the issue of segregation into the realm of social life, not merely political life. By reading these newspapers we were able to understand the general struggle that African Americans of the time faced.

During this project we were able to unearth many important stories that the general public has no knowledge of. We were able to trace the push for an African American mayor in major cities such as Newark and Atlantic City. In Atlantic City, we were able to follow the meetings of the NAACP (National Association for the Advancement of Colored People) and other important groups that fought for equality and desegregation. We were able to trace the economic developments of African Americans in the area and follow their struggle for equal pay and hiring rights as well.

By combining this information together, we three researchers were able to get a crash course in social history. We learned that many facets are necessary to create a comprehensive history of any population. I believe it made us better researchers, as we were forced to use unfamiliar microfilms and choose which newspapers were the most accurate. This information will be compiled over the next term and will be published in the spring. It will provide a history that looks into many different aspects of life. It will hopefully prove to people that the north was not devoid of racism or segregation, and that the struggles faced by African Americans are important in tracing our history as Americans.
Title of Project: Transposons in Annelids

Project Summary:

This past summer I worked at Auburn University, Alabama under Professor Damhnait McHugh’s NSF grant to do some research and learn more about bioinformatics. I attended a week-long bootcamp about bioinformatics and proceeded to work in Professor Scott Santos’ and Professor Ken Halanych’s labs.

My project focused on transposons found in the phylum Annelida. Transposons or transposable elements are segments of DNA that have the ability to "jump" from one place to another in the genome. There are multiple types and classifications of transposons depending on the order of the different genes in the transposon and the way these transposable elements insert themselves to another part of the genome. Almost all phyla have transposable elements and because of this, transposons can give a lot of information about the evolutionary relationships among organisms of different branches in the phylogenetic tree. Transposons have been discovered and studied in several phyla, but only a few of them have been studied in the phylum Annelida.

FASTA sequences of transposons found in several invertebrates were acquired from RepBase, a public database containing data on repetitive DNA sequences found in a wide variety of taxa. These sequences were used to fish out annelid genes from transcriptomes, archived in Professor Scott Santos’ lab, with highly similar regions to the DNA sequences from the RepBase database. The Basic Local Alignment Search Tool (BLAST) algorithm was used to compare the sequences and find regions of high similarity.

I found multiple transposon-like genes from the transcriptomes of 11 species of annelids representing the main branches of the annelid evolutionary tree. This indicates that there is a possibility that there are transposable elements in annelids similar to other invertebrates. By looking at the transposable elements present in each of the species, we can use these data to better understand the evolution of transposons in animals and to test phylogenetic hypotheses for the main annelid groups.
Research Fellow: Allison Shafritz (2015)  Concentration(s): Environmental Economics; Geography

Faculty Mentor: Peter Scull  Department: Geography

Title of Project: Ethiopian Church Forests: A Land Cover Change Analysis

Project Summary:

In the South Gondar region of Ethiopia, there are thousands of ancient Ethiopian Orthodox Tewahido Churches, each one surrounded by a forest ranging in size from less than one hectare to over 150 hectares. As the only remaining pockets of native forest in an otherwise degraded landscape, these church forests may be the key to conservation and biodiversity in Ethiopia. Priests, church leaders, and schoolchildren reside within the forests and help to guard them primarily for their spiritual value. While previous research has shown that church forests are disappearing and degrading, our research uncovers a much more complex story involving many internal and external pressures on the church forests, such as deforestation surrounding the churches and the planting of exotic species. The goal of this project is to assess both the ecological status and social management strategies of our study forests and use this information to guide conservation strategies. This is an interdisciplinary project that includes five Colgate professors from the Geography, Biology, and Religion departments, as well as two researchers from Ethiopia. As a research student on the geography side of the project, my primary task was to complete a land cover change analysis from 1962 to 2012 to find out how much the forests have changed in size and crown closure over the last 50 years.

In order to conduct the land cover change analysis, I used ArcMap, Google Earth, Google Maps, and other GIS software. I used a past research student’s data to locate over 1022 forests and then drew a polygon around the forest edge for each one. This was completed for two different time periods; cold-war era historical imagery was used to draw the polygons for church forests in 1962 and Google Earth imagery was used to draw polygons for forests in 2012. Using GIS software, I then calculated the area and crown closure (a measurement of percent tree cover, in five ordinal classes) for both time periods and compared the data to find the change over time. Our data shows that there has been a significant mean increase in forest size and a significant mean decrease in crown closure over time. This data was then used in conjunction with ecological data to determine forest ecosystem health and how ecological status relates to external factors.

In the middle of the summer, there was a conference for the five Colgate professors and the two researchers from Ethiopia to share recent findings and plan future research. To prepare for the meetings, I helped to compile and organize all the information we had for the thirteen study forests and created visual and tabular geographical data sets. At the end of the conference, we identified 15 new study forests to further explore in a different region of our study area.

Towards the end of the summer I began looking more into deforestation of land outside of the church forests. Using ArcMap for historical imagery and Google Earth for modern imagery, I created 80 random one-by-one kilometer plots of land within our study area and counted the percentage of tree cover within each plot in 1962 and 2012. This tree cover change analysis, along with a review of existing literature, is the first step in the deforestation study, which I plan to pursue further as an independent study.


☐ Other (specify):
Title of Project: Women and Recruitment

Project Summary:

The Baby Boomer generation is aging, and by 2030, nearly 20 percent of Americans will be over the age of 65. White, middle class women of this generation, born between 1946 and 1964, were the first to permanently enter the workforce. They are thus the first generation of women to experience retirement from these more continuous work roles. Research on retirement, however, has only recently begun to examine women’s experiences with this life transition. Our study seeks to contribute to this growing literature on women and retirement. In particular, we take an interdisciplinary approach to further investigate women’s attitudes towards retirement and their retirement decisions. Our first study utilizes interviews with 17 women who self-identify as retired. The second study draws from data from fear lists and questionnaires pertaining to retirement satisfaction and relationship quality completed by 45 female retirees. By looking at these two data sets in relation to one another, we are able to get a better sense of the factors that influence women’s decisions to retire, women’s fears about retirement, and how marital relationships might play a role in women’s attitudes towards retirement. What we find is that women’s retirement experiences are complex; for these women, retirement is simultaneously a time of loss and liberation, and relationships play an important role.

In the first study, women were asked a comprehensive set of questions about their retirement experiences. We then used an iterative open-coding process to identify common themes, helping us understand the complex interplay of factors that shape women’s retirement. Study 2 was used to support and expand on the findings of Study 1. For Study 2, female retirees listed up to ten fears about retirement. We then coded each fear as one of 26 different types of fears, and coded participants’ entire fear list using a 5-point scale for diversity of fears, overall health fear, overall relationships fear, overall financial fear, overall loss of purpose fear, and overall fear of retirement. To explore why women retire, what makes it enjoyable, and their satisfaction with retirement, we used the Retirement Satisfaction Inventory (RSI; Floyd et al., 1992). We also looked at the Dyadic Adjustment Scale (Spanier, 1976), Perceived Partner Responsiveness (PPR; Reis, Clark, & Holmes, 2004), and the Investment Model Scale (IMS; Rusbulst, Martz, & Agnew, 1998) to assess retirees’ relationship quality with their spouse. By looking at the average ratings for these measures and how they correlate with one another, we were able to better understand women’s retirement fears, see how relationship quality influences women’s retirement experiences, and see how many of the Study 1 factors interact.

Looking at Study 2 in conjunction with Study 1, the most notable findings are as follows. Out of the many factors that influence women’s decision to retire, wanting to pursue their interests had the highest mean rating. Additionally, the more women felt they retired due to external pressures (such as job stress, health reasons, or employer pressure) the less satisfied they were in retirement. We also found that women greatly valued freedom and control in retirement. However, those who rated freedom and control as greatly adding to their retirement enjoyment tended to have more time-related fears (such as becoming lazy, bored, or figuring out how to fill one’s time). In examining retirement fears, we found that on the whole women were moderately fearful of retirement, and that how fearful women were significantly negatively correlated with how satisfied they were with retirement. We also found that women were particularly fearful about relationships, such as how retirement will influence their relationship with their spouse, losing friends and loved ones, and loss of work friends. Despite relationships being a significant fear, we found that the better a woman’s relationship quality with her spouse, the more satisfied and less fearful she was in retirement. Overall, these studies reveal women’s retirement experiences are complex, marked by newfound freedoms and enjoyment as well as fear, which are shaped by that circumstances that lead one to retire, the opportunities available in retirement, and relationships.

