Cover photo: View of the summer research poster session from above in the atrium of the Ho Science Center. Photo by Andrew Daddio.
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List of Participants
DIVISION OF THE ARTS AND HUMANITIES (AHUM)

Department of Art and Art History

Name: Talitha Angelica “Angel” Trazo 2017 (Art and Art History; Biology)
Mentor: Padma Kaimal (Art and Art History)
Title: VIsuality, Story-telling, and Movement at the Kailasanatha Temple, Kanchipuram
Funding: AHUM Division

Department of the Classics

Name: Zixing “Elva” Chen 2018 (Classics)
Mentor: Rebecca Ammerman (Classics)
Title: Visual Metaphors for Ancient Marriage Rites in the Painted Pottery of South Italy
Funding: AHUM Division

Name: Daniel “Dan” Mahoney 2018 (Classics)
Mentor: Rebecca Ammerman (Classics)
Title: Visual Metaphors for Ancient Marriage Rites in the Painted Pottery of South Italy
Funding: AHUM Division

Department of East Asian Languages and Literatures

Name: Sophie Coffman 2017 (Chinese)
Mentor: John Crespi (Asian Studies; Chinese; EALL)
Title: The Rhetoric and Influence of the China Dream Propaganda Campaign
Funding: Lampert Institute for Civic and Global Affairs

Name: Ryan Hildebrandt 2017 (Japanese; Psychology)
Mentor: Yukari Hirata (East Asian Languages and Literatures)
Title: Across Languages and Disciplines: Translating Japanese research to better understand how we understand language
Funding: J. Curtiss Taylor ’54 Endowed Student Research Fund

Name: Fanyi Zhang 2019 (Undeclared)
Mentor: John Crespi (Asian Studies; Chinese; EALL)
Title: Scanlation of the Wartime Chinese Arts Magazine Resistance Sketch (Kangzhan manhua, 1938)
Funding: AHUM Division

Name: Xuanyuan “Bill” Zhang 2018 (Physics)
Mentor: Jing Wang (East Asian Languages and Literatures)
Title: Potential contribution of Chinese philosophy to the globe
Funding: AHUM Division

Department of English

Name: Ian Lynch 2017 (English)
Mentor: Jennifer Brice (English)
Title: Living Writers Fellow
Funding: AHUM Division
**Department of Philosophy**

Name: James Hurst 2018 (Philosophy)  
Mentor: Edward “Ed” Witherspoon (Philosophy)  
Title: *Spinoza’s Ethics and the Principles of Nihilism*  
Funding: J. Curtiss Taylor ’54 Endowed Student Research Fund

**Department of Religion**

Name: Maria-Dorin “Doreen” Shayo 2017 (Physical Science; Africana and Latin American Studies)  
Mentor: Harvey Sindima (Religion)  
Title: *Out of the Calabash and into the Pillbox: The Standardization Process of Traditional Medicine in Tanzania*  
Funding: Lampert Institute for Civic and Global Affairs

**DIVISION OF NATURAL SCIENCES AND MATHEMATICS (NASC)**

**Department of Biology**

Name: Eric Alvarado 2018 (Biology; Religion)  
Mentor: Timothy McCay (Biology; Environmental Studies)  
Title: *Distribution and Habitat of a Native Earthworm, Eisenoides lonnbergi, in Upstate New York*  
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Benjamin “Ben” Apple 2018 (Molecular Biology)  
Mentor: Geoffrey “Geoff” Holm (Biology)  
Title: *Innate Immune Responses to Mammalian Reovirus Infection*  
Funding: National Institutes of Health (NIH)

Name: Kathryn Bazany 2017 (Biology)  
Mentor: Catherine Cardelús (Biology)  
Title: *An Examination of the Health of the Sacred Forests of Northern Ethiopia*  
Funding: Oberheim Memorial Fund

Name: Mezmur Belew 2017 (Biochemistry)  
Mentor: Engda Hagos (Biology)  
Title: *Cells Deficient for Krüppel-Like Factor 4 Exhibit Impaired Mitophagy*  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: John Bennett 2019 (Molecular Biology)  
Mentor: Geoffrey “Geoff” Holm (Biology)  
Title: *Identifying Possible Binding Partners of the Reovirus Interferon Antagonist μ2*  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Philip Brauer 2018 (Molecular Biology)  
Mentor: Engda Hagos (Biology)  
Title: *Cells null for Klf4 exhibit higher expression of migratory phenotype*  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Kaine Brown 2019 (Undeclared)  
Mentor: Jason Meyers (Biology; Neuroscience)  
Title: *A Behavioral Analysis of the Retinal Regeneration of Zebrafish*  
Funding: Science and Math Initiative-SMI (NASC Division)
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<th>Name</th>
<th>Mentors</th>
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<th>Funding</th>
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<tr>
<td>Amanda Liberman 2017</td>
<td>Ahmet Ay (Biology; Mathematics) and Krista Ingram (Biology)</td>
<td>Mathematical Modeling of Human Behavior</td>
<td>Beckman Scholar Program</td>
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<tr>
<td>Celine Marlin Andrews 2018</td>
<td>Krista Ingram (Biology)</td>
<td>TIMING IS EVERYTHING: Circadian Effects on Athletic and Academic Performance of Division I Athletes</td>
<td>NASC Division</td>
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<td>Corrina Moncada 2018</td>
<td>Priscilla Van Wynsberghe (Biology)</td>
<td>The Effects of Diethylstilbestrol on Fertility of C. elegans over succeeding generations</td>
<td>Research Council; Science and Math Initiative-SMI (NASC Division)</td>
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<tr>
<td>Andie Nugent 2017</td>
<td>Timothy McCay (Biology; Environmental Studies)</td>
<td>Understanding Earthworm Invasion through Field and Lab Studies and Individual Based Modeling</td>
<td>NASC Division</td>
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<tr>
<td>Kayla Oliver 2017</td>
<td>Jason Meyers (Biology; Neuroscience)</td>
<td>Investigating the role of klf17 in the development of the zebrafish lateral line</td>
<td>NASC Division</td>
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<tr>
<td>Emmanuel Poku 2019</td>
<td>Jason Meyers (Biology; Neuroscience)</td>
<td>Retinal development using zebrafish as a model</td>
<td>Science and Math Initiative-SMI (NASC Division)</td>
</tr>
<tr>
<td>Natalie Pudalov 2017</td>
<td>Ana Jimenez (Biology)</td>
<td>An Analysis of Bird Migration Patterns in Madison County using Citizen Science</td>
<td>NASC Division; Research Council</td>
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<tr>
<td>William Rosencrans 2019</td>
<td>Engda Hagos (Biology)</td>
<td>Cells Deficient for Krüppel-Like Factor 4 Exhibit Impaired Mitophagy</td>
<td>NASC Division</td>
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<tr>
<td>Jonathan Santiago 2018</td>
<td>Bineyam “Bini” Taye (Biology)</td>
<td>Helminth infection and atopy in Ethiopian school children</td>
<td>NASC Division</td>
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<tr>
<td>Abigail Stanton 2018</td>
<td>Barbara Hoopes (Biology)</td>
<td>Genetic factors contributing to coat color in poodles</td>
<td>Michael J. Wolk ’60 Heart Foundation</td>
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<tr>
<td>Araven Tiroumalechetty 2019</td>
<td>Priscilla Van Wynsberghe (Biology)</td>
<td>Characterization of the dpy gene in let-7 biogenesis and C. elegans development</td>
<td>NASC Division</td>
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</table>
Name: Katherine “Kat” Titterton 2017 (Neuroscience)
Mentor: Bineyam “Bini” Taye (Biology)
Title: Helminth infection and atopy in Ethiopian school children
Funding: NASC Division

Name: Ha Vu 2017 (Computer Science; Mathematics)
Mentor(s): Ahmet Ay (Biology; Mathematics) and Krista Ingram (Biology)
Title: Mathematical Modeling of Human Behavior
Funding: NASC Division

Name: McKenzie Wallace 2018 (Neuroscience)
Mentor: Priscilla Van Wynsberge (Biology)
Title: Investigating the Role of lin-42 in the Germline Development of C. elegans
Funding: NASC Division

Name: Rachel Weinstein 2018 (Molecular Biology)
Mentor: Priscilla Van Wynsberge (Biology)
Title: Impacts of KIN-20 and LIN-42 on C. elegans Development
Funding: NASC Division

Name: Chloe Weiss 2018 (Neuroscience)
Mentor: Krista Ingram (Biology)
Title: TIMING IS EVERYTHING: Circadian Effects on Athletic and Academic Performance of Division I Athletes
Funding: NASC Division

Name: Joshua “Josh” Winward 2018 (Environmental Biology)
Mentor: Ana Jimenez (Biology)
Title: Cellular Physiological Underpinnings in Man’s Most Popular Selection Experiment: the Dog
Funding: NASC Division

Name: Yingqi Zhang 2018 (Biology; Geography)
Mentor: Randall “Randy” Fuller (Biology; Environmental Studies)
Title: Macroinvertebrate response to acid-stressed and lime amended Adirondack Mountain streams
Funding: NASC Division

Name: Sydney Ziatek 2019 (Religion; Biology)
Mentor: Ana Jimenez (Biology)
Title: An Analysis of Bird Migration Patterns in Madison County using Citizen Science
Funding: NASC Division

Department of Chemistry

Name: Yuqi “Maya” Cao 2018 (Biochemistry)
Mentor: Ernie Nolen (Chemistry)
Title: Synthesis of amino acid constituent for Carbon-Linked Alpha Mannosyl Serine
Funding: NASC Division

Name: Young-Woo “Leo” Cho 2018 (Biochemistry)
Mentor: Ernie Nolen (Chemistry)
Title: Synthesis Towards a Metabolically Stable α-Mannosyl Serine (Serine Substituent)
Funding: NASC Division
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<th>Department</th>
<th>Title</th>
<th>Mentor</th>
<th>Funding</th>
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<tr>
<td>Andre D'Souza 2017</td>
<td>(Biochemistry)</td>
<td></td>
<td><em>Investigation of Reaction Conditions for the synthesis of BOPHY</em></td>
<td>G. Richard “Rick” Geier (Chemistry)</td>
<td>NASC Division</td>
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<td>Rebecca Easly 2017</td>
<td>(Biochemistry)</td>
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<td><em>Structural Genomics of non-Homologous sequences of the Mimivirus</em></td>
<td>Roger Rowlett (Chemistry)</td>
<td>NASC Division</td>
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<td>Garrett Esper 2018</td>
<td>(Biochemistry)</td>
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<td><em>Insertion of Molecular Oxygen into Rhodium III Complexes: a Computational Analysis</em></td>
<td>Jason Keith (Chemistry)</td>
<td>American Chemical Society Petroleum Research Fund</td>
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<td>Tianyi “Mike” He 2019</td>
<td>(Philosophy; Chemistry)</td>
<td></td>
<td><em>Polar Bond Hydrogenation through CNN-pincer Catalysts</em></td>
<td>Anthony Chianese (Chemistry)</td>
<td>National Science Foundation</td>
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<td>Shelby Holland 2018</td>
<td>(Biochemistry)</td>
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<td><em>Investigation of the Insertion of Nickel into C6F5-N-Confused Porphyrin</em></td>
<td>G. Richard “Rick” Geier (Chemistry)</td>
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<td>Alexandra “Allie” Krez 2018</td>
<td>(Mathematics)</td>
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<td><em>Photochemical Pathways to the Production of Secondary Organic Aerosols</em></td>
<td>Ephraim Woods (Chemistry)</td>
<td>National Science Foundation</td>
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<td>Kaye Kuphal 2018</td>
<td>(Biochemistry)</td>
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<td><em>A Mössbauer Study of Nitrogen Reduction by Iron Complexes</em></td>
<td>Codrina Popescu (Chemistry)</td>
<td>National Science Foundation</td>
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<tr>
<td>Linh Le 2018</td>
<td>(Chemistry; Physics)</td>
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<td><em>Polar Bond Hydrogenation by Ru and Fe Complexes</em></td>
<td>Anthony Chianese (Chemistry)</td>
<td>NASC Division</td>
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<td>Jiachen “Ed” Liu 2018</td>
<td>(Chemistry)</td>
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<td><em>Ester Hydrogenation by Ru CNN Pincer Complexes</em></td>
<td>Anthony Chianese (Chemistry)</td>
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<td>Markus Miranda 2019</td>
<td>(Undeclared)</td>
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<td><em>Insertion of Molecular O2 into Rhodium III Complexes</em></td>
<td>Jason Keith (Chemistry)</td>
<td>American Chemical Society Petroleum Research Fund</td>
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<td>Margaret “Maggie” Nelsen</td>
<td>Roger Rowlett (Chemistry)</td>
<td><em>Structural Genomics of non-Homologous sequences of the Mimivirus</em></td>
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<td>Akosua “Pomaa” Ofosuhene</td>
<td>Ephraim Woods (Chemistry)</td>
<td><em>Photochemically-Initiated Formation of Secondary Organic Aerosols (SOA)</em></td>
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<td>Sam Schlichting</td>
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<td><em>Structural Genomics of non-Homologous sequences of the Mimivirus</em></td>
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<td>Francesca Viola</td>
<td>Roger Rowlett (Chemistry)</td>
<td><em>Cloning, Overexpression, and Purification of Silicase Carbonic Anhydrase Domain</em></td>
<td>Warren-Anderson Fund</td>
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<td>Alexander “Alex” Weig</td>
<td>G. Richard “Rick” Geier (Chemistry)</td>
<td><em>Synthesis of Phlorins with Different Spiro Substituents</em></td>
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<td>Emma Wellington</td>
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<td><em>A Mössbauer Study of Nitrogen Reduction by Iron Complexes</em></td>
<td>National Science Foundation</td>
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<td>Michael Chavinda</td>
<td>Elodie Fourquet (Computer Science)</td>
<td><em>Creating a next generation Scala build tool</em></td>
<td>NASC Division</td>
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<td>Christopher “Chris” King</td>
<td>Elodie Fourquet (Computer Science)</td>
<td><em>Working Towards a Vitruvian Approach of “Organic” Object Detection</em></td>
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<td>Saw Lin</td>
<td>Vijay Ramachandran (Computer Science)</td>
<td><em>Analysis of a Greedy-Algorithm Framework for Network Probing-Path Selection</em></td>
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<tr>
<td>Troy Jay Moo Penn</td>
<td>John Stratton (Computer Science)</td>
<td><em>Accelerating Dynamically-Typed Languages with a Virtual Function Cache</em></td>
<td>Holdeen Endowment Fund</td>
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</table>
Name: Quan Vu 2018 (Mathematics)
Mentor: John Stratton (Computer Science)
Title: Accelerating Dynamically-Typed Languages with a Virtual Function Cache
Funding: Holdeen Endowment Fund

Name: Tinotenda “Tino” Zinyama 2018 (Computer Science; Art and Art History)
Mentor: Vijay Ramachandran (Computer Science)
Title: Analysis of a Greedy-Algorithm Framework for Network Probing-Path Selection
Funding: NASC Division

Department of Geology

Name: Hannah Bercovici 2017 (Geology)
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)
Title: A Little Island with a Big Secret: Isla Rábida, Galápagos
Funding: National Science Foundation

Name: Aurelia Casarrubias 2017 (Geology)
Mentor: Amy Leventer (Geology)
Title: Analysis of changes in diatom populations recorded in sediments from the Sabrina Coast, Antarctica
Funding: National Science Foundation

Name: Zachary Cleary 2017 (Physics)
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)
Title: Investigating Magmatic Processes on San Cristóbal, Galápagos through Analysis and Modeling of Newly Acquired Gravity Measurements
Funding: Norma Vergo Prize

Name: Seamus Crowley 2018 (Geology)
Mentor: Bruce Selleck (Geology)
Title: Origin Exploration of the Lyon Mountain Granite in the Adirondack Lowlands, NY
Funding: Doug Rankin ’53 Endowment-Geology Research

Name: Taylor Dawson 2017 (Geology)
Mentor: Martin Wong (Geology)
Title: Investigations of crustal extension at the Harcuvar core complex, AZ
Funding: National Science Foundation

Name: Isabel Dove 2019 (Geology)
Mentor: Aubreya Adams (Geology)
Title: Locating Earthquakes in New York
Funding: NASC Division

Name: Meghan Duffy 2018 (Geology)
Mentor: Amy Leventer (Geology)
Title: Paleoclimate Records Using Marine Sediment Cores from the East Antarctic Margin
Funding: Geology Department; Hackett-Rathmell 1968 Memorial Fund

Name: Graceanne “Grace” Howard 2017 (Geology)
Mentor: William Peck (Geology)
Title: Metamorphism of Adirondack Anorthosite
Funding: Doug Rankin ’53 Endowment-Appalachian Research
Name: Oleg Kozel 2017 (Geology)
Mentor: William Peck (Geology)
Title: Metamorphism of Adirondack Anorthosite
Funding: Doug Rankin ’53 Endowment-Appalachian Research; Doug Rankin ’53 Endowment-Geology Research

Name: Jake Mahr 2017 (Geology)
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)
Title: Rejuvenescent Volcanism on San Cristóbal Island, Galápagos: A Late “Plumer”
Funding: Norma Vergo Prize

Name: Jonathan Miller 2017 (Geology)
Mentor: Aubreya Adams (Geology)
Title: Sources of Rifting in the East African Rift System from Rayleigh Wave Tomography
Funding: NASC Division

Name: Kaylie Patacca 2017 (Environmental Geography)
Mentor: Amy Leventer (Geology)
Title: East Antarctic Paleoenvironments: Iceberg Alley Productivity
Funding: Bob Linsley/James McLelland Fund

Name: Regina Pimentel Perez Olagaray 2018 (Geology)
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)
Title: Are you There Plume? It’s me, San Cristóbal
Funding: National Science Foundation

Name: Natalie Smith 2017 (Geology)
Mentor: Bruce Selleck (Geology)
Title: A Small River with Big Consequences: Examining Flat Creek’s Health through Macroinvertebrates and Water Quality
Funding: Doug Rankin ’53 Endowment-Geology Research

Name: Austin Sun 2018 (Geology)
Mentor: Martin Wong (Geology)
Title: Investigations of crustal extension at the Harcuvar core complex, AZ
Funding: Norma Vergo Prize

Name: Alexander Taylor 2018 (Geology; International Relations)
Mentor: William Peck (Geology)
Title: Orthopyroxene Megacrysts in Adirondack Anorthosites
Funding: Career Services

Name: Glenna Thomas 2017 (Environmental Geology)
Mentor: Amy Leventer (Geology)
Title: Radiolaria of the Sabrina Coast, East Antarctica
Funding: National Science Foundation

Name: Samuel “Sam” Timothy 2019 (Undeclared)
Mentor: Martin Wong (Geology)
Title: Geochemistry of samples from the Harcuvar core complex, AZ
Funding: National Science Foundation
Department of Mathematics

Name: George Armstrong 2018 (Mathematics)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: WORMSPREAD: An individual-based model of invasive earthworm population
Funding: NASC Division

Name: Maria Dascalu 2018 (Mathematics; Computer Science)
Mentor: Aaron Robertson (Mathematics)
Title: Statistical Ramsey Theory
Funding: NASC Division

Name: Ahsan Mahmood 2018 (Computer Science)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: WORMSPREAD: An individual-based model of invasive earthworm population
Funding: NASC Division

Name: Yecheng “Carlton” Yang 2017 (Mathematics; Computer Science)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Computational Modeling of the Vertebrate Segmentation
Funding: NASC Division

Department of Neuroscience

Name: Maia Dinsmore 2017 (Neuroscience)
Mentor: Ann Jane Tierney (Neuroscience; Psychology)
Title: The Effects of Social Conflict and Serotonin Agonists on Anxiety-Like Behavior in the Crayfish Procambarus clarkii
Funding: NASC Division

Name: Benjamin Hack 2018 (Neuroscience)
Mentor: Bruce C. Hansen (Neuroscience; Psychology)
Title: Mapping of the Informative Value of Early Visual Evoked Potentials: The C1 Component
Funding: NASC Division

Name: Christopher Higham 2018 (Neuroscience)
Mentor: Christina Ragan (Neuroscience; Psychology)
Title: The Effects of Clomipramine Treatment on Anxiety and Dnmt3a Expression in the Medial Prefrontal Cortex in Male vs. Female Rats
Funding: NASC Division
Name: Christopher Huber 2017 (Neuroscience)  
Mentor(s): Bruce C. Hansen (Neuroscience; Psychology) and Douglas “Doug” Johnson (Psychology)  
Title: Change Blindness: The Role of Implicit and Explicit Change Detection  
Funding: NASC Division

Name: Mahmoud Khalil 2018 (Neuroscience)  
Mentor: Jason Meyers (Biology; Neuroscience)  
Title: FGF and Notch signaling role in developed Neuromasts  
Funding: NASC Division

Name: Brianne Lacy 2018 (Neuroscience)  
Mentor: Ann Jane Tierney (Neuroscience; Psychology)  
Title: The Effects of Social Conflict and Serotonin Agonists on Anxiety-Like Behavior in the Crayfish Procambarus clarkii  
Funding: NASC Division

Name: Jack Lin 2018 (Computer Science; Neuroscience)  
Mentor: Bruce C. Hansen (Neuroscience; Psychology)  
Title: Mapping of the Informative Value of Early Visual Evoked Potentials: The C1 Component  
Funding: NASC Division

Name: Patricia Moscicki 2018 (Neuroscience)  
Mentor: Christina Ragan (Neuroscience; Psychology)  
Title: The Role of Maternal Care and Early Anti-Depressant Exposure on Later Offspring Anxiety in Laboratory Rats  
Funding: Research Council

Name: Benjamin “Ben” Phelps 2018 (Psychology; Music)  
Mentor(s): Bruce C. Hansen (Neuroscience; Psychology) and Douglas “Doug” Johnson (Psychology)  
Title: Change Blindness: The Role of Implicit and Explicit Change Detection  
Funding: NASC Division

Name: Jaime Ransohoff 2018 (Neuroscience)  
Mentor: Christina Ragan (Neuroscience; Psychology)  
Title: The Effects of Clomipramine Treatment on Anxiety and Dnmt3a Expression in the Medial Prefrontal Cortex in Male vs. Female Rats  
Funding: NASC Division

Department of Physics and Astronomy

Name: Samantha Boni—Bridgewater State University 2018 (Physics; Geological Science)  
Mentor: Thomas Balonek (Physics and Astronomy)  
Title: Optical Monitoring of Quasar OJ 287  
Funding: Keck Northeast Astronomy Consortium (KNAC)

Name: Shane Buchanan 2017 (Physics)  
Mentor: Kenneth “Ken” Segall (Physics and Astronomy)  
Title: Breather Vortex Interactions in A Josephson Junction Ladder  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Kathryn “Katie” Chapman 2020 (Astronomy/Physics)  
Mentor: Thomas Balonek (Physics and Astronomy)  
Title: The Recent Outburst of the Blazar PKS 1749+096  
Funding: NASA / New York Space Grant
<table>
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<tr>
<th>Name:</th>
<th>Logan “Cooper” Conran 2018 (Physics)</th>
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<tr>
<td>Mentor:</td>
<td>Enrique “Kiko” Galvez (Physics and Astronomy)</td>
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<td>Delayed Choice Quantum Eraser with Single Photons</td>
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<th>Name:</th>
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<td>Exploring marine organisms with polarized light</td>
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<td>Patrick Crotty (Physics and Astronomy; Pre-Engineering)</td>
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<td>Möbius Polarization of Light</td>
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<td>Frequency Synchronization in Josephson Junctions</td>
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Name: Eric Palmerduca 2017 (Physics)
Mentor: Patrick Crotty (Physics and Astronomy; Pre-Engineering)
Title: Effects of Network Topology on Hippocampal Memory Capacity
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Sarah Reid—Agnes Scott College 2018 (Astrophysics)
Mentor: Jeffrey “Jeff” Bary (Physics and Astronomy)
Title: Observing Molecular Clouds in the Infrared
Funding: Keck Northeast Astronomy Consortium (KNAC)

Name: Alina Sabyr 2019 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: Microvariability of Blazar OJ 287
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Zoe Sale 2018 (Physics)
Mentor: Rebecca Metzler (Physics and Astronomy)
Title: Adhesive and Shell Interactions in the Eastern Oyster
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Derek Sherry 2018 (Physics)
Mentor: Kenneth “Ken” Segall (Physics and Astronomy)
Title: Simulating Neurons using Josephson Junctions
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Nolan Smyth 2018 (Physics)
Mentor: Jonathan Levine (Physics and Astronomy; Pre-Engineering)
Title: In-situ mass spectrometry
Funding: NASC Division

Name: Ryan Stahlin 2018 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: The Recent Outburst of the Blazar PKS 1749+096
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Michelle Tebolt 2019 (Astrogeophysics)
Mentor: Jonathan Levine (Physics and Astronomy; Pre-Engineering)
Title: Using Lead Isotopic Dating to Date Rocks in Space
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Zachary “Zack” Weaver 2017 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: The Dramatic June 2016 Flare of the Blazar 3C 454.3
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Saiyang “Sylvan” Zhang 2019 (Astronomy/Physics)
Mentor: Thomas Balonek (Physics and Astronomy)
Title: Optical Variability of Blazar OJ 287
Funding: NASC Division
Department of Psychology

Name: Rachel Geyer 2017 (Psychology; Spanish)
Mentor: Erin Cooley (Psychology)
Title: Examining the effects of behavioral synchrony on White people’s compassion for Black people’s pain
Funding: NASC Division

Name: Christopher Huber 2017 (Neuroscience)
Mentor(s): Bruce C. Hansen (Neuroscience; Psychology) and Douglas “Doug” Johnson (Psychology)
Title: Change Blindness: The Role of Implicit and Explicit Change Detection
Funding: NASC Division

Name: Matthew “Matt” Lettieri 2017 (Neuroscience)
Mentor: Richard “Rick” Braaten (Psychology)
Title: The Influences of Personality on Patterns of Social Conformity in Zebra Finches
Funding: NASC Division

Name: Nicole Lue 2018 (Neuroscience)
Mentor: Erin Cooley (Psychology)
Title: Psychological Mechanisms Underlying Inter-Group Conflict
Funding: NASC Division

Name: Cassandra “Cassie” Miller 2019 (Undeclared)
Mentor: Richard “Rick” Braaten (Psychology)
Title: The Influences of Personality on Patterns of Social Conformity in Zebra Finches
Funding: NASC Division

Name: Benjamin “Ben” Phelps 2018 (Psychology; Music)
Mentor(s): Bruce C. Hansen (Neuroscience; Psychology) and Douglas “Doug” Johnson (Psychology)
Title: Change Blindness: The Role of Implicit and Explicit Change Detection
Funding: NASC Division

Name: Stephanie Wu 2018 (Psychology)
Mentor: Erin Cooley (Psychology)
Title: Examining the effects of behavioral synchrony on White people’s compassion for Black people’s pain
Funding: NASC Division

DIVISION OF SOCIAL SCIENCES (SOSC)

Department of Anthropology

Name: Hailey Biscow 2017 (Anthropology)
Mentor: Elana Shever (Anthropology)
Title: Visiting the Bones: How Americans Construct Science and Meaning from Dinosaurs
Funding: SOSC Division

Name: Maria Isabel Kubabom 2017 (Anthropology)
Mentor: Mary Moran (Anthropology; Africana and Latin American Studies)
Title: Agency under Oppression: The Role of Sexual Minorities in the Rise of LGBTQI Initiative in Ghana
Funding: SOSC Division
Name: Angelica Smith 2017 (Anthropology)
Mentor: Elana Shever (Anthropology)
Title: Visiting the Bones: How Americans Construct Science and Meaning from Dinosaurs
Funding: SOSC Division

Department of Economics

Name: Weilin “Emily” Gu 2017 (Economics; Mathematics)
Mentor: Yang Song (Economics)
Title: Family Background and School Choice Behavior: Evidence from Urban China
Funding: Lampert Institute for Civic and Global Affairs

Name: Shambhavi Sawhney 2017 (Economics)
Mentor: Jyoti Khanna (Economics)
Title: ‘Make in India’ and its impact on the Indian Handloom Industry
Funding: Lampert Institute for Civic and Global Affairs

Department of Educational Studies

Name: Anh “Julie” Nguyen 2018 (Educational Studies; Mathematics)
Mentor: John Palmer (Educational Studies)
Title: Multicultural education for ethnic minorities in Vietnam: A case study in Hoa Binh for the Muong ethnic group
Funding: Lampert Institute for Civic and Global Affairs

Department of Geography

Name: Julia Feikens 2018 (Environmental Geography)
Mentor: Daisaku “Dai” Yamamoto (Asian Studies; Geography)
Title: The Socioeconomic Effects of Nuclear Decommissioning
Funding: SOSC Division

Name: Angelica Greco 2018 (Geography)
Mentor: Daisaku “Dai” Yamamoto (Asian Studies; Geography)
Title: The Socioeconomic Effects of Nuclear Decommissioning
Funding: SOSC Division

Department of History

Name: Haley Allen 2018 (Africana and Latin American Studies; Political Science)
Mentor: Heather Roller (History)
Title: Memory Struggles in the Schoolyard
Funding: Lampert Institute for Civic and Global Affairs

Name: Brynne Becker 2017 (English; History)
Mentor: Jennifer Hull (History)
Title: Rewriting the History of Colgate: A Bicentennial Research Project
Funding: SOSC Division

Name: Anne “Maddy” Canning 2018 (History)
Mentor: Graham Hodges (History; Africana and Latin American Studies)
Title: William Still and the Fight to End Discrimination on Railway Cars in Philadelphia: Uniting the Abolitionist and Civil Rights Movements in the Fight Against Segregation
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<td>Anthony Duffy 2019 (Philosophy; History)</td>
<td>Antonio Barrera (Africana and Latin American Studies; History)</td>
<td><em>Experience and Knowledge in the Atlantic World 1500-1700</em></td>
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<td>Kevin Suh 2018 (History)</td>
<td>Antonio Barrera (Africana and Latin American Studies; History)</td>
<td><em>Experience and Knowledge in the Atlantic World 1500-1700</em></td>
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<td>Emily Wong 2018 (History)</td>
<td>Jennifer Hull (History)</td>
<td><em>Post-WWI Curricular Reform at Colgate University: Development of the Core</em></td>
<td>SOSC Division</td>
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<tr>
<td>Junyang “Stan” Zhang 2018 (Undeclared)</td>
<td>David Robinson (Asian Studies; History)</td>
<td><em>Fundamental Debate in Contemporary Chinese Historiography</em></td>
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<td>Jonathan “Jake” Baynum 2018 (Political Science)</td>
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<td><em>Upstate Global Collective Research Symposium-Marginalized Communities Group</em></td>
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<td><em>Reducing Recidivism in the Juvenile Justice System</em></td>
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<td>Hailey Reczka 2017 (Economics; Political Science)</td>
<td>Barry Shain (Political Science)</td>
<td><em>Revolutionary-era American Political Pamphlet Literature in Context: a Documentary History 1764-1776</em></td>
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<td>Henry Thomas 2018 (History)</td>
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<td><em>Revolutionary-era American Political Pamphlet Literature in Context: a Documentary History 1764-1776</em></td>
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**Department of Sociology**

Name: Alexis Beamon 2017 (Africana and Latin American Studies; Educational Studies)  
Mentor: Alicia Simmons (Sociology)  
Title: *News Media Framing of Unarmed Blacks Killed by Law Enforcement*  
Funding: SOSC Division

Name: Colleen Donlan 2018 (Political Science)  
Mentor(s): April Baptiste (Environmental Studies) and Christopher “Chris” Henke (Sociology)  
Title: *Food Access in Rochester, NY: A Case Study of SNAP Users at the Public Market*  
Funding: SOSC Division

Name: Timothy Englehart 2018 (Sociology; English)  
Mentor: Janel Benson (Sociology)  
Title: *Inclusion and Mobility: First Generation College Students at Elite Colleges and Universities*  
Funding: SOSC Division

Name: Jared Henderson 2017 (Sociology)  
Mentor: Alicia Simmons (Sociology)  
Title: *News Media Framing of Unarmed Blacks Killed by Law Enforcement*  
Funding: SOSC Division

Name: Chelsea Mohr 2017 (Sociology)  
Mentor: Janel Benson (Sociology)  
Title: *The long-term impacts of mentoring on low-income, rural youth*  
Funding: SOSC Division

Name: Susan Waltz 2018 (English)  
Mentor: Janel Benson (Sociology)  
Title: *Inclusion and Mobility: First Generation College Students at Elite Colleges and Universities*  
Funding: SOSC Division

**DIVISION OF UNIVERSITY STUDIES (UNST)**

**Department of Africana and Latin American Studies**

Name: Laura “Lorelai” Avram 2017 (Anthropology)  
Mentor: Mary Moran (Anthropology; Africana and Latin American Studies)  
Title: *Moving Toward a Decolonial South-African Museology*  
Funding: Lampert Institute for Civic and Global Affairs

Name: Antoinette “Onyeka” Nwabunia 2017 (Africana and Latin American Studies; POSC)  
Mentor: Mary Moran (Anthropology; Africana and Latin American Studies)  
Title: *“It’s a Man’s World” but Mothers Make Kings and Daughters become Queens: The Politics of Power in Democratic Nigeria*  
Funding: Lampert Institute for Civic and Global Affairs

**Department of Asian Studies**

Name: Angela Jang 2017 (Sociology)  
Mentor: Daisaku “Dai” Yamamoto (Asian Studies; Geography)  
Title: *Life in a Nuclear Neighborhood: Nuclear Plant Host Communities in South Korea*  
Funding: Lampert Institute for Civic and Global Affairs
Name: Haesel Kim 2018 (Psychology)  
Mentor: David Robinson (Asian Studies; History)  
Title: *Contending Narratives on the 'Comfort Women' Issue in South Korea and Japan*  
Funding: Lampert Institute for Civic and Global Affairs

**Department of Environmental Studies**

Name: Robert “Bobbie” Howie 2018 (Environmental Studies)  
Mentor(s): April Baptiste (Environmental Studies) and Christopher “Chris” Henke (Sociology)  
Title: *Food Access in Rochester, NY: A Case Study of SNAP Users at the Public Market*  
Funding: UNST Division

Name: Taylor Huffer 2018 (Women’s Studies)  
Mentor: Frank Frey (Biology; Environmental Studies)  
Title: *Reimagining Colgate’s LGBTQ Sensitivity Training*  
Funding: UNST Division

**Department of LGBTQ Studies**

Name: Em Rubey 2018 (Educational Studies)  
Mentor: Mark Stern (Educational Studies; LGBTQ Studies)  
Title: *Toiletiquette: How Dirt and Danger Shape Bathroom Behavior, Exploration of Gender in Public Toilets*  
Funding: UNST Division

**Department of Peace and Conflict Studies**

Name: David Berry 2017 (Art and Art History; Peace and Conflict Studies)  
Mentor: Daniel Monk (Geography; Peace and Conflict Studies)  
Title: *Summer Fellowship*  
Funding: Theodore Herman Fund

Name: Georgia Butcher 2017 (Anthropology)  
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)  
Title: *Nagasaki Atomic History and the Present*  
Funding: UNST Division

Name: Benjamin Kelsey 2018 (French)  
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)  
Title: *Nagasaki Atomic History and the Present*  
Funding: UNST Division

**Department of Women’s Studies**

Name: Mariam Nael 2018 (Women’s Studies)  
Mentor: Meika Loe (Sociology; Women’s Studies)  
Title: *Home Away from Home: How Do Third Culture Kids (TCKs) Form Their Personal Identity, Especially Their Cultural and Racial Identity in College?*  
Funding: UNST Division
# CENTER FOR FREEDOM AND WESTERN CIVILIZATION

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# LAMPERT INSTITUTE FOR CIVIC AND GLOBAL AFFAIRS

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<td>Sophie Coffman 2017 (Chinese)</td>
<td>John Crespi (Asian Studies; Chinese; EALL)</td>
<td>The Rhetoric and Influence of the China Dream Propaganda Campaign</td>
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Name:  Anh “Julie” Nguyen 2018 (Educational Studies; Mathematics)
Mentor:  John Palmer (Educational Studies)
Title:  Multicultural education for ethnic minorities in Vietnam: A case study in Hoa Binh for the Muong ethnic group
Funding: Lampert Institute for Civic and Global Affairs

Name:  Antoinette “Onyeka” Nwabunnia 2017 (Africana and Latin American Studies; POSC)
Mentor:  Mary Moran (Anthropology; Africana and Latin American Studies)
Title:  “It’s a Man’s World” but Mothers Make Kings and Daughters become Queens: The Politics of Power in Democratic Nigeria
Funding: Lampert Institute for Civic and Global Affairs

Name:  Shambhavi Sawhney 2017 (Economics)
Mentor:  Jyoti Khanna (Economics)
Title:  ‘Make in India’ and its impact on the Indian Handloom Industry
Funding: Lampert Institute for Civic and Global Affairs

Name:  Maria-Dorin “Doreen” Shayo 2017 (Physical Science; Africana and Latin American Studies)
Mentor:  Harvey Sindima (Religion)
Title:  Out of the Calabash and into the Pillbox: The Standardization Process of Traditional Medicine in Tanzania
Funding: Lampert Institute for Civic and Global Affairs

NEW YORK SIX LIBERAL ARTS CONSORTIUM

Name:  Sonya Dexter 2018 (Biology)
Mentor:  Timothy McCay (Biology; Environmental Studies)
Title:  Understanding Earthworm Invasion through Field and Lab Studies and Individual Based Modeling
Funding: New York Six Liberal Arts Consortium

Name:  Xaviera Gitau—St. Lawrence University 2017 (Government; Global Studies)
Mentor:  Navine Murshid (Political Science)
Title:  Upstate Global Collective Research Symposium-Marginalized Communities Group
Funding: New York Six Liberal Arts Consortium

OTHER

Name:  Michael DiGiorgio 2018 (Music; Physics)
Mentor:  Joseph “Joe” Eakin (Ho Tung Visualization Laboratory & Planetarium)
Funding: Ho Tung Visualization Laboratory & Planetarium

Name:  Megan Emch 2018 (Astrogeophysics)
Mentor:  Joseph “Joe” Eakin (Ho Tung Visualization Laboratory & Planetarium)
Title:  Science Outreach at Colgate
Funding: NASA / New York Space Grant

Name:  Mark Ma 2018 (Computer Science)
Mentor:  Joseph “Joe” Eakin (Ho Tung Visualization Laboratory & Planetarium)
Funding: Information Technology Services