In addition to learning more about an area I’m passionate about, this research experience gave me the chance to learn how to synthesize qualitative data, create and use a coding system, and analyze quantitative data in SPSS. I also learned the process of writing a journal article, which will be submitted for publication soon.
Research Fellow:  Celia Sherry (2015)  
Concentration:  Chemistry

Faculty Mentor:  Jason Keith  
Department:  Chemistry

Title of Project:  Effects of ligand variation on 1-hexene polymerization by zirconium amine bis-phenolate catalysts

Project Summary:

This summer I conducted computational chemistry research under the supervision of Professor Jason Keith. Computational chemistry is used to determine the most likely order of kinetic steps used to create a molecule. There are many ways to get to a product from reactants, and this form of chemistry uses several computer softwares to determine the most likely route taken.

Specifically, I studied the effects of varying the ligand attached to a zirconium amine bis-phenolate catalyst on 1-hexene polymerization. This work has been previously performed and reported by chemists at Purdue University, so my work will act as a review of their methods and results. In order to conduct this research, I utilized GausView and Gaussian to calculate the energies of each kinetic step and the energy barriers between steps. I will continue this work as part of my senior research this year as the project is not yet complete.

Source of Support:

☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.
☒ Other (specify):  Warren Anderson Fund
Research Fellow: Tiong Hua “Andy” Sia (2017)  
Concentration: Geology

Faculty Mentor: Constance Soja  
Department: Geology

Title of Project: Geology pamphlet and curriculum materials for Glacier Bay National Park, Alaska

Project Summary:

I am reviewing and consolidating scientific literature on prehistoric Glacier Bay, which is located in present-day Alaska. Specifically, I am looking into the geology and paleoecology of the area during the Silurian (about 420 million years ago), which in large part is understood through clues provided by fossilized reefs. The Silurian is so important because its rocks form a kind of “basement” for the hundreds of millions of years to follow.

After gathering the relevant data and information, I have rewritten and simplified the research conducted by Professor Soja and Colgate geology students. I am ensuring that there is minimal scientific jargon (and, if this is unavoidable, a simple explanation accompanies the scientific term), and using an engaging and readable prose without compromising the spirit of the original research. My work is formatted into a scientific pamphlet, which will be submitted to Glacier Bay National Park and Preserve, where the public can view it at the park and on its website.

In addition, I am devising and submitting educational strategies/activities to Glacier Bay National Park, as it pertains to the Silurian rocks. Although the national park is already hosting various educational activities for school children, little of the education focuses on the rich geologic history of the area. I am, for one, thinking of designing an interactive fossil hunting and identification activity. Thus, I will be doing further research on specific localities and policies of the park, among other things, to check the feasibility of my educational project.

Source of Support:  
☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Bob Linsley/James McLelland Fund
Project Summary:

How beneficial is Open Farm Day to the local food movement in Madison County?

This summer I worked with the Cornell Cooperative Extension Office in the Agricultural Economic Development program. My research for the summer was directed towards finding out how local farmers are gaining a larger market share among the residents of Madison County and what may be done to further improve this. Every July, the AED program organizes Open Farm Day at approximately 35 farms of Madison County. On this day, the farms welcome all visitors who may be interested in how local produce is grown or reared on the land. It is believed that once people understand the local farmers’ hard work that is put into providing the local produce, the visitors would be more likely to switch from the larger food companies.

Open Farm Day was originally a part of a larger week-long event before AED separated it to a different program that lasts for one day. Thousands of locals visit these farms where all forms of entertainment are set up as attractions. Visitors arrive at the farms with Open Farm Day passports that they can stamp to keep track of which farms they have visited. Both the visitors and the farmers submit a survey on Open Farm Day which the AED uses to understand how effective the day is in creating awareness of the local opportunities for agriculture.

It was my responsibility to update the previous Open Farm Day surveys for the farmers and the visitors. With help from the staff at AED, I organized a secondary survey that asked more specific questions about the experience of the visitors on Open Farm Day. The secondary survey was conducted in the form of a dot survey with boards placed on easels at the farms. Visitors walking by indicated their answers on the boards using the dot stickers. After Open Farm Day ended, I collated all the data from the surveys and presented a report to the AED staff. This report is intended to gauge the effectiveness of Open Farm Day and highlight issues that may exist in the event in terms of logistics e.g. navigation and maps used for locating the farms by the visitors.
Title of Project: Developing Survey Instruments for Environmental Initiatives

Project Summary:

This project involved developing survey instruments related to two research projects. One of the surveys is related to research on the US National Park System. The second survey will be used to evaluate the impact of a theatre and arts festival about climate change to be held in Morrisville State College in Spring 2015. Part of my job involved assisting Professor Galusky with developing the arts and theatre survey.

The other project, related to the NPS sites, is to investigate the issue of benefit transfer. The issue is whether estimates from one park site can be used to measure values related to other park sites. For this study, I aided Professor Turner in developing a survey instrument that can be used for several units of the NPS. In addition, I assisted Professor Turner by developing a benefit transfer literature review which helped him to submit a proposal to NSF-RUI for funding the survey implementation.

□ Other (specify):
Project Summary:

There were three major components to the research I did for Professor Thomson this summer. The first project concerned the relationship between trauma and storytelling. Initially, Professor Thomson and I were going to interview refugees at the Mohawk Valley Resource Center for Refugees in Utica, NY to learn about their experiences and better understand how telling one’s story can potentially help PTSD symptoms. Additionally, the refugees’ direct knowledge could be used to inform scholarly work with lived experience. However, the Refugee Center did not have the ethical protocol established to enable this project. Instead, I used the Colgate Library to find books and articles related to these topics and cited annotated them. I kept track of the keyword search terms such as “storytelling,” “narrative,” “trauma,” and “transgenerational.” These annotations were intended to help compose the preliminary steps of a literature review for a book Professor Thomson is considering writing about the relationship between storytelling and trauma, particularly in the lives of refugees. In relation to this project, Professor Thomson and I attended a conference in New Hampshire titled “Coming to Terms with After: A New England Colloquy” at Keene State College, which focused on trauma and storytelling, especially in relation to sexual violence and mass violence and bearing witness to trauma.

Professor Thomson is writing a different book about Rwanda from 1994 to 2014, and has therefore set up google alerts to notify her of any internet sources containing the keywords “Rwanda” or “Kigali.” My job was to go through past articles, cite and summarize them, and organize them according to social, political or economic relevance. The purpose of these annotations was to provide Professor Thomson with a means to monitor media activity in Rwanda and identify how the Rwandan government influences what stories are reported and how they are told.

The third component entailed research about how authoritarian regimes market themselves on the international scale and manage the image they present to their citizens and to the world, a practice often referred to as ‘extraversion.’ I read various authors on these topics that focused on case examples in Mauritania, Guinea, Kyrgyzstan and Kazakhstan, and I cited and annotated these sources. Later, I read and annotated speeches by President of Rwanda, Paul Kagame so Professor Thomson could begin to examine what kind of extraversion and image management might be occurring in Rwanda.
Title of Project: Study of Iridescent Shells using Optical Polarimetry

Project Summary:

Research Goal
The purpose of my research is to find out about the composition of the Pinctada Fucata shell by analyzing the polarizing effect of the shell normally and then with organic materials removed to see the effect of the organic materials on the shell composition.

The Physics Polarization
Light travels in a wave that propagates in a specific way; this is called the polarization of the wave. The picket fence analogy helps illustrate this idea and how polarizers work. Polarizers only allow light polarized in a specific direction to pass through.

About The Shell
The shells are comprised of a layering of materials; the outermost is a prismatic layer of calcite. The center layer of the shell is nacre; the material pearls are made from.