Name:  Erica Nathan 2018 (Mathematics; Astrogeophysics)
Mentor:  Joseph “Joe” Eakin (Ho Tung Visualization Laboratory & Planetarium)
Title:  Science Outreach at Colgate
Funding: Ho Tung Visualization Laboratory & Planetarium; NASA / New York Space Grant
RESEARCH COUNCIL

Name: Corrina Moncada 2018 (Biology)
Mentor: Priscilla Van Wynsberge (Biology)
Title: The Effects of Diethylstilbestrol on Fertility of C. elegans over succeeding generations
Funding: Research Council; Science and Math Initiative-SMI (NASC Division)

Name: Patricia Moscicki 2018 (Neuroscience)
Mentor: Christina Ragan (Neuroscience; Psychology)
Title: The Role of Maternal Care and Early Anti-Depressant Exposure on Later Offspring Anxiety in Laboratory Rats
Funding: Research Council

Name: Natalie Pudalov 2017 (Peace and Conflict Studies)
Mentor: Ana Jimenez (Biology)
Title: An Analysis of Bird Migration Patterns in Madison County using Citizen Science
Funding: NASC Division; Research Council

UPSTATE INSTITUTE

Name: Austin Anderson 2017 (Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Updating the Madison County Overweight and Obesity Report
Funding: Upstate Institute

Name: Erin Burke 2018 (History)
Mentor: Julie Dudrick (Upstate Institute)
Title: Museological Exploration at the Oneida County Historical Society
Funding: Upstate Institute

Name: Jinsuh Cho 2018 (Educational Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: UNSPOKEN Human Rights Film Festival (MVRCR)
Funding: Upstate Institute

Name: Sara Daniel 2019 (Undeclared)
Mentor: Julie Dudrick (Upstate Institute)
Title: Quality of Life Video and Economic Impact Study
Funding: Upstate Institute

Name: Luke Felty 2018 (English)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellowship on Local Foods in Hamilton, New York
Funding: Upstate Institute

Name: Daniel Handler 2018 (Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Cornell Cooperative Extension Hops Program
Funding: Upstate Institute

Name: Jacqueline “Jackie” Hanrahan 2018 (Psychology; Economics)
Mentor: Julie Dudrick (Upstate Institute)
Title: Rural Healthcare in Chenango County
Funding: Upstate Institute
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<td>Jordan Henderson 2017 (Sociology)</td>
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<td>Changing America at the National Abolition Hall of Fame and Museum</td>
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<td>Jeffrey Marr 2018 (Economics)</td>
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<td>Working with Hudson Headwaters to Improve the Adirondack Health System</td>
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<td>Holly Mascolo 2017 (Environmental Studies; Educational Studies)</td>
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<td>Title:</td>
<td>A comparative survey of social roles and community engagement of adults with and without disabilities in rural upstate New York</td>
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<td>Title:</td>
<td>Refugee Health Access and Trauma-Informed Care in Utica, NY</td>
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<td>Funding:</td>
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Research Summaries
Title of Project: Memory Struggles in the Schoolyard

Project Summary:

Despite its transition to democracy, Chile’s post-dictatorship society is highly divided by socioeconomic measures and historical memory. The education system, said to exacerbate this societal division, is especially debated. Any discourse on the country’s societal ills is inextricably related to conflicting interpretations of and sentiments about Chilean history, namely the coup d’état of 1973 and consequent dictatorship of Augusto Pinochet. Students in public and private universities mirror, and perhaps even magnify, Chilean society’s levels of inequality and the physical separation that exists between the rich and the poor. It would be an oversimplification to suggest a stark separation in political ideology between students of these types, to separate them in terms of Pinochet sympathizers and Allende idealists. However, the public/private university system does appear to create demographic differences that correlate in many ways with political ideology. The concentration of like ideologies on certain campuses creates a “university bubble” effect, which strengthens, and even radicalizes, the ideology of individuals.

This article discusses patterns in historical memory and public/private school status and the ways in which these “memory struggles” influence political ideology and levels of activism. Specifically, this research aims to determine whether public and private university students remember the Pinochet dictatorship differently and in what ways its legacy informs their political ideologies and identities, as well as the significance in these differences going forward in post-dictatorship democracy. Interviews and observation led me to conclude that public university students are much more likely to identify current societal ills, to reference the dictatorship as the cause, and to participate in movements for social change. In contrast, private university students are more likely to see society as improving, to distance themselves from the dictatorship, to demonstrate a sense of complacency with the current system and to ignore, if not repress student movements for change.

☑ Other (specify): Lampert Institute for Civic and Global Affairs
Title of Project: Distribution and Habitat of a Native Earthworm, *Eisenoides lonnbergi*, in Upstate New York

Project Summary:

The goal of this research project was to investigate the distribution and types of habitats that *Eisenoides lonnbergi*, a native species of earthworm, occupies in upstate New York. Today, there is a very real threat from foreign invasive earthworms that drastically reduce the three-dimensional structure of forest-floor leaf litter, and therefore reduce the habitat available to many other species as well as potentially exacerbating global climate change. We hypothesized that *Eisenoides lonnbergi* is one of the few remaining native earthworms in the northeast because of its ability to survive in more extreme environments than other invasive species. Learning more about this species will contribute to our knowledge about the exotic-worm invasion of the northeastern U.S., as well as examining the possible need for listing the species as one of conservation concern. We knew from previous work in the lab and collaboration with Professor Rebecca Pinder that *Eisenoides lonnbergi*, commonly known as the bog worm or American grey soil worm, has been associated with acidic wetlands. With the aid of Google Maps and data from published literature we were able to investigate 10 different sites in an attempt to find additional populations of *Eisenoides lonnbergi*. Upon reaching the sites, each area was scoured using a hand-searching method involving overturning rocks, logs, moss, and some of the top-layer leaf-litter. Some sites were visited multiple times and were usually searched for 4 person-hours. Collected worms were photographed and then euthanized using a combination of isopropanol and formalin to preserve the worms' pigmentation. Identification of the worms was done according to two guidebooks, Soil Biology Guide and Earthworms of the Great Lakes. If a site was inhabited by the bog worm, pH readings were taken of water or soil samples at each location. Of the 10 visited sites, 6 were found to have *Eisenoides lonnbergi*. The sites were either swampland or bog and ranged widely in pH. The location with the most basic pH was The Great Swamp Conservancy in Canastota at 8.5, and the most acidic wetland was in Stone Barn State Forest in Cleveland at 3.4. The other sites included Lost Pond in Brookfield, Jam Pond in German, Nelson Swamp Unique Area in Nelson, and Fiddler's Green in Bouckville. Quite often, the American grey soil worm wasn't the only species of earthworm found at each location, especially in the areas of swampland. *Lumbricus rubellus*, *Aporrectodea longa* and *Eudrilus euginae* were species that were frequently found coexisting with the bog worm. In addition, many of the worms collected did not have a fully developed clitellum, which made identification or distinction between species impossible. Our results indicate that *Eisenoides lonnbergi* can live in a wide variety of environments, which apparently allows them to avoid competition with many of the invasive species from Asia and Europe. The bog worm’s ability to live in highly acidic environments, in particular, places it in habitats that few other species can tolerate. Our hypothesis was in part confirmed. However, while the bog worm was the only species of worm found in the bogs at Jam Pond and Fiddler's Green, the other swampland sites had a few other species of earthworm including the invasive *Lumbricus rubellus*. This indicates that in bogs, *Eisenoides lonnbergi* may be one of only a handful of species that can handle the highly acidic soil that exists at the wetlands we found them in. This also means however, that in some cases the bog worm is competing with the foreign species of earthworm. *Eisenoides lonnbergi* was found all over Madison County and in several sites outside of the county. More than half of the sites we investigated contained adult bog worms, with several others hosting possible juveniles. From these data, it is clear that the bog worm doesn’t seem to be in need of conservation concern and is in fact thriving in its unique habitats.

Research Fellow: Austin Anderson (2017)  
Concentration:  Biology

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Updating the Madison County Overweight and Obesity Report

Project Summary:

Working with the Madison County Rural Health Council (MCRHC) this summer gave me insight into the network of organizations that affect a community’s public health. The Madison County Rural Health Council continually collects and analyzes data on health topics (ex: colorectal cancer screening, clean tap water, amount of physical exercise) to design plans and programs for the county that address the most significant health issues in areas of disparity. During the summer of 2016, the MCRHC focused on producing a state mandated Community Health Assessment/Community Health Improvement Plan (CHA/CHIP) that gives an overview of the county, the most significant health priorities, and an action plan to address these health needs. The two priorities chosen for Madison County were improving colorectal cancer screenings and reaching and maintaining healthy weights. To engage the community and create an effective action plan, the council held several community stakeholder meetings with organizations in the area to define a starting target group for each of the health priorities. In both cases worksites were chosen as the group to focus on as they are structured environments that can adopt policy and programs to fit our goals for improving colorectal cancer screening and overweight and obesity rates.

The ongoing development of the 2017-2018 CHA/CHIP motivated my personal project to update an 80 page overweight and obesity report on Madison County written by the Madison County Health Department in 2009. The update was constructed on data from the CDC’s Behavioral Risk Factor Surveillance Survey, New York State Department of Health surveys, and published journals. The report covers statistics on overweight and obesity in the U.S., New York, and Madison County, as well as, information on the factors that contribute to obesity and a list of recommended strategies to improve healthy weights. Revising the report confirmed the healthy weight priority as a significant health issue for Madison County and provided background for the 2017-2018 CHA/CHIP. Along with completing the report I created an Overweight and Obesity in Madison County Brief as a consolidation of the findings, which I presented to stakeholders and community organizations.

Overweight or Obese Adults in Madison County (13-14)

The data shown to the left was taken from Health, CNY, which reports on the level of overweight or obesity in Madison County with respect to all other New York counties, excluding New York City. Nearly two out of every three Madison County adults is overweight or obese, with one in every five children classified as obese. These percentages speak to the magnitude of this health issue for not only the individual, but the community as well. Being overweight significantly increases absenteeism costs for employers, places a burden on health insurance providers, and increases the risk for developing roughly 30 other health conditions. Many of our everyday practices exacerbate the problem, such as offering cookies at staff meetings or allowing children extensive screen time, so shifting the rates toward progress for Madison County will require a cultural shift.

Obese Youth in Madison County (12-14)

Reovirus is a double-stranded RNA virus composed of ten gene segments surrounded by a double layer protein shell. Because the virus is only lethal in newborn mice, it serves as an excellent model for studying the cellular response to infection without the dangers of self-infection. When reovirus is detected in a mammalian cell, the cell’s innate immune response activates to combat the virus’ replication and spread to neighboring cells. The innate immune response serves as an organism’s first line of defense against a pathogen. The transcription factors IRF-3 and NF-KB are essential to regulating the innate immune response after reovirus infection. IRF-3 and NF-KB activate the interferon response by binding to the IFN-B promoter. The production of interferon-B impedes viral replication by inducing the expression of Interferon Stimulated Genes, which inhibit various steps of the reovirus replication cycle. If the interferon response cannot sufficiently inhibit reovirus replication, then IRF-3 and NF-KB bind to the Noxa promoter to stimulate apoptosis, or programmed cell death. The protein Noxa serves as a pro-apoptotic factor, inducing programmed cell death to prevent the spread of reovirus to adjacent cells.

My project focused on IRF-3’s binding activity to the Noxa promoter to induce apoptosis. After reovirus infection, IRF-3’s transcriptional activity is highest at 6-8 hours post infection, however, Noxa is not up regulated until 36 to 48 hours post infection. The delay in Noxa upregulation after IRF-3 binding may be due to a requirement for prolonged binding of IRF-3 to Noxa’s promoter, the recruitment of other transcription activators to the Noxa promoter, or the release of a transcriptional repressor from silencers around the Noxa gene. To investigate how IRF-3 interacts with the Noxa promoter at various times post infection, I attempted to use chromatin immunoprecipitation, or ChIP. In short, ChIP involves pulling down DNA-bound protein with a specific antibody, purifying the DNA from the protein pulled down, and analyzing the relative levels certain DNA sequences by quantitative PCR. By using ChIP at different time periods post-infection, I attempted to identify when IRF-3 maximally binds to the Noxa promoter.

Due to difficulties with the chromatin immunoprecipitation procedure, a majority of my summer was spent troubleshooting. The main problem was that the purified ChIP DNA did not amplify to discernable levels after qPCR when analyzed by both the qPCR standard curve and gel electrophoresis. In ChIP, various portions of the experiment may go wrong, including the antibody not pulling down the specified protein, inefficient crosslinking of the protein to DNA, inadequate sheared chromatin length, poor reverse crosslinking of the sheared chromatin to DNA, protein degradation, or excessively diluting the chromatin after shearing. In order to prove that my sheared chromatin length was optimal for qPCR, I observed the sheared chromatin products by gel electrophoresis to ensure that the sheared chromatin fragments measured 300-500 basepairs, a length optimal for qPCR. Furthermore, I used western blotting to ensure that the IRF-3 protein was indeed pulled out of the cell lysate, and performed RT-qPCR to make certain that IRF-3 levels were truly increased by reovirus infection. Finally, I attempted to increase the level of chromatin concentration from 1:10 dilution to about 1:5 dilution, but little changed in the resulting qPCR standard curve. The next step in troubleshooting the ChIP procedure is to determine the optimal time of crosslinking the protein to the DNA. If various crosslinking times do not alter the amplification of products, then I’ll re-attempt the procedure using an antibody for a protein that always binds to DNA, such as the histone marker H3-K9me3, to make sure that the qPCR machine works for the ChIP primers. Despite not perfecting the ChIP procedure, this summer was an invaluable experience for learning the skills, thought processes, and adversities of biological research.
Title of Project: WORMSPREAD: An individual-based model of invasive earthworm population

Project Summary:

Invasive exotic earthworms, such as Lumbireus Rubellus, are rapidly invading much of the United States and have had significant effects in many forests. Earthworms can cause changes to forest soils, which may result in reduced forest biodiversity. Individual Based Modeling (IBM) offers a way to predict the spread of invasive species, and can provide insight for control.

We developed an individual-based, spatially explicit, population dynamics model (WORMSPREAD) using the NetLogo environment. The user interface is designed to be easy to learn and flexible enough to incorporate new data. WORMSPREAD allows ecologists and conservationists to better understand how variations in landscape structure and demographic parameters affect predicted earthworm abundance and distribution. We included the ability for users to control global temperature variation, local soil pH, and worm reproduction and mortality features. Results can help determine where and how to concentrate conservation efforts and control strategies.

An example study of the spread of L. rubellus in a portion of the Adirondack Park in upstate New York illustrated challenges to the implementation of WORMSPREAD for this and other species. In particular, more data on the relationship between species demography and environmental conditions are needed – even for this common and well-studied species. The computational demands of IBMs over spatial and time scales relevant to management also may be limiting.

WORMSPREAD can be used to predict population growth in real landscapes, with real variation in environmental conditions. However, it will only lead to accurate predictions if the underlying physiological and behavioral traits of the invading species are known. Indeed, our assessment of these traits for L. rubellus indicate that more data are needed for this species, and the situation is likely to be more challenging for less well-studied species. A better understanding of earthworm physiology and behavior will increase the efficacy of this and other efforts to model the spread of invasive earthworms.

Research Fellow: Laura “Lorelai” Avram (2017)  
Concentration: Anthropology

Faculty Mentor: Mary Moran  
Department(s): Anthropology; ALST

Title of Project: Moving Toward a Decolonial South-African Museology

Project Summary:

Though my interest was initially restricted to decolonial archaeology, it expanded to include decolonial museology: museum curation that aims to challenge the hierarchy between the individuals who are displayed and those who display, and between the viewer and the curator. In the colonial context, museums represented the site of contact between the citizens of imperial nations and the imperial subjects’ “exotic culture”. Museum exhibits displayed artifacts looted from the colonies that could be used to legitimate colonialism, by “proving” the “barbarity” of the colonies.

Thus, given a colonial history of colonizers’ having absolute control over the representation of the colonized “subalterns” and their cultural resources, I wanted to research instances of decolonial curatorship in South Africa: indigenous, multi-faceted, emic, feminist curatorship. I also wanted to explore its potential for political emancipation and self-actualization. To that end, I examined curatorial practices in ethno-tourism (tourism to “living museums” meant to depict the way individuals of different ethnicities used to live), township tourism (otherwise known as slum tourism: tourism to impoverished areas), graffiti tourism and institutionalized tourism (visiting “conventional” museums and other institutions of cultural heritage management).

What I discovered is that, tourism, even when run by “natives”, runs the risk of remaining depoliticized. Because of the economic inequality between the global North and the global South, most museum goers in South Africa are white, come from Europe and the US and have a particular imaginary of “Africanness”, which shapes the experiences that they seek and pay for.

As such, even these alternative forms of museums and of tourism in which the indigenous are in charge of the knowledge production, are often criticized by scholars for furthering culturally essentialist tropes (by advancing, for instance, all of the Zulu have a fixed cultural identity that can be performed and consumed in a cultural village) and for leaving out histories of political struggle from their discourses (by focusing more on “traditional” spaces of the township, for example, rather than on sites of protest).

Nonetheless, this is necessary because the individuals behind these initiatives are often disenfranchised; they are the survivors of colonialism and then of the racist, fascist apartheid. As such, they prioritize their financial empowerment, which often means delivering the tourists what they expect of the place they are visiting. In the interviews, these individuals reveal other benefits, as well, that stem from their tourism initiatives: a sense of self-worth coming from interest in their lives and cultures, a sense of collective identity, better knowledge of English for them and their community. So, while decolonial tourism initiatives don't automatically fight racism and white European supremacy, they do benefit disadvantaged South-African communities.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Lampert Institute for Civic and Global Affairs
Research Fellow(s): Kathryn Bazany (2017)
Max Israelit (2018)

Faculty Mentor: Catherine Cardelús
Department: Biology

Title of Project: An Examination of the Health of the Sacred Forests of Northern Ethiopia

Project Summary:

The sacred forests of Northern Ethiopia surround Ethiopian Orthodox Tewahido Churches and are of religious, social, and economic significance to local people. As of 2006, the religion has 30 million followers, 400,000 priests, and 35,000 churches in Ethiopia. Many forests contain small schools and serve as a home to priests and orphaned children. Church forests also serve as a cemetery for members of the church.

These forests are threatened primarily due to their small size and isolation and high disturbance in the form of edge effects, cattle grazing, and human disturbances including the removal of downed wood and additional deforestation for cooking fires. Much of the local conservation is motivated by religious significance, however the forests are also of ecological importance, serving as a refuge for native wildlife and pollinators, and representing the majority of the remaining plant biodiversity of the region, as most native forests have been converted to agricultural land.

These forests are vulnerable due to their small size, isolation, and high disturbance. The main concern for the survival of these forests is the lack of tree regeneration. Few seedlings in the forests survive to adulthood meaning that when current adult trees die, the forests may vanish. Outer wall construction has positive effects on seedling growth, as outer walls reduce disturbance by excluding cattle and discouraging people from gathering downed wood or cutting trees and branches.

The purpose of this multidisciplinary project is to determine the overall health of the forests by examining the nutrient composition of the soils, foliar, and litter in the forests, led by Professor Cardelús and Professor Woods, the changing sizes and geographic layout of the forests, led by Professor Scull, and the perception of the value of these forests held by local community members, led by Professor Klepeis. We were primarily working with professor Cardelús and professor Woods tree identification, taking tree DBH (diameter at breast height), seedling identification, litter collection, taking soil cores, collecting foliar, and running transects which includes tree identification, DBH, and seedling identification, and noting land uses like grave markers and cattle paths.