The bivalve shell, which has nacre, or iridescent part of the shell forms in layers of tablets, organized as spiraling steps. There are organics that are believed to hold the tablets in such a structured brick wall-like fashion.

Wave plates alter the state of polarization of a light wave. A collection of half wave plates and quarter wave plates were used for this experiment. The incoming light would be converted to each of six polarization states and then sent through the sample, where the shell would act as a wave plate and convert the light to a different polarization. Then the light is converted to each of the six polarization states, making 36 images per data collection. Matlab scripts were written to convert these images into a Mueller Matrix.

A Mueller matrix is a collection of 16 images compiled from taking photos of all the possible polarization states. A lot of information can be obtained about the shell by analyzing the Mueller matrix. For example, from a Mueller Matrix it can be proven that a sample acts like a specific optical device, which is something the project is heading towards achieving in the future.

Another aspect of the project was not only transmission through the sample but reflection as well. The setup was rearranged to record the light once it was reflected off of the shell. This was interesting because from the initial review of the matrices it seems to coincide with the findings from the transmission matrices.

Research Fellow: Peter Swiggett (2015)  
Concentration: Geology

Faculty Mentor: Bruce Selleck  
Department: Geology

Title of Project: Trace Element Geochemistry of the Basal Marcellus Formation: Tioga County, New York State

Project Summary:

Trace element geochemistry is used to predict the hydrocarbon potential of black marine shales (Lash and Blood, 2014). In this study, a drill core from Tioga County in southern New York is the subject of geochemical analysis. The core includes the basal interval of the Middle Devonian Marcellus Formation, consisting of the Cherry Valley Member and Union Springs Member.

Trace element geochemistry was analyzed using a portable X-Ray Fluorescence device in direct contact with the surface of the core in six-inch intervals. This method is used increasingly in the oil and gas industry when analyzing the production potential of hydrocarbon source rocks. In order to monitor the accuracy of the device, ten samples taken from various Marcellus outcrops were analyzed using standard x-ray fluorescence analysis. These samples were then analyzed with the portable XRF device to create a calibration curve for each element.

Trace elements of particular interest in this study are molybdenum, barium, uranium, aluminum, iron, and thorium. The relative abundances of these elements are useful in determining bottom water conditions at the time of deposition and later diagenetic conditions, which in turn helps determine the quality of organic-rich intervals in relation to hydrocarbon production (Lash and Blood, 2014).

References:

Source of Support:  
☐ HUMN Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Doug Rankin ’53 Endowment-Geology Research
Title of Project: Mouse Embryonic Fibroblasts Null for Krüppel-Like Factor 4 Show Reduced Autophagy and Elevated mTOR Activity

Project Summary:

My research under Professor Hagos this past summer focused primarily on studying autophagy - a process by which cells recycle dysfunctional components, or ones with abnormalities – and the role of KLF4 in regulating autophagy, as well as other facets of the mTOR pathway (an important pathway that plays a crucial role in aging, regulating the cell cycle, and cell growth and survival). Normally (or in normal, healthy cells), this process is beneficial one – despite this being the case, however, cancer cells can take advantage of this process to evade chemotherapeutical drugs, allowing for autophagy to instead contribute to tumor growth under starvation conditions. By removing these damaged components, autophagy additionally plays an important role in suppressing the development of tumors by limiting the presence of instability in normal cell growth – published literature, in fact, shows that through the mutation of various genes (klf4 being one of these genes), mice and other organisms are much more prone to developing tumors.

A common way of detecting autophagy is through observing the presence of LC3 – a common marker for autophagy that binds to the autophagosome and autolysosome, both key structures in the degradation and recycling of cellular contents. I transfected mouse embryonic fibroblasts (MEFs) with GFP-LC3 to determine whether or not autophagy could be observed and subsequently used fluorescence to determine if autophagy could be observed. By counting the number of puncta (using 5 and above as a cutoff, as often found in published papers on the subject), I was able to say whether or not autophagy was occurring in the cells I was observing (counting 100 MEFs in each well I examined). Using DMSO as a control and rapamycin to inhibit mTOR, I found that wildtype (+/+ ) cells (or cells missing klf4) consistently had higher levels of autophagy, both with and without rapamycin drug treatment (cells were treated 5 hours post-transfection and observed 24 hours post-transfection) compared to null (-/-) cells. Using Western Blot to confirm my results, I found that rapamycin additionally failed to induce autophagy in null MEFs – an exciting finding given that MEFs were lacking klf4, thereby demonstrating the importance of our gene of interest. Lastly, using immunofluorescence, I found that mTOR levels were reduced in wildtype MEFs compared to null MEFs with both EBSS and rapamycin treatment. The working model we derived from the data we collected then posits that under stressful conditions (namely starvation), the AMPK-TSC1/2 pathway is activated and mTOR is subsequently inhibited, resulting in the induction of autophagy. Cellular stress can additionally activate p53, then activating KLF4 – in the presence of KLF4 mTOR levels are reduced and autophagy is induced.

Source of Support:  □ HUMN Div.  □ NASC Div.  □ SOSC Div.  □ UNST Div.  ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Project Summary:

This summer I studied water samples that were taken from a cruise aboard the Nathaniel B. Palmer research vessel in the year of 2010 (NBP1001). These samples were obtained from various locations along the coast of the Antarctic Peninsula over the duration of the cruise, fifty-seven days. With a total of 223 water samples collected from numerous regions, I gathered data from samples taken during both the early and late stages of the cruise. By identifying and counting diatom species within specific areas, I was able to observe the regions in which certain species are more prevalent than others along the Antarctic Peninsula and during what period of the season they are at their highest abundance based on the observed blooms. Collecting this data helps to better define the differences in primary productivity along the Antarctic Peninsula as well as the dissimilarities that exist at various locations within a region. Complementary data collected include sea surface salinity, sea surface temperature (SST), transmissivity, relative chlorophyll-a concentration, and partial pressure of carbon dioxide (pCO2). The combination of the diatom data and these physical-chemical properties will provide a better understanding of where the two competing water masses along the Peninsula, Circumpolar Deep Water and Weddell Sea Water intercept and how their shifting status affect the seasonal blooms of diatom species.

The water samples I examined under the microscope came from Barilari Bay, Flandres Bay, Andvord Bay, and the Eastern Antarctic Peninsula. Due to the route of the cruise, I was able to collect data from each location early in the trip (Julian days 7-44) and later (Julian days 45-57). Using Olympus and Zeiss microscopes, I collected my data at 400x magnification and 1000x magnification with immersion oil. I identified and counted a minimum of 400 diatoms for every slide using fields of view as the standard measuring area. The results showed that in all regions, the diatom species, Fragilariopsis cylindrus had the highest abundance during both early and late season. High Fragilariopsis productivity is representative of marginal ice zones due to their ability to persist in areas after the sea ice has melted. However, relatively high numbers of centric diatoms, Thalassiosira species, were found in Flandres Bay, Andvord Bay, and the Eastern Antarctic Peninsula only during the earlier part of the cruise. The increased abundance of Thalassiosira may be characteristic of a late spring/summer bloom because they are more productive in open waters. A greater concentration of sea-ice was observed later in the season in Flandres Bay, Andvord Bay, and the Eastern Antarctic Peninsula, which supports the decreased numbers of Thalassiosira during days 45-57. Barilari Bay showed a consistently high abundance of Fragilariopsis cylindrus throughout the entire cruise with no Thalassiosira bloom. The salinity of Barilari Bay was also lower than Flandres Bay, Andvord Bay, and the Eastern Antarctic Peninsula and there was more ice observed during both the early and late portion of the cruise, suggesting the role of ice melt in controlling the bloom of Fragilariopsis cylindrus and the absence of Thalassiosira. The Eastern Antarctic Peninsula samples comprised a more varied assemblage of diatom species including Chaetoceros vegetative cells and Eucampia, and the Thalassiosira were larger compared to those from the western coast of Antarctic Peninsula. The sea surface temperature of this region was significantly lower than that of the western areas, which is characteristic of the Weddell Sea Water. data collected from these samples provides a more accurate understanding of the seasonality of diatom species. With this information, we can further define the relationship between diatom species and their environment, and develop more useful diatom proxies. By comparing the recent seasonal diatom data to that of the past, observations can be made as to how seasons shifted in Antarctica during the Holocene. A further question to be considered is how changes in seasonality in the modern system will impact phytoplankton communities in the Southern Ocean today.