We worked in collaboration with a team of Ethiopian graduate students in partnership with Bahir Dahr University. The University provided lab space for us to conduct time sensitive lab work, primarily with processing soils for analysis of available phosphorous, microbial biomass, nitrogen mineralization, bulk density, and gravimetric water content. We also weighed disks of foliar tissue to determine the thickness of leaf tissue, or SLA. The contributions of the Ethiopian team are vital to the success of the project. Not only were they constantly assisting us in field and laboratory tasks, they also created a cultural and language bridge that allowed us to gain permission from local priests to enter these sacred forests in order to conduct our research. The Ethiopian team is also continuing research year round, collecting samples from old and new forests, and shipping new samples and extracts back to Colgate so they can be processed.

After three weeks in Ethiopia we returned to Colgate to continue processing samples. For the rest of the summer we focused on grinding litter and foliar so it could be rolled and processed for carbon and nitrogen in an elemental analyzer. Litter and foliar samples were also processed for inorganic phosphorous using an ash digestion method and colorimetry. Dried soils are currently being processed using the same methods. The first set of new foliar and litter samples and soil extracts are currently being shipped to Colgate for processing. The social science team is continuing interviews with members of the church and surrounding communities. With the combined efforts of the natural science team and the social science team we aim to be able to better understand the immense value of these tiny forests on the preservation of unique biodiversity and the communities that surround them.

☑ Other (specify): Oberheim Memorial Fund
Title of Project: News Media Framing of Unarmed Blacks Killed by Law Enforcement

Project Summary:

Professor Simmons' project “News Media Framing of Unarmed Blacks Killed by Law Enforcement” grapples with the primary research question: how has the mainstream news media framed the issues and events surrounding deaths of unarmed blacks at the hands of law enforcement? Framing is a process of selecting aspects of reality and making them salient, while directing attention away other aspects; this process has implications for audience members' understanding of and opinions about the world. To assess how the news frames these events, this project uses the content analysis methodology, which entails systematically analyzing message characteristics. There were two main phases of our research.

During phase 1 of our research, we updated and expanded a database of 133 events, the police killings of unarmed blacks, occurring between 2013 and 2015. Key variables we updated in the database included: Details about the event (e.g., reason for the officer/victim encounter, involvement of a chase, methods of injury to the victim), details pertaining to the aftermath of the event (e.g., protests, civil rights investigations, civil suits), details about the victim (e.g., age, mental health, criminal record), and details about the officer(s) (e.g., race, rank, previous complaints). Additionally, for each event, we updated and expanded a database of broadcast transcripts and articles appearing in six news outlets (i.e., ABC World News, CBS Evening News, NBC Nightly News, New York Times, USA Today, and Washington Post) between the date of the specified event and 5/31/16, the day we began to compile data. The total number of stories in this database equaled 2,538. Key variables in this database included: Amount of coverage, prominence of coverage, and type of coverage (i.e., mere mentions, feature stories, launchpad stories).

Phase 2 of our research centered around exploring the Agenda Setting theory, the idea that the media filters and shapes reality rather than reflect it; the media not only tells us what to think about, but they also tell us how to think about a given topic. Focusing on the five most newsworthy cases (Michael Brown, Amadou Diallo, Eric Garner, Freddie Gray, and Sean Bell), we conducted a content analysis on 2,323 articles and broadcast transcripts that were either feature stories about a particular case and its surrounding events or articles that used these cases as a launchpad to talk about other social issues. Key variables here included: Topic of article; Events pertaining to the case (e.g., Criminal justice proceedings, demonstrations, official concessions); social issues (e.g., Racial stratification, police practices, public policy); Actors (e.g., Victim family/friends, Police, Politicians); and Sources that the information is attributed to.

![Figure 1](image1.png)  ![Figure 2](image2.png)

□ Other (specify):
Project Summary:

In preparation for Colgate’s upcoming 200th anniversary, a team of researchers is working to rewrite the history of Colgate. The goal of this project was to help tell the history of Colgate in a way that includes people, trends, and events that may not have appeared in traditional stories of the university. As part of the team working on rewriting the history of Colgate, I focused on coeducation at Colgate with a special emphasis on Title IX.

Aside from conducting interviews and working on a few other projects, I do most of my research in the Special Collections and University Archives section of the Case Library and Geyer Center for Information Technology. My work involves identifying, summarizing, and organizing documents of interest that are found either in the archives or through Colgate’s digital collection. I also wrote a blog post for the Colgate website about my research.

In doing my research I discovered that coeducation at Colgate began long before its official advent in 1970. The first known woman to attend Madison University was Emily Taylor, the daughter of a former Colgate President, during the first half of the 19th century. She appeared to have only audited classes. Mabel Dart Colegrove, Colgate’s first official coed, attended the university in the late 1870s. She was a local girl who was permitted to become a student by President Dodge and a trustee. Colegrove attended classes until the second semester of her senior year when she was encouraged to transfer to Vassar in order to receive a diploma and a degree. It appears that there were multiple other less well known women attending Colgate at this time, as well as girls who attended the Colgate Academy and the Hamilton Female Seminary.

Female students at Colgate seem to disappear from the records after the death of President Dodge, but it does seem like the wives of faculty members may have taken classes or at least been a frequent presence on the campus during the 1920s. In the 1940s the wives of veterans were permitted to enroll at Colgate with their husbands and take classes.

The question of admitting female students in large numbers was a contentious one during the 1960s. Many alumni were extremely opposed to the idea that Colgate would cease to be an all-male institution, while the faculty and current students seemed to be more in favor of coeducation. There were women admitted Colgate as graduate students and women at Colgate getting teacher certifications, but the question of undergraduate coeducation was a subject of contention throughout the 1960s. During the final years of this decade, exchange programs between women’s colleges and Colgate as well as the presence of some upperclass female transfers increased the presence of women on campus and the Board of Trustees voted to implement coeducation starting in 1970 in response to the demand for Colgate to evolve into a modern day school. While the advent of coeducation at Colgate was certainly a step forward for women’s educational rights, the decision to do so was made more with the interests of current and prospective male students in mind.

In August of 1970 the class of 1974 entered Colgate University as the first coed class. Throughout the 1970s and 1980s issues such as housing for women, female sports teams, admissions quotas for women, sexual assault, and daily occurrences of sexism in the classroom and within the social scene dominated the student publications and official records. Quotas that limited the number of women that could be admitted to the school became points of contention between the alumni, students, Board of Trustees, and administrators during the second half of the 1970s. These discussions and debates paralleled the movement to hire more female faculty members and achieve a higher number of tenured female faculty members. A lack of female athletic facilities, equipment, resources, and funding continued to be an issue even through the 1990s. Colgate was at the center of a landmark Title IX case in which the women’s club ice hockey team took the school to court over the fact that the repeated denial of their petition for varsity status was due to the fact that the school did not feel that women’s sports were important enough to justify diverting funds and resources away from male teams. Groups such as the Women’s Caucus, The Women’s Coalition, and Women at Colgate worked to create a space for women at Colgate. The Women’s Resource Center moved between 84 Broad and Cutten before finding a home in the basement of East Hall. Greek life expanded to include sororities in the 1980s. Students and faculty members worked together to introduce a major and a minor in Women’s Studies, as well as other interdisciplinary courses in other departments.

Working in the archives required a lot of patience and perseverance. However, that is what made the work so interesting and rewarding. This research contributed to shedding light on an important part of Colgate’s past.

Autophagy is the process by which cells remove and recycle old or dysfunctional cellular components ranging from individual proteins to entire organelles. Deficiencies in autophagy have been shown to be implicated in diseases including Parkinson’s, cancer, and even aging itself. Without the removal of dysfunctional cellular components, the cell suffers from systematic malfunctions to metabolism and DNA integrity. One major source of damage comes from impairment of mitochondrial autophagy known as mitophagy. Mitochondria are responsible for providing the energy for a cell, but they are also responsible for producing disruptive chemicals known as reactive oxygen species (ROS) that can cause damage to DNA and other cellular components. ROS are thought to be responsible for causing age-related DNA and cellular damage that can lead to cancer. Damaged mitochondria produce higher amounts of ROS; therefore, cells need to remove them through mitophagy to avoid damage.

Krüppel-like factor-four (KLF4) is a zinc finger containing transcription factor. Through its ability to both activate and repress certain genes, KLF4 performs a multitude of functions. KLF4 has been implicated in cell growth, proliferation, and differentiation and embryogenesis. Recently KLF4 has been implicated in tumor development. Previous research in our lab has demonstrated that cells lacking KLF4 demonstrated higher levels of ROS and DNA damage. They also found that KLF4-null cells demonstrated impaired autophagy. However, the mechanism that leads to increased ROS and impaired autophagy is not yet characterized. The focus of our research was to determine what the KLF4 role in autophagy is and whether impaired autophagy could be responsible for the increase in ROS.

**Methods**

**Cells:** We used two line of cells in this project: Mouse embryotic fibroblasts that were null for KLF4; and A colorectal cell line known as RKO that had inducible KLF4 expression. **Treatments.** We treated cells with various chemicals that could induce autophagy, and mitophagy. **Analysis:** Western blotting techniques were used to quantify protein expression. We used a series of dyes that targeted healthy mitochondria and quantified the results using fluorescent microscopy and flow cytometry. To analyze transcription at the mRNA level we utilized RT-qPCR.

**Results**

We found that cells lacking KLF4 were deficient in the ability to undergo mitophagy via flow cytometry and microscopy. We demonstrated that the mitophagy protein BNIP3 was not expressed when KLF4 was present via western blotting and RT-qPCR. We also found that essential autophagy proteins such as ULK1 and Beclin1 were expressed at lower levels when KLF4 was knocked out. These results allowed us to characterize KLF4 role in autophagy and mitophagy pathways. This provides evidence that impaired mitophagy is responsible for the excess ROS found in KLF4-null cells and explains a mechanism to explain how KLF4 functions as a tumor suppressor.

**Source of Support:**

- AHUM Div.
- NASC Div.
- SOSC Div.
- UNST Div.

Other (specify): Michael J. Wolk ’60 Heart Foundation
Project Summary:

Reovirus is a double stranded RNA virus that is lethal only to newborn mice. Reovirus comes in two major strains, T1L and T3D. Reovirus is often used as a model to show how viruses infect, replicate, and overall viral virulence. Reovirus has also been shown to elicit the antiviral response, which is initiated through the production of interferons. Interferons are molecules that bind to receptors on the cell that leads to the production of proteins that help combat the virus. In a prior study, the Reovirus protein µ2 has been implicated in inhibiting the antiviral response (Zurney et. al 2009). In this study, we looked at the µ2 protein to see if we could detect what it binds to in the cell to inhibit the response.

Specifically in this study, we transfected 293T cells with a gene encoding the T1L µ2, T3D µ2, or an empty vector, all of which were flag tagged. An immunoprecipitation was done using a flagtag antibody. The samples were analyzed using Western Blots, using a µ2 antibody along with another antibody specific to a different protein we identified as potential binding partners. We had decided that we would start with looking to see if the Syk protein, a protein previous implicated with the association of µ2, was bound to the viral protein (Stebbings et. al 2014).

From our Western Blot analysis we were able to identify that the protein Syk is not a binding partner for µ2 in 293T cells (Figure 1). The analysis showed that the µ2 protein was transfected into the cells; however, analysis with the syk-antibody showed that syk was not present in either the input or the immunoprecipitate.

![Figure 1: Syk is Not the Binding Partner of µ2. 293T cells were transfected with an N-vector, or either T1L or T3D µ2. Immunoprecipitation was performed using a flag-tag antibody. The blots were then probed with a flag-tag antibody to show the µ2 expression within the cells, the same blot was then stripped and reprobed with a syk-antibody. No Syk was found in either the input or the pulldown.](image-url)
The Galápagos Archipelago is a hotspot island chain 1000 km west of Ecuador, where the vast majority of the lavas are basaltic. Four volcanoes in the archipelago, Rábida, Santiago, Pinzón, and Alcedo, erupt rhyolites and trachytes. Isla Rábida, a small island 50 km east of the mantle plume center, is the focus of this project. It is 5 km² in area, and lavas range from 0.9 to 1.1 Ma. About 25% of the rocks in our suite are intermediate to felsic, extending from Mg#=2 to 57. Major and trace element data indicate the evolved rocks formed by advanced crystallization of basaltic magma. One of the unique aspects of Rábida is the cumulate xenolith suite ranging from olivine gabbro to ferroan granite. The basalts have 6 to 58 modal% plagioclase phenocrysts, which we interpret as mixtures of melt and accumulated plagioclase mush at the margins of the shallow reservoir. Thus, Rábida erupts material that has undergone different extents of crystallization and crystal sorting from pure melts, to melt-mush hybrids, to solidified cumulates. This hypothesis is evaluated by comparing plagioclase compositions from the xenoliths and the lavas. Plagioclases in two of the lavas, one with Mg#=57 and the other with Mg#=36, have similar compositions and zonation patterns to each other. There is on average less than 4% change in anorthite content from the core of the plagioclases in the basalts to the rim, with the compositions overall varying between An22 and An37. Both melts likely picked up the crystals from the same plagioclase mush before eruption. In comparison to plagioclases in an olivine-gabbro xenolith from Rábida, those in the lavas are less zoned, suggesting that the lavas’ plagioclases experienced a different growth environment. Plagioclases in the xenolith are normally zoned, with cores averaging An37 and rims averaging An32. The xenolith’s plagioclases also have more diverse compositions than those in the lavas. The normal zoning in the xenolith’s plagioclase is likely from late-stage crystallization of evolved intercumulus melt. Our results suggest that the extraordinary petrologic diversity of Rábida is attributable to crystal-liquid segregation and reincorporation of plagioclase in various melts. These processes result in the eruption of pure melt, melt mixed with mush, and cumulates.

Project Summary:

This summer I contributed to Professor Shever’s research investigating people’s engagements with and interpretations of dinosaurs. Professor Shever’s research project more broadly is using dinosaurs to examine how public scientific knowledge is created within the contemporary United States. I helped Professor Shever for 8 weeks this summer specifically concentrating on data collection and analysis from 3 previously selected sites in Colorado. Fortunately, I spent 2 out of the 8 weeks conducting ethnographic fieldwork, including oral surveys and participant observation, during various tours, exhibits, and activities offered at these places. I spent the other 6 weeks at Colgate transcribing and summarizing interviews conducted by Professor Shever and my recordings from Colorado; and, coding the survey data, transcriptions, and field notes in a qualitative data analysis program called MAXQDA. The process of coding enabled me to see the major themes in the data.

My engagements with various individuals in the field illustrated how the topic of dinosaurs provides a unique window to understand experiences of people living in today’s society. Although I asked all of the individuals I surveyed the same question about dinosaurs, our conversations varied greatly. Some people I talked to identified themselves as dinosaur experts while others told me they knew nothing about them. After interacting with over 500 people, I realized that each individual I spoke to had been exposed to dinosaurs in some form in their life. The popularity of dinosaurs in our society allows for everyone to engage with the topic in some form. I experienced several conversations where people shared with me their views on topics ranging from politics to religion to climate change to violence to gender. Dinosaurs and the ethnographic methodology provided the platform for people to share their genuine views on the world with me that I would not have been privy to otherwise.

I found an overwhelming amount of people attribute their fascination with dinosaurs to the size, violent nature, and unique qualities of dinosaurs. I wonder how perceptions of dinosaurs are influenced by visiting an informational site that explains the variations in dinosaur size and behavior while highlighting the evolutionary connection between dinosaurs and modern day animals? How much can scientific discoveries affect people’s perceptions of dinosaurs, which have been largely shaped by media’s portrayal of them? These are questions my research this summer helps to answer, but we do not have answers yet.

This is a photo of Angie Smith, me, and Professor Shever on our last day of fieldwork in Colorado!
Research Fellow: Samantha Boni—Bridgewater State University (2018) Concentration(s): PHYS; GEOL
Faculty Mentor: Thomas Balonek Department: Physics and Astronomy
Title of Project: Optical Monitoring of Quasar OJ 287
Project Summary:

During the course of the summer, I was granted the opportunity to monitor the optical magnitude (brightness) of several different quasars with my fellow research students. A quasar is a very distant galaxy with a supermassive black hole at the center. Surrounding the black hole is what is known as an accretion disk – a rotating disk of matter. It is believed that the accreting matter spinning around the black hole is accelerated away from it in massive jets, with massive amounts of energy. Quasars are the brightest objects in the observable universe.

One of the objects that we studied is the quasar OJ 287, with data going back to the late-1980s at Colgate up until today. We monitored several quasars with Colgate’s Foggy Bottom Observatory’s 16-inch telescope during the summer months. The graph below illustrates the historic light curve of OJ 287, an object of continued interest at the observatory. On the top x-axis is the decimal year, with the bottom in equivalent Julian Day; the y-axis is magnitude (brightness) and the equivalent log flux on the other side. The graph shows the optical variability of the quasar as it continuously flares. The black data points refer to the Colgate data going back to 1989 to the present day. The lighter points are from the Yale-SMARTS survey. This historic light curve allows us to better understand OJ 287 and its optical fluctuations. Additional graphs have been made by our group to show microvariability – changes occurring within a few hours – for this and blazar 3C 454.3.

![Optical Monitoring of Quasar OJ 287](image.png)

**Figure:** The optical R-band historic light curve varies in magnitude (brightness).

☑ Other (specify): Keck Northeast Astronomy Consortium (KNAC)
Title of Project: Cells null for Klf4 exhibit higher expression of migratory phenotype

Project Summary:

One important hallmark of cancer is an increase in migration, which enables cancerous cells to more rapidly spread throughout their host tissues. The process of migration is understood to be a result of actin polymerization and remodeling, which occurs in multiple steps. These include the protrusion of lamellipodia and filopodia at the leading edge, the detachment of focal adhesions between cells, and the contraction of actin/myosin at the rear of the cell. Therefore, one way to characterize motile cells is by examining their actin structures, which are regulated in part by the Rho GTPase family. In particular, RhoA has been extensively studied with respect to this role. RhoA has been shown to be involved in cytoskeletal dynamics and specifically the formation of actin stress fibers that are associated with a migration phenotype.

Krüppel-like factor 4 (Klf4) is a zinc-finger transcription factor that regulates genes related to proliferation, cell differentiation, apoptosis, autophagy, reactive oxygen species, and cancer. Past research has suggested that Klf4 can act as a tumor suppressor or an oncogene depending on the circumstances, such as the status of p21 expression. In colon cancer cells, overexpression of Klf4 leads to the inhibition of migration and invasion, which supports Klf4’s role as a tumor suppressor. However, the mechanism behind Klf4’s involvement in the inhibition of migration is not well understood.

Initial observations of morphology indicated that cells lacking Klf4 have a phenotype associated with motile cells. To confirm that Klf4 inhibits migration, standard scratch assays were performed along with serum-starvation scratch assays to eliminate proliferation as a confounding factor. Both sets of scratch assays, without and with serum starvation, were statistically significant, with p < 0.05 and p < 0.01 respectively. By staining F-actin with phalloidin, MEFs null for Klf4 were found to have elevated levels of stress fibers compared to wild types cells, p < 0.01. The requirement of Klf4 in stress fiber formation was supported by an overexpression experiment. Klf4-null MEFs transfected with GFP demonstrated higher levels of stress fibers compared to Klf4-null MEFs transfected with Klf4 conjugated to GFP, p < 0.01. In order to help determine the mechanism, Western blotting was utilized to examine the relative expression levels of proteins. Preliminary data indicates that cells lacking Klf4 have increased levels of P-S6K1, a downstream target of mTORC1, and RhoA. Additionally, semi-quantitative one-step RT-PCR indicated that Klf4 does not transcriptionally regulate RhoA, although quantitative RT-PCR remains yet to be performed for confirmation. Thus, based on our data and published research, there is a strong indication that Klf4 indirectly inhibits stress fiber formation, associated with migration, via mTORC1.