Project Summary:

*C. elegans* is an excellent model organism to study how gene interactions regulate somatic and germline development because its whole genome has been sequenced, every cell fate is known, and it has a short life cycle. The *C. elegans* reproductive system consists of germ cells that ultimately become gametes and somatic cells that help regulate germline development. The distal tip cell (DTC) is a part of the somatic gonad that maintains nearby germ cells in a mitotic state through a signaling pathway. Cells that are further away from the DTC are not kept in mitosis, and therefore begin to enter meiosis. This mitosis-meiosis switch is controlled in part by a network of regulatory proteins that has only been partly elucidated. The goals for this project were to analyze the localization of the LIN-42 protein and observe the effects of LIN-42 expression in the germline.

Because the LIN-42 protein is expressed in the DTC, it is a potential regulator of the meiosis-mitosis switch. This hypothesis is supported by the fact that lin-42 mutant worms have significantly smaller germline mitotic zones. LIN-42, a period protein homolog, is known to regulate circadian rhythms and the biogenesis of microRNAs and mRNAs. To verify that LIN-42 is present in the DTC, immunofluorescence was used. The immunofluorescence technique consists of dissecting worms so that their gonads are exposed and later subjected to a primary antibody that binds to LIN-42. This primary antibody was then bound to a secondary antibody that was attached to a molecule that fluoresces under UV light. To help localize the DTC within the dissected gonad, DAPI staining was used to visualize the nucleus of each cell. LIN-42 has several isoforms, and the antibody binds to the C-terminus of the isoforms A and B. The lin-42(n1089) loss-of-function mutants were able to produce isoform A and showed a constant presence of LIN-42A during the 26 and 42 hour age groups. The N2 worms showed a presence of LIN-42 during the 26 hour age group, but showed a decrease in LIN-42 in the 42 hour sample. This suggests that there could be a mechanism of regulation or competition occurring between the isoforms at the 42 hour time period.

To understand how LIN-42 might regulate the mitosis-meiosis switch, the effect of ATX-2 on LIN-42 was analyzed. In *Drosophila*, ATX-2 activated the translation of PER, a LIN-42 homolog. In *C. elegans*, atx-2 has been shown to be important for germline development. To determine if a similar interaction occurred between LIN-42 and ATX-2, a Western Blot Assay was used to quantify how much LIN-42 was present in wild type worms and ATX-2 mutated worms, with the expectation of having varying amounts. A Western Blot essentially consists of transferring *C. elegans* proteins to a membrane. This membrane is then exposed to a LIN-42 primary antibody and a secondary antibody that binds to the primary antibody. The secondary antibody is bound to a reporter enzyme used to cleave a chemiluminescent agent, which produces a luminescence that corresponds to the amount of protein present. The Western Blot assay showed that the amount of the LIN-42A isoform present in the ATX-2 worm was double the amount in the wild type worm. This suggests that ATX-2 is directly or indirectly regulating LIN-42 in *C. elegans*.

**Source of Support:**
- HUMN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify): Michael J. Wolk ’60 Heart Foundation
Research Fellow: Duy Tran (2017)  
Concentration: Undeclared

Faculty Mentor: Jing Wang  
Department: East Asian Languages and Literatures

Title of Project: Western Orientalism on China: an Anthology with a Critical Overview

Project Summary:

The project’s long-term goal is an anthology of writings of Western thinkers on China, the Chinese people and philosophy. We examined the perspectives and observations about China from various scholars through history, the progress of which generally followed three trends. First, early writings from 1500s to mid-1700s praised Confucian humanism and meritocracy. The perception of a stagnant China that opposed Western ideals of progress came later, but lasted until the 20th century. Since then, scholarly perspectives have been diverse, but attention has also been redirected to the merits of elements of Chinese culture that are different, if not superior, and could be solutions to certain problems of the West.

Together with my co-fellow Se Min Her and Professor Jing Wang, we read and engaged in discussions about the historical circumstances of trends of thought, history of ideas and ideals, the philosophical frameworks behind each author’s admiration or aversion to China (e.g. German idealism), the concept of “progress” (and its various meanings from ancient Greek to modern philosophy) and the characters of Western and Eastern civilizations. I facilitated these discussions with annotated bibliography of primary and secondary sources, including writings by Joseph R. Levenson, Karl Marx, Johann Herder, Arthur Smith, John Dewey, and Bertrand Russell.

Discussion on the anthology organization and choices of authors drew out the structure for the anthology, which would be either chronological and/or focused on themes and relational ideas. Thematic organization may account for the exceptions and unique works that do not follow the aforementioned chronological trends; however, the anthology also needs to contextualize the origin of these works that usually relates to the time in which they are written, possibly through a comprehensive critical overview.

Although the anthology is still an ongoing project, it has provided us an opportunity to escape from the common homogeneity and linearity of Western notions such as progress, freedom and modernity. With these concepts challenged and one reaching a higher vantage point, Chinese culture and its philosophy emerge to be a much larger system from which the West could learn a lot to deal with the ills of modernity such as environmental destruction.

Project Summary:

This summer, I researched Colgate University's self-image through its own published materials from 1832–1908. I spent most of my time in the University Archives examining the course catalogues, yearbooks, viewbooks, photographs, prints, and other documents from this period to explore how Colgate has understood itself as a place and presented this understanding to the public. At the end of my research, I compiled a report that contains the data I collected over the course of the summer. This report, along with the spreadsheet of notes and set of images that I collected, can be used by future researchers to guide their study of Colgate’s campus and self-image.

Today, Colgate’s incredible campus is a significant part of its published self-image. However, I found that Colgate has not always understood itself in this way. Before 1890, the year that Madison University became Colgate University, images and texts describing the school lacked a sense of connection to the physical environment. For example, prints found in the catalogues from this time do not show the hill, which today is a defining feature of the campus (Fig. 1). The university is shown in these early materials as a set of facilities in a generic environment. In the 1890s, wide, complete views of “the Hill” and detailed texts about the structures and location began to appear, demonstrating that the school was thinking of itself as a “campus” of integrated buildings, grounds, and paths, although it was not yet a Colgate that would be fully recognizable today (Fig. 2). The campus continued to develop over the course of this decade and the next, and by the publication of a 1907 viewbook, the beginnings of the modern Colgate had emerged. These images show the campus resembling a well-groomed park, with polished landscaping, the picturesque lake, and buildings nestled into the Hill (Fig. 3). By the end of my period of study, 1908, Colgate was thinking of and presenting itself as it does today: a special place in which the buildings, grounds, and institution are woven together to create a unique experience.
Title of Project: Oxygen isotope ratios of Marcy anorthosite massif as indicator of shallow emplacement

Project Summary:

The Marcy anorthosite massif makes up almost the entirety of the high peaks region of Adirondack State Park. Anorthosites are defined as igneous rocks containing greater than 90% plagioclase feldspar, with less than 10% mafic components. This intrusive igneous batholith is part of the Mesoproterozoic Grenville Province, which resulted from long, active tectonics and dates back to 1.155 billion years ago. While the batholith formed, plagioclase crystallized in this stratified magma chamber. Because the plagioclase is less dense, it ascended as a buoyant pluton to form its current 5 km deep, 100s of km² igneous exposure. Questions still remain about this anorthosite though, such as at what depth it formed and to what depths it reached during ascent.

One way to find the depth of formation is to use oxygen isotope data. Meteoric water has a lower oxygen isotope ratio than crustal water sources, so a lower ratio in rocks that have experienced hydrothermal alteration means that meteoric water was present at the time of mineral formation. If meteoric water was present, the anorthosite massif formed closer to the surface. Previous studies showed low isotope values near the southern border of the high peaks region.