Source of Support: □ AHUM Div.  ☑ NASC Div.  □ SOSC Div.  □ UNST Div.  ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Title of Project: A Behavioral Analysis of the Retinal Regeneration of Zebrafish

Project Summary:

Zebrafish have the useful quality of being able to regenerate parts of their body. Many studies show that zebrafish have the ability to produce stem cells, meaning that after you completely damage a part of their body, they are able to regenerate it. I choose to focus on the eyes of the zebrafish because humans and zebrafish have very anatomically similar eyes. Although this regeneration is an amazing quality, scientists still don't know much about the recovery in the behavioral response of the fish following the regenerative process. In particular, I was looking at whether or not the function of the fish’s eyes is optimal after regeneration of the retina; do they regain their eyesight just enough to survive in the wild? Or do their eyes regenerate up to the point where it's like they were never injured?

What I did to test for a difference in their behavioral response was take the larvae of a fish that was around five days old and placed it in the center of a petri dish facing a projector that was projecting a black and white striped image. Using a microscope and a microscope camera, I tracked the movement of the fish's eyes as it followed the moving image. All animals eyes reflexively follow a moving image so it is natural for its eyes to follow the moving image (this natural tendency to follow what is in front of you is called optokinetic response. I quantified the eye movements using ImageJ, an image processing program. After recording the fish's starting visual behavior, I injured the fish’s eyes by burning their retina using a very bright light from a microscope illuminator. Allowing time for the fish eyes to recuperate, I then re-recorded the behavioral response of the fish to the initial set of stimuli every two or three days to monitor the loss and recovery of vision, noting whether or not the fish follows the image with the same accuracy as before they were injured.

I found that the ability to regenerate eye cells varied in fish; the degree of recovery in fish differed between fish. One thing I can conclude is that some fish do in fact heal to their full potential. It’s interesting to note how different fish, even though born from the same set of parents, had different regenerative capabilities. The variability between the different “levels” of regeneration could be caused by many factors. One factor might be how much light exposure each fish was exposed to (even though I made sure fish were exposed to the same amount and intensity level of light for the same amount of time). Another factor might be the varying abilities to heal between fish (Some fish may heal faster than others). Whatever the case, it will be very interesting to discover more about why these fish have varying ability to heal their eyes to optimal capacity.

☑ Other (specify): Science and Math Initiative-SMI
Title of Project: Breather Vortex Interactions in A Josephson Junction Ladder

Project Summary:

My research this summer was split into multiple parts. The first part was the hands on aspect of the research. I soldered a connector for the lab, as well as helping with the upkeep of the testing bath. I also transferred helium to keep the bath at low temperatures, so that we could keep testing. The other major part of my research was the physics component. The main goal of that was looking to find an interaction called a pinning event between two different types of modes of a Josephson Junction array, also known as a ladder. The two different modes are called a breather and a vortex. Josephson Junctions have these modes because each junction is a superconducting chip that at low temperatures can act differently under applied magnetic fields. These magnetic fields create currents in the different junctions in the ladder and if you get the field right you can create a breather or a vortex. I worked mostly on the simulation so that when we go to test in the fall we have a simulation data to compare to the experimental data.

The simulation was a continuation of previous summers work on Breather Vortex interactions. I changed the way simulation took the data and added another loop to the simulation so that we could get simulated data while changing both the vortex magnetic field and the global magnetic field. This allowed us to test more data points and get a more complete set as we looked for breather vortex pinning. Then to see if at the set fields there was a pinning event the code was rewritten. The code was changed to measure the switching current of each junction and record it. Then the electrical current value from junctions 10, 19, 21, and 24 were picked as the important junctions. In the code the four switching currents of the junctions were compared. Here we had a large if statement that compare each of the four junctions with each other. If the difference between the junctions before 20 and the junctions after 20 was positive then it was possible that we had found conditions that created a pinning event with the right magnetic fields. This is because the junctions after 20 switched much later as the current ramped up high enough to send the vortex all the way through the breather. The last part of my summer research was to work on the experimental code to get the data from the actual ladder. This is the hardest part is that we have four different magnetic fields that we have to set up, as well as get the experimental data in the same form as the simulation data. To get the He3 bath to the right temperature for the experiment, I had to transfer the liquid helium from the compressor into the bath. The experiment bath would then have to cool the liquid helium down over a couple of hours before it was ready to run the tests. A large part of my job was the set up and oversight of making sure the bath was ready to run tests along with working on the breather vortex pinning problem.
Project Summary:

Historical societies are timeless places. In this sense, timeless does not mean unchanging, but rather something lacking a distinct time period. Historical societies hold the objects of our immemorial past from which people of the present try to reconstruct some meaning of the past, perhaps to help us think differently about our own present. Historical societies are thus neither present nor past, neither here nor there. Walter Russell Mead has written, “Utopia is a place where everything is good; dystopia is a place where everything is bad; heterotopia is where things are different – that is, a collection whose members have few or no intelligible connections with one another.” This summer in the heterotopia that is the Oneida County Historical Society, it was my task to take pieces from different places, people, times, and situations and weave them together into a coherent exhibit telling the story of Mohawk Airlines.

The previous historiography of Mohawk Airlines has focused on the effect of the federal regulation of the airline industry on Mohawk Airlines. Airline regulation prevented airlines from lowering their rates so airlines competed by offering special inflight services, usually involving refreshments or entertainment by stewardesses. Historians have explored this “free enterprise in a time of federal regulation” and thus have focused mainly on the actions and decisions of Mohawk’s Board of Directors.

I strove to contest this dominant economic narrative in two ways. Firstly, I explored Mohawk employees typically left out of Mohawk histories: women, people of color, and the working class. Women at Mohawk, like other women in corporate settings during the 1960s, could not break through the “glass ceiling.” Women were barred from the highest levels of the corporate ladder. Although some women advanced up the ranks, it was in fields considered appropriate as “women’s work”: public relations, caretaking (stewardesses), and menial clerical and secretarial jobs. Similar to women barred from the top executive positions, people of color were barred from jobs in the sky. Jobs as pilots and flight attendants were highly coveted and thus reserved for white people. Mohawk broke this significant color barrier by hiring the first African American flight attendant, Ruth Carol Taylor, in 1958. Lastly, Mohawk’s history is ravaged with strikes by stewardesses, pilots, mechanics, and machinists, and their willingness to strike and fight for better wages and working conditions significantly contributed to Mohawk’s eventual economic collapse.

The second part of my exhibit focused on the local aspect of the Mohawk story. In the company’s beginning, the local connection is almost painfully obvious: the airline grew in a response to local businessmen’s need for a faster and more convenient commute to the New York City area. But by 1965, Mohawk was the largest regional airline in the country and served 10 states, DC, and 2 Canadian provinces. I asked myself: Why is it significant that Mohawk Airlines was a regional airline based out of the Mohawk Valley? This part of the exhibit required a redefining of the typical historical actors (Mohawk Board Members) to a focus on local people as historical actors. However, whereas Mohawk Board Members left behind binders full of Board Room minutes that were saved by collectors, local people generally left behind far fewer historical artifacts, and even fewer of those artifacts found their way to the collections of historical societies. To remedy this gap in the historical record, I focused on the advertising company that created all of Mohawk’s promotional material, as well as the effect of Mohawk’s Headquarters at the Oneida County Airport on employment and life in the community.

By presenting two different versions of the same story, I hoped to communicate that there is not history but rather histories, and that behind an exhibit that speaks with the faceless authority of fact, there are people making decisions and crafting a history. I believe that museums should become places of discourse, rather than places of passive intake of information.

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Title of Project: Nagasaki Atomic History and the Present

Project Summary:

Nagasaki was the second and last city to have an atomic weapon used on it in an act of war. Nagasaki also introduces a unique set of ethical and moral questions that are slightly different from those that can be posed about Hiroshima. The goal of this website is to introduce the lived experiences of atomic bomb survivors, doctors, peace activists and more in Nagasaki through an interactive and engaging interface, something that we feel is lacking among currently existing websites. Through the lived experiences and also programs like NUKEMAP on the site, we hope to have students think more critically about the use of nuclear weapons.

The site seeks to attract both educators and students. For educators, there are lesson plans, projects, and activities that teachers can use to supplement how they teach World War II. On the student side, there are also paths that students can use to navigate through lessons without teacher guidance. We foresee these two areas fitting together, in the sense that teachers will direct students in how to use the student-oriented resources, and students will use the projects proposed to teachers to guide their learning and inspire work on this subject.

To achieve this, we have analyzed and edited interview footage taken by Colgate 2010 alum Alex Sklyar. These videos were edited for two main final products: Person-specific videos, which contain footage of only one person and tell that person’s story, and Theme-based videos, which contain footage of one or more interviewees as well as b-roll and other content, and which focus on one topic or area of interest to construct a lesson or narrative around it.

We also interviewed professors who specialize in nuclear weapons or teach about the atomic bomb with the goal of improving our own comprehension and skill-set on how to teach about this subject and to use parts of them on our website as content. The preparation for these interviews involved finding and contacting the interviewees, organizing a time and location for interview to occur (be it in-person or over video-conferencing software), preparing questions, and testing the equipment and software. These interviews were recorded, and parts were edited and uploaded onto the website.

We constructed lesson plans and paths with AP History students in mind. We then collaborated with high school teachers to make sure that the plans are cohesive, understandable and most importantly, useful. For these lesson plans, we had a dual focus of bringing out the most interesting and most important content of the videos and presenting content on the atomic bombing of Nagasaki in a way that challenges and engages with the common narratives taught in high school. We designed our resources to supplement these traditional narratives and to bring discussions of them to a more intellectual and nuanced level, both to make this topic more interesting and to prepare students for college-level thought about such topics as these.

We also constructed a website to house our content. This project involved much collaboration with Colgate ITS and library staff, and we spent a good deal of time learning about and mastering the software we used for it.

Research Fellow: Anne “Maddy” Canning (2018)  
Concentration: History

Faculty Mentor: Graham Hodges  
Department(s): History; Africana and Latin American Studies

Title of Project: William Still and the Fight to End Discrimination on Railway Cars in Philadelphia: Uniting the Abolitionist and Civil Rights Movements in the Fight Against Segregation

Project Summary:
This summer I was fortunate enough to receive a fellowship from the Lampert Institute, which included a grant to support my research this summer. My research focused on African American history and specifically on segregation and desegregation in Philadelphia. The major goal of my research was to prove that the abolitionist movement and the civil rights movement were not completely separate movements only united by the fact that both fought for African American liberties; both also fought against segregation and discrimination. While it has long been established and accepted that the civil rights movement crusaded against segregation and discrimination, the abolitionist movement has generally been viewed as a crusade against slavery. In reality, abolitionists all over the United States fought to better the lives of African Americans everywhere, not just in the places where they were enslaved. The goal was to eliminate the enslavement of African Americans in the south and the widespread contempt for African Americans in the north. Additionally, my research touches on contemporary issues of race relations such as the Black Lives Matter Movement and contemporary forms of segregation especially in education.

In Philadelphia in the 1860's, African Americans were excluded from taking advantage of public transportation on the cities streetcars. In response to this injustice, Philadelphia abolitionists and other African Americans fought to outlaw discrimination. In the Pennsylvania State Legislature, Senator Morrow B. Lowry led the fight to end discrimination on streetcars in Philadelphia and throughout the state. Interestingly enough, Senator Lowry already proposed legislation to put an end to the discrimination before the railway car committee in Philadelphia, that was leading the charge, even sent a petition to the State Legislature calling their attention to the injustice. In the State Legislature, the House of Representatives was the major road-block to getting the bill through the Legislature. The House killed the legislation that the Senate passed in 1865, and would have liked to kill the 1867 legislation as well but were ultimately unsuccessful in their efforts to stop the floor vote.

My research proves that the abolitionist movement should not be so singularly characterized as only fighting for the abolition of slavery because the efforts of abolitionists such as William Still and others in cities such as Philadelphia and Los Angeles fought against other injustices such as segregation, in addition to abolishing slavery.

Source of Support:  
☒ AHUM Div.  ☒ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Lampert Institute for Civic and Global Affairs
The dystrophin-glycoprotein (DG) complex is a protein working as a transmembrane linkage between the extracellular matrix and cytoskeleton in skeletal muscle. Composed of an extracellular component and a transmembrane component, it contributes to the structural stability and cell adhesion of muscular cells. Its main extracellular component, α-dystroglycan (α-DG) is an extensively O-glycosylated protein where the mannose-initiated glycans are attached to α-DG via glycosyltransferases. Mutations of multiple genes encoding these glycosyltransferases hinder the glycosylation of α-DG and have been found to be a key factor of various forms of muscular dystrophy. Though the oxygen-linked α-mannosyl serine is significant for study of muscular dystrophy, it is unstable and susceptible to decomposition. By synthesizing a carbon-linked mannosyl serine, a stable mimic of the natural structure, the means of decomposition are diminished due to the increase of the stability of the linkage between the mannose and serine. This mimic molecule could be utilized as an advantageous tool for further research on muscular dystrophy and other diseases.

The scope of our summer research was to prepare the amino acid constituents, compound IX, for the carbon-linked mannosyl serine (Figure 1). This protected alkene will be used as a building block to attach to the glycan component for production of the target carbon-linked mannosyl serine. Producing this tosyl-protected alkene demands a nine-step synthesis and provides an advantage over the conventional boc-protected alkene because it is more stable in presence of electrophiles. To synthesize the diol intermediates (compound VI), purchased D-serine methyl ester hydrochloride was protected, followed with a DIBAL reduction and a Grignard addition. Different Grignard reagents were used to maximize the yield of the desired diastereomer. The yield of the crude diol (compound 6) was >95% over the 5 steps. Selective oxidation was then performed on the diol, oxidizing the primary alcohol to a carboxylic acid. The carboxylic acid (compound VII) was then reacted with benzyl bromide to produce the benzyl ester (compound VIII). Through manipulation of oxidizing approaches, TEMPO and BAIB were found to be the best oxidizing agents, giving a 14% yield after purification. With a significantly lower yield comparing to previous steps, further research is needed on the oxidation method to improve the yield of the reaction.

Project Summary:

Holocene climate variability at high southern latitudes can be reconstructed based on micropaleontologic analysis of marine sediment cores from the Southern Ocean. For this study, quantitative analysis of diatom assemblage data was completed from a suite of overlapping sediment cores collected from the Sabrina Coast, East Antarctica. This 13,000 year record documents changes in oceanographic conditions since the last glacial period ended. My project involved statistical analysis of the diatom data to evaluate changes in overall diatom assemblages through time. My three-week project began with the use of the Statistical Package for the Social Science (SPSS) and using a principal components method to see if the species could be sorted based on correlations between them. However, the data set has too many variables, or species, to have statistically significant results using SPSS software. Therefore, throughout the fall semester, I will continue looking at the data through the use of different statistical software. These include SAS and STATA, with the goal of establishing whether there are significant correlations and components within the species.
Quasars, objects billions of light years from Earth, are the brightest objects in the observable universe. A bright region of dust and gas, called an accretion disk, feeding into a supermassive black hole lies at the gravitational center of particularly massive galaxies. The consumption of this disk by the supermassive black hole generates jets of relativistic particles constrained by a magnetic field. The charged particles in these jets produce photons at all wavelengths of the electromagnetic spectrum. These phenomena are classified as Active Galactic Nuclei (AGN). AGN subclasses are denoted by the angle by which the jets are incident to the observer; quasars’ jets are almost aligned, while blazars’ jets are directly in line with the line of sight of the observer. We have been monitoring quasars and blazars at the Colgate Foggy Bottom Observatory since 1989.

The blazar PKS 1749+096 became of interest due to its recent activity. We measured its brightness, or flux, in optical wavelengths, specifically in the R filter, to be more than three times than it had been in months previous. We were able to take continuous images of the object throughout the night, for several nights, in order to determine if shorter-term variability, or smaller events on the hourly or daily scale, was occurring on top of the general increasing trend. We observed that the optical peaks possibly coincided with gamma ray outbursts reported by other astronomers.

Pictured below is a ten-day light curve of PKS 1749+096 in the R filter, showing the peak of the outburst event. Each data point represents one sequence of a dozen images. We will continue to observe this object into the fall.
Research Fellow(s): Zixing “Elva” Chen (2018) Concentration: Classics

Faculty Mentor: Rebecca Ammerman Department: Classics

Title of Project: Visual Metaphors for Ancient Marriage Rites in the Painted Pottery of South Italy

Project Summary:

The project examines wedding iconography of the 4th c. BCE, in south Italian vase-painting from Paestum, Lucania, and Campania in order to understand the visual language artisans used to express concepts related to nuptial rites in the Greek communities of southern Italy. The method of approach was to identify on each vase elements that are linked to marriage celebration. These include personalities, gestures, dress, objects, and such physical settings as a spring sanctuary where, for example, the pre-nuptial rite of a bridal bath was performed in honor of the nymph who presided over the spring. (The word “nymphe” refers both to the divine personification of the spring as well as to a mortal bride.) We designed a database to record the presence or absence of 36 elements that have marital connotations for each of 313 vases that we identified as making reference to wedding themes out of a corpus of some 5000 south Italian vases. The database was linked to a PowerPoint file of photographs of each vase. The database enabled us to analyze associations between different visual elements within each vase and thus to understand better the cultural background within which the painters were working.

To acquire a fundamental understanding of the physical objects that formed the basis of our study, we went to the Wellin Museum at Hamilton College in April to see a small sample of south Italian vases. In May, we conducted library research reading numerous articles and books in order to learn about methods of approach to the analysis of vases and their visual imagery, the art and archaeology of southern Italy, and ancient Greek weddings. In the next phase of the project, we worked in different directions: Dan learned more about south Italian vases assisting Prof. Ammerman in the storerooms of archaeological museums at Paestum and Metaponto, and Zixing conducted research and wrote a formal paper on the nuptial gesture of anakalypsis (the unveiling of the bride) and its appearance on Attic and Lucanian red-figured vases.

In July, we reconvened at Colgate to create the database. A printed spreadsheet of the data enabled us to identify patterns of associations within the wedding imagery of the vase-paintings. These associations of visual elements might recur with the vases of a single artist, a workshop, or even a larger regional center of production. A group of vases about the myth of Cadmus and the dragon, for example, caught our attention because the woman identified as Thebe by an inscription makes the gesture of anakalypsis. Thebe is not only the personification of the city Cadmus founded, but also the water nymph of the local spring where Cadmus slew the dragon. The nuptial elements in Dionysiac scenes became an important focus of our research. Dionysus plays a dual-role as the god of revelry and the husband of Ariadne, a mortal woman. Ariadne thus represents an ideal model for a bride. Scenes representing the divine couple combined visual symbols that evoked nuptial celebration as well as the world of the symposium. Therefore, we analyzed Dionysiac themes in the vase paintings in order to determine whether they are relevant to a wedding scene or not.

☐ Other (specify):
Title of Project: UNSPOKEN Human Rights Film Festival (MVRCR)

Project Summary:

I worked with the Mohawk Valley Resource Center for Refugees on this year’s UNSPOKEN Human Rights Film Festival that will be hosted October 27-29-2016. My work with this project started with selecting the films to be shown at Munson-Williams-Proctor Arts Institute, one of the two locations where the festival will take place. After the films were chosen, I sent out emails to directors notifying them of decisions, and I continued to coordinate with them regarding the festival’s promotion. In addition to working on festival preparation, I designed a new flier for this year’s event developed information for the festival website (film descriptions, further information about the films, etc.). I created a program, wrote a draft of a press release, and created a promotional video for this year’s UNSPOKEN. I also began to build an audience evaluation survey kit and a list of organizations that the audience can look into if they are interested in learning more about human rights issues discussed in the films to be shown.

In organizing a human rights film festival, there were a number of things with which I was concerned and about which I was careful. The most important one was the power dynamics portrayed in the films. I constantly asked myself, “Who has the power in the film?” in order to prevent perpetuating the portrayal of certain kinds of bodies as exotic, helpless victims for a curious audience instead of people with power and in charge of their own voices and narratives. The mission of the film festival as well as the reason why it is named “UNSPOKEN” is to create a platform where different voices can be heard in order to promote understanding of people from various backgrounds. Therefore, I tried to identify who had the authorship or the voice in the films and if members of marginalized groups were able to speak for themselves. Although this was difficult at times because there were a lot of politics interweaved to it, we kept this as a priority.

My experience at MVRCR, however, was not only about the UNSPOKEN project, but also about the community that I was working with. Even after spending two years at Colgate, I knew very little about the neighboring city, Utica. This summer, I was able to see the diversity of Utica and the pride people have in its unique community. At the same time, I could get a glimpse of the numerous hardships that await the refugees who settle in Utica. Although many were glad to settle in a place where they could be safer, many were still separated from their family which brought great distress to their well-being. Getting adjusted to a completely new structure and culture and learning a new language also posed a great challenge. Through my internship at MVRCR, I was able to learn more about the community that I was working with and the experiences of refugees that come to Utica to live.

☑ Other (specify): Upstate Institute
Concentration: Biochemistry

Faculty Mentor: Ernie Nolen  
Department: Chemistry

Title of Project: Synthesis Towards a Metabolically Stable α-Mannosyl Serine (Serine Substituent)

Project Summary:

Oxygen-linked glycopeptides are a major contributor to cellular adhesion: the cell’s ability to bind with components of the extracellular matrix and ultimately to other nearby cells. The scope of this summer’s research was an oxygen-linked α-mannosyl serine, present in dystroglycan, a protein found on the sarcolemma of skeletal muscle cells. Atypical variations of this glycopeptide, in which there are no additional monosaccharide linkages from the α-mannose, have been linked to cases of muscular dystrophy. Though this variant is desirable for study, the glycosidic bond between the sugar and amino acid is susceptible to several means of degradation. The likelihood of degradation can be lowered by synthesizing a carbon-linked mimic glycopeptide, as there is less reactive opportunity with the more stable carbon linkage. The increased stability of this carbon-linked α-mannosyl serine will allow for its further study in medicinal research.

The focus of the summer’s work was the synthesis of several Boc- or Ts- protected serine derivatives for a cross-metathesis reaction with the α-mannose constituent. Preparation of the two Boc- protected serine derivatives I, II (Figure 1) demanded a six, eight-step synthesis, respectively. The amino group was protected with the Boc- group following an acid/base reaction on the cation of D-serine methyl ester hydrochloride (1). The compound was then cyclized (2) to form a 5-membered ring. The methyl ester was reduced (3) to an aldehyde, and was further reacted (4) to supply a secondary alcohol with an alkene substituent, which would be the reactive group for the cross-metathesis to join the mannose constituent. Following the acid-catalyzed methanolysis (5) of this compound to a diol, two synthetic routes characterized by early/late stage oxidations to the primary alcohol were performed. For the late-stage oxidation approach, the diol was cyclized (6) to form a cyclic carbonate, I. For the early-stage oxidation approach, the primary alcohol was selectively oxidized immediately (7), followed by an esterification (8) on the carboxylic acid. This compound must be cyclized (9) to minimize free-rotating bonds that may interfere with the cross-metathesis. These cyclized alkenes need to undergo a cross-metathesis in the future to produce the designed carbon-linked α-mannosyl serine.

Figure 1: Synthetic scheme of serine derivative in preparation for cross-metathesis with α-mannose substituent

San Cristóbal, in the eastern Galápagos, is one of the oldest islands formed by the same magmatic system currently responsible for volcanic activity in the western archipelago. Unlike the younger western islands, San Cristóbal lacks any morphological evidence of a caldera, which is a characteristic feature of the western Galápagos shield volcanoes. Instead, San Cristóbal consists of two shield complexes dominated by eruptive cones aligned along presumed fissure systems. The island thus provides an opportunity to investigate whether the dichotomy between the morphology of the western and eastern Galápagos volcanoes is a result of evolving magmatic systems or a fundamentally different set of formation processes. We are reporting the results of a recent gravitational survey on San Cristóbal’s southwestern shield, which consists of 186 measurements at ~500 m spacing along all passable roads. Our results indicate that the Bouguer Anomaly (BA) on the southwest shield of San Cristóbal has a range of ~8 mGals. The BA has a relative low along the western part of the shield complex and a relative high in the central and eastern sections. Within the central complex, there is a prominent BA low, which corresponds to a large cone. These results contrast with previous studies performed on the western volcanoes of Fernandina and Sierra Negra (Case et al., 1974; Vigouroux et al., 2008), which exhibit a ~30 mGal BA high centered over each caldera. On these volcanoes, the BA high was interpreted as a dense plug of cumulates in the magmatic system beneath the volcano's caldera. Though our results differ from those obtained in the western Galápagos, a study by Schwartz et al. (2014) on the eastern island of Santa Cruz also fails to identify a prominent gravity high. Schwartz et al. concluded that a low magma supply to older islands cannot support the caldera formation process that characterizes the western islands, which are believed to form by evacuation of shallow magma sills (Bagnardi et al., 2012). Our results suggest that either the old calderas of the eastern islands have been filled by a low density material, or that these islands have been formed by a fundamentally different process, rather than being in a later stage of evolution.
The China Dream (中国梦) campaign is a national rejuvenation propaganda campaign proposed and implemented by Chinese President Xi Jinping at the 18th National Party Congress on 8 November 2012. Through the use of propaganda and rhetoric steeped in historical context, the Chinese Communist Party seeks to influence the Chinese population towards achieving a social, economic, and political rejuvenation. This study aims to understand the functions and historical context of the rhetoric and images employed in the campaign, as well as how the citizens of Shanghai understand the campaign, and the degree of influence the campaign has on them. Through extensive book and article research, as well as field interviews in Shanghai, China, this study concludes that the China Dream campaign has achieved progress through the implementation of concrete political and economic policies, but that the citizens of Shanghai remain largely unaffected by the propaganda.

When he announced the China Dream slogan and campaign, Xi also laid out the campaign’s goals. The goals, according to President Xi, are to reach a “pinnacle of prosperity” by the year 2049, the 100th anniversary of the founding of the CCP, by having successfully transformed China into a “strong, democratic, culturally advanced, and harmonious” country. He claims that these goals will be achieved through the national rejuvenation the campaign pushes for.

The CCP’s rhetoric surrounding the campaign centers largely around the theme of national rejuvenation, which is couched in a rhetoric of national humiliation and China’s imminent rise from this humiliation, and that they will achieve national rejuvenation by demonstrating the Confucian and other traditional Chinese values the propaganda advocates. The entire campaign is shrouded in vagueness. This vagueness allows any policy enacted by the CCP to be labeled under the heading of the “China Dream,” and therefore as working towards rejuvenation.

Research was conducted through extensive study of scholarly books, articles, and primary source materials, as well as field work, including one on one interviews, conducted over one month spent in Shanghai, China.

Examples of China Dream propaganda found on the side of a popular shopping street. Photo by Sophie Coffman.

Project Summary:

The goal of my research was to implement a Gedanken (thought) experiment in the lab to test how a single photon reacts to a “delayed choice”, that is how and when a photon “decides” whether to behave like a particle or a wave. Our experiment revolved around measuring counts of two polarized photons that were entangled. What this means is the two photons we were trying to measure shared a measurable property. Polarization is the property of light that describes the orientation of its oscillations. Entanglement is a physical phenomenon of groups of particles that show some sort of correlation in their physical measurements. In our experiment we used a down conversion crystal that created two entangled photons that always had the same polarization. By controlling the polarization of one of these photons that we sent to a detector and then sending the other into an interferometer, we were able to control how the photon behaves in the interferometer just by changing the polarization of the first photon, leaving the interferometer completely untouched.

The setup to our experiment consisted of sending an 809nm horizontally polarized pump laser through a half wave plate set to 22.5 degrees then a compensating quartz crystal then two very thin down conversion crystals. By passing through this combination of components, we are left with two down converted entangled photons in the following state:

$$|\psi\rangle = \frac{1}{\sqrt{2}}([|H_1\rangle|H_2\rangle + |V_1\rangle|V_2\rangle] |x_1\rangle)$$

We then sent the two photons to three different detectors. The first photon was sent to a half wave plate that either rotated the photon 0 or 45 then into a polarizing beam splitter that created two new photons, each going to a different detector, A and C. The other initial photon was sent into a Mach-Zehnder interferometer with a full wave plate in one leg and a half wave plate in the other, with detector B at the exit.

By controlling the polarization of the photons, we were able to affect the probability of detecting photons at each detector. From the above phase we calculated that when the wave plate in front of detectors A and C was set to horizontal and the half wave plate in the interferometer was set to 0 we got a probability of $W_{H,0} = \frac{1}{4}[1 + \cos\delta]$ where $\delta$ is the difference in path lengths of the two arms. When the wave plate in the interferometer was set to 45 we calculated a probability of $W_{H,45} = \frac{1}{4}$. What this means is that we should see interference when the wave plate is set to 0, and none when it is at 45. In other words, the photon in the interferometer will act as a wave when the wave plate is set to 0 and a particle when set to 45. We then calculated that these probabilities switch when we change the half wave plate in front of A and C to diagonal instead of horizontal. In figure 1 we can see the interference pattern theorized from our $W_{H,0}$ setting. In figure 2 we can see the constant $W_{D,0} = \frac{1}{4}$ when we change the half wave plate in front of A and C.

Project Summary:

Granite is a type of rock that is coarse-grained, intrusive, and igneous in nature, meaning that it forms under the Earth’s surface from the slow cooling and ultimate crystallization of a magma melt. Granite is also felsic, thus it is a rock type that has a chemical composition high in Silica and is exhibited as being light-colored. It forms after other rocky material melts under high pressure and temperature conditions below the surface. Since the components of the previous rocky material are completely melted down in the process of creating new granite the minerals that make up the new, granitic composition are of the age that the granite crystalized, rather than being the age of the previously material. Zircon is one of the minerals that can be most useful regarding dating the age of a rock in this context. This distinction on determining the age of rocks is important, because it can tell us whether or not two different rocks are of the same age, which can then provide insight into the geologic events that have occurred in the past regarding certain rocks.

My research this summer focused specifically on the Lyon Mountain Granite (LMG), which is found in the Adirondack Lowlands in upstate New York. The LMG is a point of importance because its existence shows a strong possibility of being related to the AMCG granite in the area, as well as some instances of Amphibolite as well. It has been proposed in the past that the LMG is product of a re-melting period that affected portions of the AMCG granite, with the potential for the Amphibolite being an associated product of that. My research set out to provide assistance in determining if the LMG is in fact a younger granite that was produced from the AMCG granite. In order to go about this I produced thin sections for both petrographic and Scanning Electron Microscope (SEM) use. These thin sections can then be used to search for certain minerals, such a Zircon, in the rocks collected in the Adirondack Lowland region. If found, Zircons can be age-dated at a later time and can provide the ages of both the AMCG and LMG, potentially showing a contrast in their ages; cross-cutting relationships of the LMG over the AMCG observed in the field are in support of this possibility. Additionally, I made glass discs for major element analysis and trace element pellets from the rocks that were collected in the field. These two materials can then be run through the X-ray fluorescence (XRF) machine in order to determine the major and trace element composition in the rock. This is useful in the context of the project because it can be used to determine if, for instance, the LMG is made of a similar composition compared to the AMCG, thus helping to explain the origin of the LMG in the Adirondack Lowlands. Overall, conclusions have yet to be made on the status of the LMG following this summer, but there is now a wealth of data that should be able to yield results in the future.
Research Fellow: Benjamin “Ben” Cvarch (2017)  
Concentration: Physics

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

Title of Project: Exploring Liquid Crystal Cells

Project Summary:

For my summer research I worked with premade liquid crystal cells. The aim of my research was to create physically interesting patterns of light polarization by shining a laser through the liquid crystal cells. These patterns exhibit polarization singularities characteristic of high order light beams which are a thriving topic of optics research. In addition, I strove to develop a better understanding of liquid crystal cells so that they could eventually be made here at Colgate University. It may be helpful to know that liquid crystals are substances that at a certain range of temperature have characteristics of both liquids and crystals. Like crystals, liquid crystals can be structured with their molecules aligned with one another. This structure allows liquid crystals to be birefringent and thus change the polarization of light in the way crystals do. The liquid aspect of liquid crystals is that they flow. This allows their influence on light to be controlled more easily than that of solid crystals by utilizing electric fields, heat, and boundary conditions set by the cell containing the liquid crystal.

The first part of my research dealt with filling simple premade liquid crystal cells with liquid crystal and investigating an electric field’s impact on the birefringence of the cell. Testing the relation between birefringence and applied electric field was done by placing the cell between polarizers which, without the liquid crystal, would block light when crossed and pass light when parallel. Then the cell was attached to an AC voltage source that created an electric field in the liquid crystal and a laser was shown through both the polarizers and the cell. Afterwards, the light power leaving the cell and polarizers was measured at various voltages to see the relation between electric field and the amount the liquid crystal impacted polarization (fig 1).

I then worked with fully premade liquid crystal cells known as q-plates with specially engineered cell linings. Q-plates’ cell linings set boundary conditions for the liquid crystal that create polarization singularities in beams of light passing through the cells’ centers. The shape of the polarization singularities was predicted by a MATLAB program I made based on known properties of the q-plates. And the polarization singularity each q-plate created was experimentally investigated by shining a laser beam with adjustable polarization orientation through a q-plate and then through a polarimetry set-up which could be set to filter out all but one type of light polarization. Pictures of the filtered beam’s beam spot were then taken by a camera and uploaded to a MATLAB program that created polarization mappings like those seen in fig. 2. The position of the q-plates, the orientation of polarization incident on the q-plate, and the electric field in the q-plate were all adjusted until the mappings agreed with the predictions made by my MATLAB program.

☑ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: Exploring marine organisms with polarized light

Project Summary:

We study the effects polarized light has on the shells of marine organisms including the Pinctada Fucata, the Akoya pearl oyster, the Haliotis Asinina, a sea snail, the Nautilus, and the Haliotis Refescens, a red sea snail. All these shells are composed of aragonite tablets and an organic and aragonite soup creating a “brick and mortar” shape (like a brick wall). Aragonite is birefringent and allows us to use polarization to look more deeply into the structure of these shells. We prepare light in the six different polarizations, horizontal (H), vertical (V), diagonal (D), antidiagonal (A), right-circular (R) and left- circular (L) using wave plates. We send each polarization state into the shell (called the encoding), and then after the shell, we have more wave plates to create the six polarizations again (the decoding). For each of the six encoding, there are six decoding pictures, totaling 36 pictures, allowing us to create the Muller matrix. The Muller matrix is just a fancy math concept that tells us if our shell acts as a wave plate that could be used for optical purposes.

These are two maps of a singular encoding state made from a MATLAB script showing how the shells interact with polarized light. The Pinctada Fucata is the picture on the left it produces a uniform beam. The Haliotis Asinina is the picture on the right and produces a scattered polarization map that have pockets of uniformity. There is a striking difference between these different types of shells. The four shells do fit into three categories (univalve, bivalve and gastropod), but all three of these grow their shells layer by layer. We are still uncertain about what causes the difference, but it could be that the Asinina and Refescens almost grew their layers less uniformly and creates the pockets of uniformity.

The next thing we did was bleach the shell, which can be seen on the right. Because there are organics between the tablets of the shell, the bleaching removes that organic and leaves pockets of air between the tablets. Because of the difference in indexes of refraction of aragonite and air, the light scatters before going through the shell and we see nothing useful. Then we place the shell in a vacuum chamber submerged in oil. The oil seeps in as the air is pulled out of the shell. The oil and aragonite have a close refractive index so the beam becomes more uniform. This shows a relationship between the uniformity and the refractive index of the organic holding the shell together.

Besides just shells, we have also been looking into animals, specifically chiton, a mollusk, and a mantis shrimp. The chiton respond to the removal of light by lowering their girdle, essentially dropping a shield because they move slowly. We want to test if they react different to polarized light instead of just white light. The mantis shrimp’s exoskeleton structure is helically shaped. We are testing to see if the exoskeleton can act as a circular polarizer.

The ongoing research for the shells are trying more types of shells and trying to fill it with more things other than just oil. There has not been too much done with the animals yet as they are in the first stages of research.

□ Other (specify):
This summer, I have been given the opportunity and responsibility of taking on two different research projects. The project assesses both qualitatively and quantitatively the importance of arts and cultural organizations in the region, and how these organizations can impact the quality of life in Madison County. I was working with the Madison County Cultural and Heritage Tourism Committee (MCCHT) and the Madison County Industrial Development Agency (IDA).

My project with the IDA office was a documentation of the quality of life of Madison County through a video. This video consists of different local events, historic monuments, and various aspects that make Madison County a unique and great place to live. The project I worked on behalf of Madison County Cultural and Heritage Tourism Committee was an expansion on the research done on the economic impact of arts and cultural organizations that was started last year by including all non-profits in the county. Economic impact is analyzing direct and indirect impacts of having non-profits in the county. Some factors that are taken into account are the expenditures, total full-time equivalent jobs, income, and revenue of different organizations throughout the county.

I also worked with the Madison County Cultural and Heritage Tourism Committee to expand on a project that was started last year by another Upstate Institute Fellow. This project was generating the economic impact from 18 different culture and heritage organizations in Madison County. This year, the project was expanded to looking at data from all non-profit organizations in Madison County as well as adding another component. This second component of the project was working to create a visual representation of the data and economic impact. This project was based off of the American for the Arts template for Arts and Economic Prosperity.
Ramsey theory is a subset of graph theory (itself an area of pure mathematics) that deals with finding order within chaos. My research dealt with finding the distribution of monochromatic subgraphs on complete 2-colored graphs.

To understand this, imagine a room containing \( n \) people. Each of these people is connected to everyone else in the room, and this connection is concretely shown by strings attached to each person’s belt which connect to every other person in the room. If we call each person a vertex and each string an edge, we realize that we have defined a complete graph on \( n \) vertices—a graph where each of the \( n \) vertices is connected to each other vertex. A 2-colored graph means that each edge can be one of two colors—red or blue. For the purposes of our example, a red string signifies two mutual acquaintances, and a blue string denotes two mutual strangers. A monochromatic subgraph is a complete graph which contains only red or only blue edges and is contained within the larger complete graph. In our example, it’s a smaller group of mutual acquaintances or mutual strangers. We denote the number of vertices on this subgraph by \( k \).