For this project, I went to the Adirondacks to collect samples from the southern part of the anorthosite. I collected 27 hand samples from 17 different localities with the help of Mike DuBois. After returning to Colgate small pieces of plagioclase were knocked off each sample, crushed into a coarse sand, and examined under a binocular microscope. At least 10 mg of unaltered small crystal pieces were collected into vials. Microscope slides were also made. This followed a process of cutting rock billets, gluing them to microscope slides, and then cutting and grinding them down to an approximate thickness of 30 microns. When examining the slides, 2 samples were omitted because of late-stage alteration.

Oxygen isotopes were analyzed at the University of Wisconsin using laser fluorination mass spectrometry. All of the samples analyzed have isotope ratios similar to isotope data collected from the rest of the anorthosite, and are not indicative of hydrothermal alteration. In order to make the conclusion that a large-scale meteoric water hydrothermal system was present, lower values would have needed to be obtained. These results show us that either very specific areas experienced alteration or that the data collected in previous studies (which were done with a different fluorination technique) are not directly comparable to these new data.

Source of Support: ☑ NASC Div.

☐ Other (specify):
Title of Project: The Effect of Peripheral Images on the C1 Visual Component

Project Summary:
Throughout the summer, we worked towards understanding the basic components involved in the processing of vision. Specifically, we were looking to see if the C1 component of the Visual Evoked Potentials (VEPs) was affected by information presented in the peripheral visual field. While the two first components, P1 and N1, of the VEPs have been incorporated in many different studies, the C1 component has not been looked at as often. We first designed an experiment consisting of five conditions, four of which were in the corners of the peripheral vision, and one in the center point of the visual field. We used electroencephalography (EEG) to measure neuroelectric signals from human participants, and then used MATLAB software to analyze the data. The information we have collected thus far is consistent with previous studies of the C1 component.

Using EEG, we studied the effect of movement in the peripheral visual field on key components of visual evoked potentials. Electroencephalography allows for the ability to see how electricity is affected by being passed through the brain, resulting in the colloquial term, brain waves. By studying the peaks and troughs of the brain waves, we were able to see if placing images in the peripheral visual field of a participant had an effect on a specific area on the brain. For our first experiment, participants were instructed to focus their eyes on a focal point in the center of the screen. They were told not to move their eyes from that point, even as objects appear in their peripheral vision. We assigned the participant to an arbitrary task of remembering the letter flashed in their peripheral vision, and instructed them to ignore the checkerboards. Before the letter was flashed, a circle containing a checkerboard pattern was presented for 100 milliseconds in one of five locations: upper left, upper right, lower left, lower right, and the center.

In a follow-up experiment, we repeated the experiment described above, with the following exceptions. Instead of having five separate locations for circular checkerboards, we had six conditions: limited lower, limited upper, limited all, full lower, full upper, and full all. The limited conditions consisted of the same circular checkerboards used before. For example, in the limited upper condition, two circular checkerboards appear on the screen, one in the upper left corner and one in the upper right corner. For the lower section, the two circles appear in the lower corners. For the all condition, all four checkerboards are shown. For the full conditions, a semicircle filled in with checkerboard spanning from the left side to the other above the focus point is used instead of the two circles. Thus, for the full upper condition, one semicircle appears in the top half of the screen. For the full all condition, both the semicircle from the upper condition and the semicircle from the bottom condition are shown, creating a full circle.

For both experiments, we collected our data using Net Station and analyzed it through MATLAB. We ran baseline correction, rereferencing, artifact rejection, low-pass filtering, and segmentation on all data collected. We then focused our attention on certain channels from the HydroGel 120 net. We focused on 75, as it was a previously decided on reference channel, and the 67 and 72 channels, as they were placed near the visual cortex. The results imply that the C1 component does exist and is a factor in visual evoked potentials, yet the data also indicated that other components could be occurring within the same time region of the C1 (between 50 and 100 milliseconds post stimulus onset). As more data is collected, it will be interesting to see if the results of these experiments align with the new information.
Research Fellow: Brendan Walsh (2015)  
Faculty Mentor: Julie Dudrick  
Title of Project: Upstate Institute Summer Field School  

Project Summary:

I worked on two separate projects this summer. For the Impact Project, a non-profit specializing in home repairs for the elderly and impoverished residents free of charge, I was an assistant to the director. As assistant, I researched grants, participated in meetings, worked on projects, assisted with marketing and helped research possible partnerships for the organization.

For the Town of Hamilton, I was an historian and an archivist. As the archivist, I was cleaning and organizing the archives. As the historian, I was consulted on items to be kept for the town archives and those to be destroyed. In addition, I was working on a timeline for the town, as well as a historical display which will be in front of the town office for the month of August.

By the end of the summer, I finished a complete timeline of the history of Hamilton, as well as a display that is currently in the window of the town office. For the Impact Project, we have finished all marketing and grant finding needed. I helped the Impact Project exceed their project quota for the first half of the year.

This summer, I accomplished many goals. I have aided in the Impact Project’s marketing tools. I have helped find important grants to help the organization sustain itself and begin to grow. I have provided the town of Hamilton with an historical timeline which will add traffic to their website, as well as a display board which will help to showcase archival pieces found during the project. As a history major, the town of Hamilton project was the perfect fit. I used my historical research skills, as well as prior historical knowledge, both to write a history and properly identify important pieces within the archives.

I have learned a few skills while working these positions. I developed a better understanding of how grassroots history works. The people of the town of Hamilton have an immense pride in their history and I hope to convey that in my timeline. In addition, I learned proper archive maintenance and storage. I hope to use this experience and newly-developed skill set to help write other town histories in the future. At the Impact Project, I understood how a small non-profit maintains itself and grows properly. I have also enhanced my understanding of construction and carpentry.

Source of Support:  
- HUMN Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  
- Other (specify): Upstate Institute
Title of Project: Photosensitized Aerosol Growth Kinetics

Project Summary:

Pinene for some Chemistry?

Our investigating aerosol chemistry and aging in the atmosphere contributes understanding of Earth’s radiative balance. My colleague, Megan Tigue, and our advisor, Prof. Woods, and I began a study of light-induced oxidative growth as a possibility for secondary organic aerosol formation. Photosensitizers, or light absorbing species, enhance the uptake of organic aerosol mass onto particle surfaces. We are investigating the initial kinetics of excited triplet state photosensitizers reacting with volatile organic compounds (VOC). VOC are ubiquitous and are emitted by both anthropogenic and natural sources. Research involving VOC can lend insight towards associated exposure concerns and health impacts.

In our experiments, we measured signal energies over particle count to determine triplet state lifetimes on surfaces with variable composition and to investigate 2-AN’s reactivity with VOC. After testing air flows with and without oxygen, we found that oxygen does not have an initial influence on aerosol evolving processes and introduced oxygen-containing flows for the rest of our project.

We produced the excited triplet state of 2-acetonaphthone (2-AN), our photosensitizer compound, using 355-nm laser excitation. We detected the transient triplet state by selectively photoionizing the triplet 2-AN. Changing the delay between excitation and ionization laser pulses while tracking concentration of triplet 2-AN provided a means of measuring the lifetime. The triplet lifetime differs in NH₄NO₃ (τ ~ 50 ns), NaCl (τ ~ 80 ns) and in KI (τ ~ 10 ns) owed to varying degrees of quenching capacity and 2-AN auto-reactions. 2-AN triplets were quenched most readily in the presence of iodine, confirming its known triplet quenching chemistry. When α-pinene was introduced, we noticed a fast initial response and a gradual but resilient decline. We conclude that the initial signal increase is owed to prompt reaction of 2-AN with surface-adsorbed α-pinene. The subsequent slower decline is from eventual 2-AN auto-reactions or substrate reactions combined with enduring secondary product signals.

We began aqueous testing after building some confidence about our solid phase results. We’ve begun investigating how substrate concentration affects triplet state deterioration to understand how these nanosecond-scale events could occur naturally.
Title of Project: Extreme Weather and the U.S. Economy

Project Summary:

It is generally believed that extreme weather could affect economic performances, but few people have attempted to quantify how big this influence is. This project examined the impacts of extreme weather on the broad economy and selected industries in the U.S. The weather events we studied include extreme temperature, precipitation, and snowfall. On the economy side, we looked at economic indicators for the whole economy as well as for individual industries including construction, transportation, utility, mining, manufacturing, and retail.

Following an initial stage of literature review, we started to look for datasets that contain monthly data by state in order to match with the high frequency and the large geographical span of weather data. Databases we looked through include central government websites, regional Federal Reserve’s websites, individual state governments’ websites, private companies’ publications, and also several universities’ publications. Monthly state data over the past few decades (ranging from 20 to 40 years depending on data availability) were obtained for weather, employment, unemployment rate, composite index, electricity sales, coal production, traffic vehicle miles, and housing permit. Monthly data for purchasing manager’s index (PMI) and retail revenue were obtained only for several individual states due to low data availability. Once we finished gathering and compiling data, we ran OLS regressions, with economic indicators as dependent variables and weather data as independent variables. The weather data are composed not only of regular monthly total, average, maximum and minimum data, but also of variables indicating how many days in the month certain extreme weather events take place, such as the number of days in a month with temperature higher than 90 degrees Fahrenheit. We used panel data methods for nation-wide or multi-state data and applied fixed effect models in most of our study. But for manufacturing and retail, we conducted case studies and used time-series methods for specific states only because of the shortage of data. If necessary, we also included control variables in a model. For example, gasoline price was treated as a control variable in the transportation model and mortgage rates played the same role in the construction model.

Our research reveals some interesting findings. We found statistically significant relationships between weather variables and several economic indicators, notably employment, unemployment rate, and a composite index. The findings also largely aligned with our expectations. For example, extreme high and low temperature both tended to lower employment levels, and extreme snowfall exhibited a negative impact on the composite index, which was a measure of overall economic activity. Besides, statistically significant effects of extreme weather on individual industries were also observed, most notably for electricity sales, coal production, and traffic miles. However, robustness checks suggested that further work would be needed to improve our model specification. This is an issue that we would like to work on in the future.
The gastropods of Lake Tanganyika are unlike other fresh water gastropods because their shells have the hardness of a marine gastropod shell. Evolutionarily, research has been able to discover why this is the case; an arms race between the crabs of Lake Tanganyika and the gastropods led the crabs to have bigger, stronger claws, while the gastropods evolved to have stronger shells. Researchers have not yet been able to identify physical and structural reasons behind the increase in strength. When the gastropod shells form, they form interlocking crystals in layers called crossed-lamellar layers. These layers can have different organizational patterns including perpendicular, parallel, curved, or disorganized. Another important developmental aspect is the shell forms from the top down so the part of the shell near the apex, the top, is younger than the part of the shell that is further from the apex.

Four different species of gastropods, *L. nassa, L. grandis, Spekia and Reymondia*, were examined in order to investigate their crossed-lamellar strength. In order to investigate different factors influencing the hardness of a sample, the first step was to determine the hardness at various points around the shell. About one hundred indents were made on each of the sixteen total samples. Some samples were prepared by a previous research student during the summer of 2013. The hardness value of a specific indent is calculated by measuring the diagonals of the diamond-shaped indent and using a specific formula dependent upon the force the microindenter applies to make the indent.

We first looked into the influence of age on hardness value which is equivalent to looking at the relationship between distance from the apex and the hardness value. Measurements were taken from the apex to the indent and plots were created of Hardness Value v. Distance from the Apex. No correlation was seen between the distance and the hardness of the shell.

We also looked into the influence of the orientation of the crystals, or layer type, on the hardness value. From our data, the layer type in which the crystals were perpendicular to the shell edge, called the whorl, was the hardest.

In addition to examining factors that may contribute to hardness, we also examined the fracture radius around an indent and its possible correlation to layer type. Based on our data, the relationship between fracture radius and layer type appeared to be dependent; however, only three samples were able to be analyzed. More analysis needs to be done in regards to this because if it is only physical reasons causing larger fractures around the indent, it should not be dependent of species if they are the same structurally.

Overall, we found that the hardness of the shell was not dependent on age. We found that perpendicular crystal orientation may lead to a harder shell; however, more data needs to be analyzed in order to be more certain. After also examining fracture radius and its relation to hardness value, and the results being inconclusive, we would also like to examine the chemical composition at various points along the samples to determine if there are differences chemically that could be altering the physical strength of the shells.

**Source of Support:**
- HUMN Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: Optical Variability of the Blazar 3C 454.3 at Foggy Bottom Observatory

Project Summary:

Over the summer we have investigated the intensity and color variations as a function of time of the blazar 3C 454.3 at Colgate’s Foggy Bottom Observatory. A blazar is a compact quasar (quasi-stellar radio source), believed to be a giant elliptical galaxy with a supermassive black hole in the center. The gravity due to the black hole is so great that matter, as it falls into the hole, is expelled in two jets. These particles in turn produce photons, mostly in the direction of the jet. One of these jets is usually aligned close to the line of sight to the Earth. As a result these objects are bright in the night sky, even though they are located billions of light years away.

Occasionally, blazars and quasars will go through “flares” – meaning that their brightness sharply increases, and then exponentially decays to their usual levels of brightness. We were alerted to such a flare at the beginning of the summer via the Astronomers’ Telegrams. We used images obtained this summer at Foggy Bottom Observatory over 33 nights. We tracked color changes in the R-(red), I-(infrared), and V-(visual, green) filters. The brightness is plotted below in magnitudes (astronomical units for measuring brightness, where lower magnitude corresponds to a brighter object) as a function of the day of the year.

☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Research Fellow: Timmera Whaley (2015) 
Concentration: Social Sciences

Faculty Mentor: Frank Frey 
Department(s): Biology; Environmental Studies

Title of Project: The Power of Encouragement

Project Summary:

From May 19 to June 23, 2014, a 5 week fieldwork project was conducted at Ashford High School. This research was sponsored by Colgate University and supervised by both Professor Frank Frey of Colgate University and Principal John Odom of Ashford High School. The preliminary data collection started by interviewing 20 rising seniors at Ashford High School, who were in great academic standing. These students were not only academically successful but involved in extracurricular activities, as well. Their extracurricular activities included anything from being club presidents to playing varsity football. Although their interests were diverse, they all shared several things in common. The first is that these students belonged to low-income families. The second factor was that many of these students had to overcome significant challenges in the face of adversity. Lastly, these students had a genuine interest in applying to college. Out of the 20 students I interviewed, all 20 students believed that obtaining a college degree was important. “It helps better yourself, career, and allows you to become financially stable,” said one student. Some of the students even wanted to apply for college because no one in their family has ever done so. From the 20 students, I hand selected 10 to be a part of the research process. The project's overview was a 10-week research project under the supervision of the Office of Undergraduate Studies that focused on the impact of pre-college counseling and encouragement on four-year college applications in a low-income, rural community in southeastern Alabama. The second part of the study, which lasted 5 weeks, was performed at Colgate and focused on data analysis.

From my fieldwork with the students, it was concluded that a College Bound Opportunity style course incorporated within the curriculum to help relieve some stress from the students' everyday schedule. A course like this, however, should not be mandatory for all students. In fact, 3 out of the 20 students, in the initial process, had no desire to go to college. Instead, I think that a course, which provides students with computer access, printers, copy machines, fax machines, a conference telephone, and access to guidance counselors, as a .5 credit course for those who are interested in applying for college would be beneficial. At the end of the project, the 10 students said that they felt more confident and comfortable with the college application process. In the preliminary interview, many of the students believed a CBO style course would be beneficial.

While helping students with their applications, the answer to the research problem became clear by shedding light on an issue that may have been overlooked over the years in the Ashford community. What role does encouraging students through resources and guidance play in the college application process? Each student was academically equipped to be accepted into the colleges on their top choice list. For example, one student received a 31 on the ACT and a surpassing 4.0 GPA. Even the most "promising" student, however, may suffer from a lack of confidence. This lack of confidence derives from a lack of information. Students do not automatically know what to look for in the application process, unless they are exposed to it.

Exposure, however, does not equal motivation, and motivation is not the problem in this situation. The problem these students face is a lack of resources to help them with their college application process. If it were possible to create a course which solely caters to applying for college, it would be beneficial to students who are interested. The amount of time it takes to apply for different colleges--especially using the Common Application--can be overwhelming. These students are already overwhelmed with their current responsibilities. High school is a place to help students transition from adolescence to adulthood. For some people, college is an important part of that process. It would be unfortunate that the difference, between a person who goes to college and a person who does not, is a lack of guidance and resources.