Ramsey theory concerns itself with finding Ramsey numbers, which are defined as the smallest number of vertices \( R(k) = n \) needed to guarantee a monochromatic subgraph on \( k \) vertices. That is, how many people do you need in a room to guarantee that \( k \) of them will either mutually know or mutually not know each other? Calculating \( R(3) = 6 \) can be done by hand very easily, \( R(4) = 18 \) with a bit more effort, but \( R(5) = 43-49 \) (yes, that is a range of numbers) would take 76 years to calculate on one computer. Forget about calculating \( R(6) = 102-165 \). The problem is very difficult, and there is no easy way to do it without a) brute force or b) a Ph.D. and lots of hard work.

We decided to approximate Ramsey numbers using statistical methods—by generating roughly 1 million graphs for each Ramsey number we knew within a certain range of \( n \), plotting the distribution of the number of monochromatic subgraphs contained within each individual complete graph, and then comparing the distributions of Ramsey numbers we know to the distribution of the Ramsey numbers we do not know. My work this summer dealt mainly with creating a computer algorithm that would generate complete \( r \)-colored graphs, then count all the monochromatic subgraphs contained in it. We found that the distribution of monochromatic subgraphs on complete 2-colored graphs is matched by the Delaporte distribution, which means that we will have a paper in a statistical or experimental math journal later this year. The figure shows the MLE of the Delaporte distribution overlaid on the probability mass function of the number of monochromatic subgraphs on each complete graph.
Title of Project: Investigations of crustal extension at the Harcuvar core complex, AZ

Project Summary:

My research project was based on rock samples from the Harcuvar Mountains in Arizona. This area is a metamorphic core complex which is where deep continental crust, from below the brittle-ductile transition, has been brought up to the surface during extension. The core complexes provide a chance to study ductile deformation. In metamorphic core complexes, a detachment fault separates metamorphosed rocks below it from unmetamorphosed rocks above it. My samples underwent ductile deformation in the deep part of the crust that has been brought up to the surface due to the extension from the detachment fault and they are from a new area that is farther away from the fault than previous studies done in the Harcuvars.

This summer I prepared thin sections from these samples for optical and scanning electron microscopy. The goal of these analyses was to assess the kinematics and temperature conditions of deformation to better understand the tectonic significance of the ductile deformation recorded in these samples. Grain size was also assessed by these methods to determine the stress conditions during ductile deformation.

We also applied Electron Backscatter Diffraction (EBSD) techniques to these samples, which identifies the physical orientation of the crystal lattice of minerals. By applying EBSD, we can generate a map (Figure 1) of the analyzed area based on the orientation of the crystal lattice, which maps the grains. Along with a map of the mineral grains, the EBSD data can be used to create a plot of the orientation of the c and a-axes of the minerals (Figure 2). The orientation of the c-axis gives us an insight into the slip plane of the mineral during ductile deformation and the sense of shear. The active slip system during ductile deformation can help to constrain the temperatures during deformation, which may provide insight into the timing and tectonic significance of this deformation.

While not all of the samples have had a clear pattern in their c-axis orientation and more EBSD runs are needed, some of the initial results are intriguing. One of the samples seems to have a slip system that indicates a higher temperature than what has been previously seen in the Harcuvars. Further work on this project will likely include comparing the sense of shear obtained from the kinematic indicators under the microscope to the data collected from the EBSD. Also, comparing the data from this new area of the Harcuvars to previous areas of study will help us to understand if the area has been subject to a single or multiple phases of ductile deformation.

Project Summary:

*Amynthas* (from Asia) and *Lumbricus* (from Europe) are invasive exotic earthworm genera that are rapidly invading much of the United States. Potential impacts of these invaders include harm to local species and altered soil properties as well as changes to nutrient cycling. It has been shown that factors such as temperature, moisture, and pH can impact earthworm survival and growth and may therefore present barriers to their spread. Our project seeks to better understand the population dynamics of these earthworms and their environmental limits so that we can direct conservation efforts to areas most susceptible to earthworm invasion.

Our first goal was to determine tolerances to various environmental conditions including moisture, temperature, and soil pH by designing microcosms. Earthworms will be contained in each microcosm and monitored over time for mortality. An additional goal was to determine life history characteristics by creating several lab colonies of worms. Worms were sampled regularly to determine maturity, length, and weight over time. Colonies will be maintained for up to two years to investigate growth, reproduction, and cocoon development under favorable temperature and moisture conditions.

Finally, we investigated the movement of *Lumbricus rubellus* and *Amynthas agrestis*. We determined the average rate of movement of an individual worm in a laboratory setting by placing randomly sampled worms in the track and measuring their position every ten minutes for at least 100 minutes each during both night and day. We also investigated the direction and rate of dispersal in the field by constructing a large outdoor setup designed for catch-and-release as tagged worms disperse through the area.

Additionally, we collaborated with Professor Ahmet Ay and his research students to develop an individual-based model (IBM) for earthworm invasion. The model is capable of using GIS and other database information to create realistic models of environments in which earthworm movement can be simulated using earthworm environmental tolerances and lifecycle parameters.

Whereas we are still in the preliminary stages of the two-year study, we have been able to reach some important conclusions after our work this summer about invasive earthworms. Primarily, there is strikingly little data available on earthworm behavior, characteristics, and lifecycles. Through our literature search for the IBM, we found that data are sparse or nonexistent for burrowing behaviors, rates of movement, and effects of pH and temperature on life cycle characteristics including cocoon survival, juvenile growth, and mortality. As our project continues, we hope to fill in some of these gaps in earthworm research.
Title of Project: The Effects of Social Conflict and Serotonin Agonists on Anxiety-Like Behavior in the Crayfish *Procambarus clarkii*

**Project Summary:**

Anxiety-like behavior is one of the most common responses to stress. In invertebrates and vertebrates alike, this behavioral adaptation persists after a stressor is removed and allows the animal to avoid further threats. A study by Fossat et al. (2014, 2015) found that *Procambarus clarkii* stressed by electric shocks showed an increased preference for dark areas in a light-dark box. This dark preference serves as a model for anxiety-like behavior in crayfish. Fossat et al. (2014, 2015) also found that injections of the neurotransmitter serotonin induced this same dark preference, suggesting that serotonin plays a role in anxiety-like behavior. Our experiments were designed to reproduce Fossat et al.'s results using social conflict as a more natural stressor, instead of electric shocks. In addition, we tested the effects of two different serotonin agonists to further investigate serotonin's role in the behavior. We hypothesized that crayfish exposed to social conflict, especially defeat, would exhibit anxiety-like behavior and a significant dark preference. Furthermore, we hypothesized that serotonin agonists would mimic serotonin and induce two measurable effects of the neurotransmitter, increased anxiety-like behavior and decreased locomotion.

To test our hypotheses, we designed three experiments. In the first, male crayfish were randomly assigned to social defeat or control groups. Crayfish in the social defeat groups spent 20 minutes in the tank of a crayfish significantly larger than themselves, while controls spent 20 minutes in an empty tank. The social defeat subjects spent a varying amount of time actively fighting, but nearly all of them took a submissive role by the end of the 20-minute period. After this period, each crayfish's behavior in a light-dark box was video recorded for 35 minutes. Videos were analyzed at a later time, when an experimenter recorded how much time the crayfish spent in the light, their latency to enter the light, the number of squares walked forward and backwards, and the number of crosses into the light. Results of this experiment showed that contrary to our hypothesis, the stressed crayfish spent significantly more time in the light than the controls. This suggests that fighting actually reduces anxiety-like behavior, possibly due to mechanisms of arousal. Further experimentation will be necessary to determine the nature of this effect.

In our second experiment, crayfish were randomly assigned to receive 100 µL injections of two serotonin agonists, 5-CT, mCPP, or saline. After receiving an injection into the second abdominal segment, the crayfish were placed in an empty tank for 20 minutes. Following this period, the crayfish were put into the light-dark box. Data on each crayfish was collected as described above. Results of this experiment showed that crayfish injected with 5-CT tended to spend more time in the light, while crayfish injected with mCPP exhibited the predicted increase in anxiety-like behavior and decreased locomotion.

In our final experiment, we tested the effects of both winning and losing in social conflict on anxiety-like behavior. Crayfish were randomly assigned to be in social defeat, social victory, or control groups. Social defeat crayfish spent 20 minutes in the tank of a larger crayfish before being placed in the light-dark box. Social victory crayfish, spent 20 minutes in the tank of a crayfish smaller in size than themselves. Control crayfish spent 20 minutes in an empty tank, as in the first experiment. Data on each crayfish's behavior in the light-dark box was collected as described above. Results showed that both social victory and social defeat crayfish tended to spend more time in the light compared to controls, again suggesting a decrease in anxiety like behavior.

**Source of Support:** □ AHUM Div.  ☑ NASC Div.  □ SOSC Div.  □ UNST Div.
□ Other (specify):  □ Other (specify):
Title of Project: Food Access in Rochester, NY: A Case Study of SNAP Users at the Public Market

Project Summary:

This research project is a part of a multiyear study by Professor Baptiste and Professor Henke to understand food access and preferences of low income residents. In the summer of 2016, they brought on two student researchers, Colleen Donlan and Bobbie Howie, to assist them in their work. The team of four worked to understand the food desert status in Rochester, NY in an attempt to compare an urban food desert setting to those of a more rural setting, such as in Maddison county. A food desert is defined by the United States Department of Agriculture as an area that is of low income and has low access to a healthy supermarket. Low income meaning at least 20% of the population is on food the Supplemental Nutrition Assistance Program (SNAP) and low access meaning the residents live at least 1 mile for urban or 10 miles for rural from a supermarket. Within Rochester, the Rochester Public Market was chosen as a central location to be examined due to the markets expansive SNAP incentive programs.

To understand if the area around the market was a food desert, our team overlaid point data of supermarket locations and SNAP retail locations using ArcGIS to examine the regions spatially. Our team decided to define Rochester and partition it using the census tract data from the Census Bureau from the 2010 census. Then, an analysis was done by setting a radius of 1 mile to see which data points fit within the one-mile radius from the center of the Rochester Public Market. With this map, we visited the sites to examine what food was offered on site to assess the level of access for the community. While we were in the field we also worked to compile a community profile by taking notes and comparing these with demographics of the neighborhoods via census data.

Our results found that while there may be 10 different stores in a region surrounding the Rochester Public Market that would accept SNAP, these were very limited in selection and not fall under a supermarkets’ definition according to the federal government, which is based upon gross sales and employees. These stores very rarely would sell fresh produce or other healthy options. Furthermore, locations that were identified by the US government as supermarket locations, were at times observed to either be smaller than listed, or in one instance not exist at all. This raises questions about the accuracy of the data sets being used by the government to ascertain food desert status. Based on the analysis done of our data thus far, it seems to indicate that the area surrounding the Rochester Public Market is in fact a food desert, perhaps even to a greater degree than was previously thought.

Title of Project: Effects of Network Topology on Hippocampal Memory Capacity

Project Summary:

The brain is perhaps the most complex structure that humans are currently aware of. While brain cells, also known as neurons, have their own complexities, it is not believed that significant amounts of information are stored in individual neurons. If information were stored in single neurons, the death of a few of these cells, which is a common event, could result in significant information loss such as the loss of a memory. It is highly plausible instead that information is stored in the overall structure of connections between large numbers of neurons. This project used computer simulations to explore the relationship between the network structure of neural connections and the maximum amount of spatial information that could be stored in these networks. This research can potentially test the robustness of current models of spatial memory storage as well as suggest ways that brain damage and disease may impair memory storage and recall.

This project specifically focused on simulating neurons in the hippocampus, an area of the brain known to be involved in the storage and consolidation of memories. Experimental research has indicated that specialized neurons in the hippocampus, known as place cells, are directly involved with the storage of spatial memory. Each location, also known as a place field, in each spatial environment corresponds to a place cell, and the same place cell can correspond to different place fields in different environments. Place cells are highly active when the subject occupies the corresponding place field and are quiescent otherwise. In other words, place cells keep track of an animal’s position in its environment. Because place cells can have place fields in multiple environments, a population of place cells can “map” multiple environments simultaneously. Our research explored questions related to the maximum number of such mappings, also known as charts that can be stored in a set of place cells.

The summer research project primarily consisted of constructing a Python simulation which determined the maximum number of charts, known as the chart capacity, that can be stored on a given place cell network. The simulation was largely based on a model used by Azizi et al. (2013). We modeled neural dynamics using a leaky integrate-and-fire model that included an adaptation current to simulate spike-frequency adaptation. The simulation stored charts on the network by randomly assigning each neuron a place field in an environment and then calculating synaptic weights using a Gaussian tuning function which depended on the distances between place fields. The simulation numerically integrated the differential equations using either an Euler method or a 4th order Runge-Kutta method. We determined chart capacity by testing the network’s ability to form localized bumps inside of each stored environment. This corresponds to testing the network’s ability to localize positions in each environment it is attempting to store. Our simulation found a linear relationship between a place cell network’s chart capacity and its size when all neurons were connected to all others. This result agreed with the findings of Azizi et al. (2013).

While the simulation was used this summer to reproduce results for networks in which all neurons are connected to all other neurons, the simulation is designed to work with networks of arbitrarily complex connection topologies. Future work on this project will use this simulation to determine the spatial memory capacities of networks with varying connectivity structures in order to explore the relationship between the topological properties of networks and their ability to store information. Additionally, the type of neuron model will be varied in order to move towards a more biologically representative model.

Title of Project: Locating Earthquakes in New York

Project Summary:

Although New York is not typically viewed as a seismically active area, the state has experienced notable earthquakes, including a 5.3 magnitude earthquake in 1983, a 5.1 magnitude earthquake in 2002, and numerous earthquakes large enough to be felt but too small to cause significant damage. It is possible to locate where earthquakes originated by measuring the arrival times of P and S waves, which are body waves that propagate through the Earth as a result of slipping along a fault. The availability of data from many different seismic stations is essential because earthquakes are most accurately located when the arrival times of seismic waves, including P and S waves, can be measured at stations surrounding the event in all directions. Using data collected from approximately sixty seismic stations, the majority of which belonging to the U.S. Transportable Array, a network of stations moving across the US that was temporarily installed in this region from 2013-2015, the goal of this project was to detect and locate earthquakes more precisely, enabling a more accurate analysis of New York’s geology and seismic hazards. Earthquakes occurring in the Adirondack Mountains were of particular interest due to the Adirondacks’ unique geology and to the previous occurrence of two earthquakes with large magnitudes within the region.

Earthquakes were located using data collected between 2013 and 2015 by over sixty seismic stations from seven different networks. A program called Antelope detected potential P and S wave arrival times based on signal to noise ratios. This program, however, gives many false positives and inaccurate or missed picks, so all preliminary picks were reviewed and adjusted by hand, and uncertainties in the times of the arrivals were estimated. 4,615 P waves and 3,457 S waves were picked for 232 detected events. 38 were earthquakes recognized by the USGS and 194 were events detected by Antelope. The measured arrival times of P and S waves were used to locate the events based on the relationship between time, distance, and velocity. The relocations were performed using the gn33 velocity model, which was created specifically for the Grenville Province. This gives a more accurate and complete description than locations based on global velocity models.

After relocating numerous events, we found that the gn33 velocity model yields shallower depths than those calculated by the USGS. Another notable finding is the abundance of earthquakes occurring to the north of New York in Canada, an area known as the Western Quebec Seismic Zone, which is transverse to structural trends in the Grenville Province. Although many detected events were relocated in hopes of finding earthquakes not recognized in the USGS catalogue, the majority of events occurring within New York were determined to be the result of quarry blasts. Determinations were made by analyzing event proximity to quarries and by frequency content of waveforms. While data from quarry blasts is not particularly useful in locating New York earthquakes, it may be of interest for future tomographic research.

Another element of this research project was the installation of three seismic stations in the Adirondacks. These stations, located in North Hudson, Saranac Lake, and Keene, will collect seismic data and will assist researchers in accurately locating future seismic events. Although data from these stations were not used in this study, such data will greatly benefit future research regarding New York’s seismicity.
Title of Project: Spectral Classification of Extincted Stars by CO Absorption Strength

Project Summary:

The process of how dust and ice grains in molecular clouds eventually turn into the stars and planets that we see in our galaxy is something that is of much interest to astronomers today. We are curious about the properties of these molecular clouds, which are dense regions in our galactic neighborhood that are completely opaque to visual light. To overcome this we observe background stars behind the clouds in the near infrared (NIR) as light at these wavelengths can pass through the cloud while still having noticeable amount of extinction, the amount of light being blocked due to effects of the dust in the clouds. To figure out the extinction, we need to know the spectral types of the stars that we are observing. This was accomplished by taking spectra acquired on TripleSpec at Apache Point Observatory in New Mexico and determining the ratio of one of its absorption features for CO to the continuum region $D_{CO}$ from Marmol-Queralto et. al (2008) which has been shown to strongly correlate to the stars surface temperature. We use this index to get a temperature and an uncertainty, which we then map to different spectral types with data on stars with previously determined spectral types from the Infrared Telescope Facility (IRTF) Spectral Library. We determine the spectral type by minimizing the difference between $D_{CO}$ for our observed spectra and the IRTF spectra. To get a value for the extinction we remove the extinction from our observed source until it best matches that of the IRTF spectra as their data has already been reduced, and the extinction has been removed. Moving forward with data taken in the mid infrared we can be more precise in figuring out the properties of these clouds and in general, the processes that are taking place inside of them. See below for a more technical overview of our project and a figure showcasing the end result of our spectral type determination.

We investigate the dust contents of the molecular clouds CB188 and L429C by taking near-infrared (NIR) spectra on the 3.5m ARC Telescope at Apache Point Observatory with the TripleSpec cross-dispersed spectrograph over the wavelength range 0.9-2.5 μm of giant stars behind the clouds. We determine the spectral type for each target by comparing the evaluation of a temperature-sensitive CO spectral index for the target to standard spectra from the SpeX Infrared Telescope Facility Spectral Library and fit the extinction via Markov Chain Monte Carlo techniques to find best extinctions and uncertainties. We use an extinction law empirically-derived from observations of giants behind dense molecular cloud cores for our analysis. With these newly determined spectral types and extinctions, we will be using mid-infrared spectra and photometry to further constrain the dust properties of these clouds, focusing on ice and silicate features not present in our NIR data.

☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund; Keck Northeast Astronomy Consortium (KNAC)
Title of Project: Investigation of Reaction Conditions for the synthesis of BOPHY

Project Summary:

Fluorescent chromophores have applications in chemical and biological research, including biological imaging of cells. Specifically, BODIPY (boron dipyrromethene) variants have been used. In recent years, a new fluorescent chromophore named BOPHY was synthesized by the Ziegler group. This new chromophore was observed to have similar excited state behavior to BODIPY, suggesting analogous research applications.

![Image of BODIPY and BOPHY structures]

A previous student (Sam Schaefer, '16) conducted experiments to gain experience synthesizing unsubstituted BOPHY using the method reported by the Ziegler research group. The BOPHY precursor (a pyrrole-imine dimeric chelate) was successfully prepared. Synthesis of the unsubstituted BOPHY from the precursor pyrrole-imine dimeric chelate resulted in a mixture of BOPHY and a monoboronated species. Attempts to improve the ratio of BOPHY to the monoboronated species were made, but suitable reaction conditions were not found.