Young Scholars (YS) is a partnership between Utica College and Utica City School District aimed at improving the graduation rate and college readiness of students in Utica City Schools. The organization works with public school teachers to identify students who would benefit from tutoring and other resources, students who otherwise might not graduate from high school. After identifying these students, Young Scholars provides school-year-long tutoring as well as a summer program intended to curb the summer achievement loss associated with fewer academic opportunities. Young Scholars are also encouraged to go on college visits with the organization and must fulfill certain community service requirements. The program itself has been exceptionally successful and, in the past, was funded in part by the Utica City School District. However, due to budget cuts, the district has recently cut all funding, resulting in the necessitation of alternative funding strategies.

As fellows of Young Scholars, Emily Hawkins and I were asked to work on the organization’s alumni database as well as to further develop its web presence. Because I worked only part-time at Young Scholars, I took on a variety of small projects. First, I worked on Young Scholars’ LinkedIn page. The organization hoped to portray a professional presence for its graduates and to provide a space for academic discussion. As it was, however, only a few graduates were aware of the page. One of my small projects, then, was to go through the entire alumni database and add graduates to LinkedIn.

Another small project I took on was a review of Young Scholars’ social media presence in general. The organization had various webpages, but the purpose of each page was not entirely evident. After discussing the efficacy of each page, I suggested ways in which to clarify and improve them. Most notably, I worked on YS’ Facebook alumni page. Because the intention was to maintain community among the alumni with this page, I altered the page in such a way that it catered more so to alumni than to the general public. Along with this, I researched ways in which to develop an alumni council and held an initial meeting with recently graduated seniors. Hopefully the foundation we set down will foster a thriving alumni community in the future.

While YS has quite a few social media pages, Emily and I thought it also might be beneficial for the organization to maintain a blog. Our initial thought was that current Young Scholars could blog about their experience in the summer program and YS more broadly. However, once the blog takes off, graduates of YS could be asked to contribute. Not only will this allow participants in the program a platform on which to make their voices heard, but it could also serve as a source of information for both potential donors and potential students – a more vivid depiction of the experiences within the program.

There is certainly a great deal more work to be done, but we hope that with these initial steps toward a more effective web presence and establishment of an alumni council, Young Scholars will be able to secure more funding sources – whether it be in the form of YS graduates who are now ready and able to give back, or outside sources. This is particularly critical given that Young Scholars currently has fewer sources of reliable funding than in the past, yet fills a dire need in the Utica community.

☑ Other (specify): Upstate Institute
Title of Project: U-Pb Dating of the Harcuvar Mountains

Project Summary:

Crustal extension is an important geologic process that allows the crust to stretch and thin, typically along a series of normal faults, ultimately allowing continents to rift apart. Areas of active crustal extension, such as the East African Rift, provide an opportunity to study the surficial processes of these faults directly as well as how faulting is accommodated in the upper crust (upper ~10 km) through seismic studies of earthquakes. However, such locations do not allow geologists to examine how the mid- to lower crust responds to crustal extension because earthquakes do not occur at these depths. Ancient extensional provinces provide the opportunity to investigate how extensional faulting occurs at greater crustal depths. The Basin and Range Province of western North America is one such region where significant crustal extension occurred, nearly doubling the width of the region during the Miocene (~24.5 Ma)[1]. Within the Basin and Range, a series of extreme normal faults, known as metamorphic core complexes, have exhumed mid-crustal rocks to the surface. This provides an outstanding opportunity to study how the mid-crust behaves during crustal extension.

One fundamental aspect of core complexes is the ductile shear zone that is thought to have played an integral role in the exhumation of these rocks. The goal of my research is to evaluate whether the shear zone formed concurrently with brittle normal faulting in the Miocene or whether this ductile deformation represents an earlier period of exhumation. To test this, I conducted U-Pb geochronology on the minerals zircon and monazite. Zircon can directly date the emplacement of igneous rocks that were involved in the shearing or post-dated it, thus constraining the timing of the ductile shearing. Monazite can grow during metamorphic events and shearing, which may provide additional insight into the timing of these events at this core complex.

Zircon grains were separated from the samples and then imaged using cathodoluminescence (CL) imaging on the scanning electron microscope (SEM) to assess when zircon crystalized (igneous or metamorphic) and whether inheritance of older zircon grains was a potential problem. Monazite grains were located in thin section by energy dispersive spectroscopy (EDS) on the SEM. Both zircon and monazite were dated using the U-Pb method by laser ablation inductively coupled plasma-mass spectrometry (LA-ICPMS) at the University of California, Santa Barbara. Preliminary results suggest major phases of igneous intrusion in the Jurassic (ca. 160 Ma) and Late Cretaceous (ca. 70 Ma) with minor pegmatite emplacement continuing until ca. 55 Ma. Pegmatites are only weakly deformed, suggesting they were late-tectonic and that ductile shearing primarily occurred in the Late Cretaceous to early Tertiary. Monazite U-Pb ages are also predominantly Late Cretaceous, suggesting that major metamorphism and local melting occurred just prior to extension accommodated by the ductile shear zone. Brittle faulting may have followed up to 50 million years later and may have been a separate event. These data suggest that exhumation of the core complex did not occur in one stage during the Miocene, but rather was a protracted and multi-stage event.


Project Summary:
This summer I have been assisting Professor Padma Kaimal with her book manuscript Many Paths to the Divine. It analyzes one of the canonical monuments of Indic architecture: the eighth-century Kailāsanātha temple in Kanchipuram, a city in India's southern-most state of Tamilnadu. The chapter of the book I have worked on most examines the narrative sculptures and inscriptions on the temple walls in detail. In addition, the book discusses circumambulation — the act of walking around the monuments — and challenges the perception that moving in a counterclockwise direction is forbidden and unorthodox.

The Kailāsanātha temple in Kanchipuram is covered with large sculptures of Hindu deities interacting with each other in ways that evoke famous myths. My work has involved boiling down the sculptural and narrative information on the Kailāsanātha temple walls to a minimum number of plans and photos in order to help both the non-specialist and professional reader to understand why story-telling was important to this monument and how narrative might have functioned there. The inscriptions on the temple walls often break and bend mid-word around the multi-faceted structure, and the sculptures usually do not follow linear logic. In the diagrams I’ve made, the texts are accompanied by figures that are most representative in posture, style, and symbolism. Because the sculptural elements, their sequence, and their subtle connection with the Sanskrit inscriptions are crucial to the reader's understanding of the experience of circumambulation, I have emphasized the various pivot points and moments around the walls.

I have been working with an amazingly dynamic assemblage of hundreds of photographs, labeled plans, different versions of Sanskrit translations, and sources provided by Professor Kaimal and other scholars who have studied this temple in situ. I began with an extensive reading of the online and printed resources of the Kailasanatha temple in Kanchipuram. Then I made maps of where the inscription is on the Vimana building. I replaced the late 19th century translation of the Sanskrit text with the latest one by E. Francis and Professor Kaimal. I also engaged the inscriptions with the photographs of their corresponding sculptures on the temple walls and marked out the embedded key words and where they belong on the ground plan of the temple. In the process, I employed different technical devices including Keynote, Pages, and Photoshop.

The following illustrations are examples of the work that I have done this summer:

Ill. 1 Ground Plan, Sanskrit Inscriptions (featuring the latest translation), Key Words Highlights. Kailasanatha Temple, Kanchipuram.
Ill. 2 Ground Plan and Corresponding Photographs of Sculptures Narrating the Eternal Cycle of the Yugas

Ill. 3 Segmented Ground Plan, Inscriptions, and Key Words
Ill. 4 Segmented Ground Plan

Ill. 5 Ground Plan, [a]pradaksina ([anti]circumambulation), and Photographs
Ill. 6 Segmented Ground Plan, [a]pradaksina
Title of Project: Conformity in Songbirds

Project Summary:

My project focused on conformity and social learning between two species of songbirds, zebra finches and Bengalese finches. In particular, I was concerned whether the birds of each species would conform to the food choices of the majority, represented by the birds of the other species. Conformity between the species of songbirds is a relatively unexplored area in animal psychology, so it was interesting to study the behavior of the birds in this situation.

In the first part of my project, the birds were trained to prefer one type of a food and to dislike the other type. Eight zebra finches and eight Bengalese finches were housed separately from each other. They were daily deprived of food for 1-1.5 hour, and then fed crushed hard-boiled egg of two types, either green-colored or pink-colored. Their choices of food were recorded, where each food could only be chosen once per a 5-minute interval. When I confirmed that all birds had eaten of both food types, one of the food types was treated with methyl anthranilate, a food additive that is harmless but very distasteful to birds. The food that the bird groups were trained to prefer is referred to as “home food”, and the one they were trained to avoid as “away food”. I confirmed that both bird groups tended to avoid their “away food” even after methyl anthranilate was no longer added.

After the training period, the birds were transferred into the cage of the other species. Two birds were transferred every other day, so that they would be a minority in an unfamiliar environment that had been trained to avoid the food that was preferred locally. Again, the food choices of each bird were recorded. Their choices were quantified and analyzed for food conformity. Each bird group showed some conformity to the other group’s food choices.

However, a potential confounding variable was that the zebra finches showed aversion to pink food even prior to the training stage. This could be due to poisonous insects and plants often being brightly colored in the nature. Bengalese finches did not show this aversion, possibly because this species does not exist in the wild. To better assess the birds’ conformity in food choices, I conducted the experiment again, using green and yellow food coloring. This time, neither bird group showed any preference for either color before the training with methyl anthranilate. Both groups showed conformity to the food choices of the other bird group, increasing their preference for their respective “away food”. This finding suggests that zebra finches and Bengalese finches are able to learn from each other, particularly when it comes to the vital issue of choosing food.
Project Summary:

This study seeks to test food choice conformity in zebra finches. Conformity is defined as an individual’s behavior that is demonstrated based on the most frequent behavior that is seen in others due to the influence of social normality (Claidiere and Whiten, 2012). Research has shown that conformity is not a social phenomenon specific only to humans. A study on vervet monkeys, showed that conformity existed among other species. This study sparked the idea for a pilot study, to see if such food choice conformity exists in zebra finches. The results of the pilot study suggested that zebra finches could in fact exhibit signs of food choice conformity.

This experiment, conducted within the study at large, was a replication of the pilot study. We hypothesized that zebra finches would conform when moved to another cage that had been conditioned to prefer a different color of food. In the study, there were two cages with eight birds in each cage. In testing, we moved two birds from their home cage to the away cage, which was the cage that had been conditioned to eat the opposite color of food. We decided to do two different trials in the study. One trial included pink and green food and the other trial included yellow and green food. The results for one cage in the pink and green trial are follows:

Figure 1 shows the proportion of five-minute intervals when Cage 3 birds chose to eat their home (pink) or away (green) food in either their home or away cage.

The results for this part of the testing were significant. First of all, the conditioned preference for home food was significant (p=.0001). There was also a significant decrease in the proportion of intervals in which birds ate their home food in the away cage (p=.003). The birds did show signs of conformity in the away cage, as the proportion of intervals in which they ate the away food increased from their home cage to their away cage (p=.04).

The Cage 3 birds in the pink-green trial show that zebra finches are capable of exhibiting food choice conformity. This finding is important in that no previous research has focused on food choice conformity in finches before. Thus, this study builds upon the notion that non-human animals are capable of conforming to one another.

The study creates an opportunity for future research on conformity in finches. Future studies could test other colors of food, to try to avoid the same bias that we found in our research. In addition, dominance testing could be conducted before the study, and the dominant birds could be split between cages to try to ensure that results were most indicative of reality.
Benzyl cyanide and cyclopropyl-phenylcarbinol are important intermediates for synthesizing various kinds of useful molecules such as amphetamines. So it is crucial to fully understand the geometric structures. In order to analyze the diffraction data, the Cartesian co-ordinates of all the atoms in the molecule were generated from a set of bond distances, valence angles, and dihedral angles. Values from the results of ab initio molecular orbital calculations were used as initial values. Using the interatomic distances from the Cartesian co-ordinates, theoretical diffraction intensity curves were calculated and used to compare with the experimental data using least squares analysis.

For benzyl cyanide, the model with the cyanide group rotated 5° from the plane of the benzene ring gave the best agreement with the data. The experimental geometry compared rather well with the geometry from ab initio calculations.

For cyclopropyl phenylcarbinol, the conformation composition is complicated by the presence of two rotational degrees of freedom (C-CPh and C-C_{cyclopropyl}). There are four likely low energy conformers. Preliminary results showed that a model with the two dihedral angles at 45° gave the best fit to the experimental data.

Source of Support:  [] HUMN Div.  [] NASC Div.  [] SOSC Div.  [] UNST Div.  ☑ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Research Fellow: Jonathan Zeosky
Concentration(s): Astronomy/Physics

Faculty Mentor: Enrique “Kiko” Galvez
Department: Physics and Astronomy

Title of Project: Polarization Möbius Loops

Project Summary:

My project was looking for specific polarization structures and patterns that were predicted to occur when two specially prepared light beams were intersected at small angles. These structures took the form of Möbius loops, which are essentially twisting ribbons that loop back around and connect with themselves. An easy way to understand what polarization is; is to think of light as a wave. Some waves like waves in water can only oscillate in one direction. Light is different though, light waves can move up and down, or side to side or any angle in between. When we describe a light’s polarization, we are describing what pattern the light waves will oscillate in at any given point in space. So vertically polarized light is light consisting of waves that only move up and down vertically, horizontally polarized light waves only oscillate side to side and so on. This twisting ribbon structure is created by the vectors that define the polarization state of the light at each point in space. When you look at all the points on a circle concentric about the axis on which the light beams intersect these vectors should twist as you move about the circle forming the Möbius loop. What is interesting about these structures is that (to my knowledge) nobody has ever tried to detect them experimentally. Our hope was to see if we can verify experimentally the papers that predicted these loops, and see how much we could uncover about their nature.

The beams we chose to use, and the ones used in the paper, were a Laguerre-Gauss beam of index l=+(-)1 with left-handed circular polarization, and a beam of mode l=0 with right-handed circular polarization. The beams were then intersected at angles ranging from .03-.06 degrees, and were imaged by a camera with an adjustable polarizer in front of it. Our results were promising but inconclusive. Ideally we would detect these loops directly, however the Z component of the polarization ellipse, was extremely small. This essentially rendered direct detection of the polarization impossible when using a simple camera to image the light. So instead of looking directly for the polarization structures, we decided to simulate what we might expect to find, and use that simulation to give us predictions that we could then verify experimentally. Using MATLAB we came up with a figure showing the semi-major axes of the polarization ellipses on a few circles around the Z-axis (side image). We then manipulated the program and had it map the electric field components over the range of the beam, which should show us what we might see if we placed a polarizer in front of our camera. The simulated images matched up very closely to what we were able to observe, and so we have good reason to believe that these structures are present in the light beams. A more sophisticated setup would likely be needed for direct detection of the loops, however I think we have rather convincing evidence that they are there. There are still many avenues that we did not explore yet such as the specific modal dependence of the loops, and perhaps branching into what might happen if we were to use higher order Laguerre-Gauss modes l>1.

Statistics

Please note the total number of participating students is the number of student projects. Students working on two different projects with different faculty are counted twice. Students with double-majors are counted twice in the Distribution of Students by Concentration table.

In addition, the total number of participating faculty is the number of faculty supervising student research projects. Faculty holding joint appointments are listed by the department/program which most closely matches the subject of the research project supervised (source of funding consulted for interdisciplinary projects). Faculty in different departments jointly supervising one student research project are both counted in the Distribution of Students by Faculty Division and Department table.
Total number of participating students: 209

Distribution of Students by Concentration (students with double majors are included twice)

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Distribution of Students by Faculty Division and Department:
(Number is greater than total number of participating students due to jointly supervised projects)

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### Distribution of Students by Funding Source

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Total Number of Participating Faculty: 87

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