This summer, we prepared two pyrrole-imine dimeric chelates (unsubstituted and tetramethyl substituted) and further examined the synthesis of BOPHYs from these precursors.

![Image of reaction scheme]

Boron insertion to both pyrrole-imine dimeric chelates was attempted using two different reported methods. The key differences were the solvent, temperature, and reaction time; one calling for an overnight reaction in dichloromethane at room temperature, and the other for a six hour reaction in refluxing toluene.

![Image of boron insertion reaction]

When using either method to synthesize BOPHY from the unsubstituted pyrrole-imine dimeric chelate, a mixture of BOPHY and the monoboronated species was obtained. When attempting to synthesize tetramethyl BOPHY from the tetramethyl pyrrole-imine dimeric chelate, a mixture of BOPHY and the monoboronated species (1:1) was obtained using the reaction condition with dichloromethane as the solvent, but a higher yield of the BOPHY devoid of the monoboronated species was obtained from the toluene condition.

□ Other (specify):
Title of Project: Experience and Knowledge in the Atlantic World 1500-1700

Project Summary:

Professor Antonio Barrera is working on a book about the way in which the understanding of what knowledge is changed throughout the sixteenth and seventeenth centuries in Europe. He hired me as a research assistant to help him code books. In other words I had to read books in Spanish and in English from the period to find references regarding knowledge. For the first part of my research I read books mainly about medicine. The purpose of reading them was to find the ways in which the exposure to the New World changed what Europe considered to be true knowledge. As Europe was exposed to the new world its explorers were forced to experiment in an entirely unknown place. This lack of knowledge, unwillingly forced them to rely on Native Americans for their knowledge. The second part of my research focused on Navigation. Its purpose was to understand how the information from the discoveries of the New World was being assimilated in Europe. Essentially the developments in navigation, which allowed Europeans to explore the world, changed their perception of it. The knowledge from the Greeks and Romans upon which they relied was put into doubt and they were forced to consolidate their new knowledge. I was paying special attention to the importance of the Spaniards and Portuguese in this period. They were the first to write books about the new navigational techniques they were developing. Throughout this period as they acquired more knowledge through experimentation leading them to challenge the knowledge of previous writers. Thus they referenced previous writers to prove them wrong, to then expose their knowledge which became their new truth. In other words the conception of truth changed from being blind trust in a set of knowledge to being an exercise in skepticism.

In the books about medicine I was searching for the way in which the exposure to new drugs challenged European knowledge. For instance Monardes wrote a book in 1574 in which he lists all of the drugs that were being brought to Europe and their medicinal purposes. For example he talks about Tobacco and of how the Europeans discovered it. Essentially, they discovered it because the natives taught them to use it. Thus they were forced to experiment, because they did not trust in the knowledge of the natives. In other words the notion of empirical experimentation became very important, because what validated something as true became successful experimentation. Skepticism towards knowledge became essential. The idea that something can be true became fully dependent on experimentation, rather than on the authority of a traditional source of knowledge.

The books I read about navigation were all read in chronological order, because I was trying to understand the way in which this body of knowledge was evolving. Where it was coming from was essential. I was trying to find references of the authors to pilots and sailors. It is surprising to see how the main sources of knowledge in the earlier books focused on reinterpretations of the Greek and Roman writers, to then rely mainly on empirical sources. I was also focusing on the way in which the knowledge spread. Thus, I first read earlier books by the Portuguese and the Spaniards and then read later books by the British, to try to find references of the earlier in the latter.

Overall this research is still a work in progress. Professor Barrera has some very interesting theses, which have to be proven by the books of the period. If Professor Barrera’s theses are proven then our current conception of the development of what we currently consider to be knowledge would be disproven. Our European centered conception of the development of knowledge would be challenged. Europe was able to develop what is currently our conception of knowledge only because of its exposure to the rest of the world.

The Antarctic is a part of the world greatly impacted by recent climate change. Loss of glacial and sea ice are evidence of the drastic changes occurring in Antarctic environment. This summer, I studied environmental change from the Sabrina Coast, East Antarctica, using marine sediment cores. I focused on analyzing four cores taken from a cruise on the Nathaniel B. Palmer in 2014 (NBP1402). Two kasten cores (KC9 and KC20) were taken at mid-shelf locations. A jumbo gravity core (JG16) and a jumbo piston core (JPC17) were taken closer to the coast. The cores were sampled at 5 or 10 centimeter increments and prepared into slides to be viewed at 1000x for analysis of the diatom assemblages. Diatoms are microscopic algae that can be used as proxies for different environmental conditions. By analyzing how the assemblages fluctuate throughout a sediment core, we can study how environmental conditions in the Antarctic have changed over time. Last summer, I collaborated with Aurelia Casarrubias to identify and count diatoms in KC9. This summer, I analyzed the diatoms from JGC16 and JPC17. KC20 was counted by a previous student, Ryan Clements. In all four cores, the absolute abundance of diatoms decreases over the past 10,000 years, suggesting a decrease in biosiliceous productivity through the Holocene. Similarly, a decline in the relative abundance of the genus Chaetoceros points to the decreasing contribution of a spring bloom over the past 10,000 years. Finally, the species Fragilariopsis kerguelensis, along with Thalassiosira lentiginosa, increases towards the top of all four cores. The increased importance of these two species, both associated with the permanently open ocean zone, suggests a poleward shift in the position of the Antarctic Circumpolar Current in the later Holocene. Overall, the data shows consistent environmental change throughout the Holocene. This type of research is important in studying how the Antarctic has been changing and continues to change with the rapid changes in global climate today.
Research Fellow: Ishir Dutta (2017)  
Concentration(s): Physics; Mathematics

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

Title of Project: Möbius Polarization of Light

Project Summary:

It has been theorized that interfering circularly polarized Laguerre-Gauss modes at small angles causes the semi-major axes of the resulting polarization ellipses to form Möbius strips. Our objective was to verify the existence of these objects, and find an accessible way to present our findings.

Light may be represented as a wave, and polarization refers to the direction of the electric field component of this wave. We may classify polarization in three basic ways; linear, circular, and elliptical. Elliptically polarized light is the most general of the three since it is a combination of linear and circularly polarized light.

Linearly, circularly and elliptically polarized light trace lines, circles, and ellipses respectively when passing through fixed planes in space – all of which may be generalized as ellipses. In our problem, we were interested in the semi-major axes of these ellipses, which formed the surface of a Möbius strip.

Besides running an experiment in the lab, we also used a MATLAB script to simulate and visualize our results. This allowed us to verify the theoretical predictions in two different ways. Our experimental set up (L) is shown below, along with two preliminary simulated and real data sets (R).

Given the complexity of the geometries involved in the problem, we wanted to make our findings easy to visualize - this motivated our work in 3D printing.

We first had to give the plots a thickness, and tile the surface with triangles to turn them into printable, 3-dimensional objects. We then used Autodesk Netfabb to clean up the output meshes before finally printing our results! This process is represented below, starting from the 2D surface plot in MATLAB, to a 3D mesh tessellated by triangles, then a printable file, and finally a physical object! (L-R)

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Research Fellow(s):  Rebecca Easly (2017)
Margaret “Maggie” Nelsen (2018)
Sam Schlichting (2019)

Concentration:  Biochemistry
Concentration:  Neuroscience
Concentration:  Undeclared

Faculty Mentor:  Roger Rowlett
Department:  Chemistry

Title of Project:  Structural Genomics of non-Homologous sequences of the Mimivirus

Project Summary:

Our goal in this lab was to overexpress and purify proteins from uncharacterized, non-homologous genes of the *Acanthamoeba polyphaga Mimivirus* in order to potentially discover new protein folds. We studied five different proteins selected from the bioinformatics of a previous student researcher that had the most likelihood of protein overexpression and solubility. The *Mimivirus* sequences were transformed in *E. coli* and grown overnight, and then archival DNA was isolated from the cultures. Competent *E. coli* cells were transformed with plasmid DNA, supplied by Blue Heron Biotechnologies, of the sequences. The cells were grown in LB Media in the presence of ampicillin and incubated overnight. These culture were transferred to Terrific Broth and protein expression induced using IPTG. Samples were taken every hour for a few hours and then overnight to measure protein concentration. SDS gel electrophoresis was performed to determine if proteins were formed by examining gels for bands of the expected molecular weight. Ideal conditions for protein synthesis were found to be a seventy-two hour growth period at 4°C in LB media. In optimum conditions, cells were also induced earlier on to slow protein synthesis, and avoid protein aggregation. Pelleted cells have been obtained from expected ideal protein synthesis conditions, and will be further characterized at a later date. Pellets are His-tagged and ready for purification on an affinity column. The end goal of the lab is to isolate and determine the molecular structure of the proteins by X-ray diffraction.
Title of Project: Science Outreach at Colgate

Project Summary:

Fifty second graders fill the atrium of the Ho Science Center. As they walk up the many steps to the Ho Tung Visualization Laboratory, their excited voices echo through the building. A typical day of VisLab Outreach has begun. After a show in the VisLab and a night sky talk, the students explore a few of the various science demos. Some will go tour the greenhouse and plant sunflowers, while others learn the about rock cycle in the geology museum. Then, it’s time for some hands on (and usually explosive) science.

Volcano demos use chemistry to illustrate different types of eruptions. Students also have the opportunity to experiment with physics and rocketry at the water rocket demo. Pressurized up to 120psi, the rockets soar above the Ho and hit professors’ windows on occasion. Other demos include constructing planispheres and making liquid nitrogen ice cream. Science outreach is more than just fun; it inspires younger students to pursue science.

Over a thousand school kids participated in the field trips over the summer from 18 different schools ranging from PreK to high school.

☒ Other (specify): Ho Tung Visualization Laboratory & Planetarium; NASA / New York Space Grant
Title of Project: Inclusion and Mobility: First Generation College Students at Elite Colleges and Universities

Project Summary:

Professor Janel Benson and Elizabeth Lee’s project *Inclusion and Mobility: First Generation College Students at Elite Colleges and Universities* seeks to better understand the ways in which first generation (FGEN) college students (students with no parents or caregivers that have received a bachelor’s degree) enrolled in elite institutions have differing experiences, and what mechanisms account for these differences. Sociological research has demonstrated that first generation college students, as a population, experience lower graduation rates; lower levels of general satisfaction; and lower levels of campus involvement than their continuing generation peers. However, the majority of existing research on first generation college students compares the experiences of first generation students to the experiences of continuing generation students. What is missing is an understanding of race and gender differences among those who are first in their family to attend college.

For this project, Tim and Susan coded and summarized 54 interviews with first generation college students at Colgate University. As a whole, FGEN students experienced exclusion and discomfort in academic and social settings due to perceived economic differences with the larger affluent student body. Although FGEN students share larger differences with the affluent student body, we also observed patterns of difference in experiences between white men, men of color, white women and women of color. First generation women estimated that they spend more time on coursework than first generation men, and they also give a higher number when trying to guess how much time the average student spends doing coursework. In terms of explaining academic shortcomings such as low grades, men attribute their performance to lack of effort, while women often question their academic ability. Men also seem more likely to spend time outside of class relaxing or partying than women. Women, especially women of color, say they feel comfortable in places like ALANA, Bunche House, and WMST and many feel uncomfortable in mainstream social spaces such as frat parties and downtown bars. Men varied more in the spaces and places they felt comfortable compared to women.

Additionally, we noted differences in preparedness for and comfort with campus culture between students who attended public and private high schools. We found students from private high schools experienced somewhat less of a culture shock when immersed in the majority white and affluent student body. These students were also more prepared for vigorous coursework and often said they felt comfortable participating in class. In comparison, students from public high schools felt underprepared for both the competitive and elite campus and classroom culture. Other factors that influenced FGEN experiences included the different institutional pathways that incoming first years are often filtered into, such as OUS and Varsity athletics. We found that students involved in these formal groups were more likely to express satisfaction with their social experiences at Colgate.

Project Summary:

Our project involved a computational analysis on the various pathways and the resulting energy barriers that are present in the insertion of molecular oxygen into a Rhodium III Cyclam complex. Molecular oxygen, commonly written as O\textsubscript{2}, has become very useful as oxidant centers due to it being inexpensive, clean, and abundant. The major mechanistic pathways we analyzed were the Radical Chain Pathway (RC), Hydrogen Atom Abstraction (HAA), and Base Catalyzed Pathway (BC). The final products of the reaction were well known, with the formation of the metal-hydroperoxide being of particular interest as our goal was to find the lowest energy pathway that would lead to the formation of the metal-hydroperoxide compound. Our project was done using calculations performed by the Gaussian09 suite. Our major calculations included an optimization function of the reaction, a stability calculation of the reaction, a frequency calculation of the reaction, and a solvent calculation to take into account the reaction would occur in solvent.

Rhodium III complex with equatorial nitrogen ligands and axial ligands consisting of either H, H\textsubscript{2}O, OH, OO, or OOH.

Radical Chain Pathway, involving a radical initiator which abstracts a hydrogen atom from the Rhodium-Cyclam complex to produce a reduced complex which reacts with O\textsubscript{2} to produce the superoxide Rh-OO•.

Hydrogen Atom Abstraction, involving a triplet oxygen acting as the radical initiator to abstract the hydrogen atom and produce a very reactive HO\textsubscript{2}• intermediate which rebounds and directly inserts itself into the Rhodium complex to produce a hydroperoxide.

Base Catalyzed Pathway, involving an exogenous base, (1M hydroxide for our project) which deprotonates the Rhodium complex. The complex then forms the superoxide after the addition of O\textsubscript{2} which becomes protonated by the conjugate acid to form the hydroperoxide.

Title of Project: The Socioeconomic Effects of Nuclear Decommissioning

Project Summary:

Our research ties into a larger question that our mentor, Professor Dai Yamamoto, has been examining: how does the decommissioning of a nuclear power plant impact the community that hosts it? Last summer, our mentor's research has focused on nuclear power plants that have already been decommissioned (such as the Maine Yankee plant in Wiscasset, Maine and the Connecticut Yankee plant in Haddam, Connecticut). This summer we conducted research looking at the James A. FitzPatrick Nuclear Power Plant in Scriba, New York, just an hour and a half away from Hamilton. The operator of the FitzPatrick plant, Entergy, had announced he plant for decommissioning in January of 2017. In other words, unlike the previous studies, this case study was expected to provide us with the real-time unfolding of a controversy over nuclear decommissioning.

Prior to this summer's project, we collected secondary data sources (e.g., news articles) on the planned decommissioning and socio-demographic data of the community, identified key stakeholders, and assembled the timelines of nuclear power plant development in the region. With the background information, during the summer project, we gathered qualitative, on-site data by interviewing stakeholders in Scriba and Oswego County. We also interviewed people involved in local government and school systems to give us a picture of how the plant’s closure will affect the community from a variety of perspectives. We recorded all interviews, upon the permissions of the interviewees, and transcribed them for future analysis.

Our preliminary analysis of the information from the interview indicated the followings. First, while there was some cause for concern among social changes, the three tax jurisdictions seemed relatively calm about the idea of losing FitzPatrick as an economic base when compared to the reactions gathered from previous locations like Wiscasset. A major factor of this was that Entergy had created a PILOT (Payment in Lieu of Taxes) Program with the jurisdictions, giving them the chance to prepare accordingly. Second, the Mexico School District's (MSD) planning and frugal investments allowed them to be more financially secure than the Wiscasset schools, as well as illustrating that school districts can survive after suffering major economic blows. Third, Governor Cuomo and New York State’s involvement in the fate of FitzPatrick provided a great more deal of support than previously witnessed, to the extent that the plant may now remain open. In addition, however, the politics of this situation was far more complicated than in Haddam or Wiscasset by creating connections throughout State Policies and relationships with companies, including Entergy. Further analysis of the interview data and other information collected thus far will be conducted by Prof. Yamamoto.

Figure 1. Oswego County seal. In the above image, an atom, which represents energy production, is visible in the center of seal. (Photo by Julia Feikens)

Title of Project: Field School Fellowship on Local Foods in Hamilton, New York

Project Summary:

This summer, I worked at the Partnership for Community Development in Hamilton, New York. The Partnership for Community Development (PCD) is a local not-for-profit organization based on Payne Street in Hamilton. As an economic development agency, the PCD is responsible for spearheading and overseeing Hamilton’s economic growth through projects that aim to support local businesses through grants and by expanding the town’s infrastructure, for example, through trail and park construction. The particular project that I worked on at the PCD was aimed at introducing more foods from local farms to restaurants in the town. Hamilton and the surrounding area is home to hundreds of farms, and those farms could be used as a food source for area restaurants. I was tasked with researching the barriers that prevent local restaurant owners from accessing the abundant local food supply. This research is intended to inform an action plan that the PCD will develop in order to make these local foods more accessible.

Despite the hundreds of farms in and around Hamilton, very few of Hamilton’s restaurants feature local foods on their menus. Through my research, I discovered that there are a few reasons for this. First, there is currently no available distribution infrastructure that can transport food from farmers to the restaurants. All food systems need producers, distributors/purveyors, and buyers. The distributors act as the bridge between producers and buyers (restaurant owners), but without a local distributor to bridge the gap, restaurants must rely on established supply chains. These existing supply chains have been established by companies such as Sysco, the largest food distributor in the U.S. Companies such as Sysco allow food to be transported cheaply long distances, often thousands of miles, and sold for a premium, which helps restaurants maintain profit margins. Paradoxically, then, it is often easier for restaurants to buy food that was grown 1,000 miles away than it is for them to buy food grown in their own town.

Another barrier to local food access in restaurants is volume. Companies such as Sysco are able to provide large volumes of the foods that restaurants need, whereas it is unlikely that a single small, local producer will be able to provide all the food that a single restaurant needs. This makes food distribution even more complex, as restaurant owners would then have to manage interactions and transactions with multiple local producers rather than rely on the simple and established infrastructure that Sysco offers.

The third major barrier to local food access is cost. However, this topic was not as unanimously agreed upon as the barriers of volume and distribution. Some people with whom I spoke maintained that the difference in price between local foods and regular foods, especially meats, was not a major barrier. Still, others insisted that trying to sell certain local foods, such as salads consisting of local greens, would push prices too high and profit margins too low. In any case, many local producers are able to offer fairly competitive prices, and economic studies have shown that buying local foods returns a significantly larger percentage of money to the local economy than buying nonlocal foods, providing further incentive and benefit to buying local meats and produce.

My research was focused on analyzing systems of Josephson junctions. A Josephson junction is made up of two superconducting metals separated by an insulator. The currents across these junctions oscillate in the same way that many natural systems, like neurons and fireflies, also oscillate, and the models for Josephson junctions also model these natural systems. We arrange Josephson junctions in a ring array (figure 1), with the red junctions being oscillators and the yellow allowing us to adjust parameters; the yellow junctions allow the red junctions to couple to each other, and the fact that the yellow junctions are in loops allows us to adjust the coupling. The rings form a system called the Kuramoto model, in which each oscillating junction is coupled with its neighbors. We then simulate the equations which model the dynamics of this system, and we observe the synchronization of frequencies in the results.

Once we get the results of the simulations, we first get a weighted result by factoring out the individual frequencies of the individual oscillators and examining the amplitudes (figure 2). We compare this result to the general curve which theory would tell us to expect, and examine the difference between the general result and the results. We examine the modes which make up the coupling matrix which describes the system, and compare these modes with the strongest mode that drives the bifurcations which we observe in the system (figure 3). Our next step is to try to figure out what makes specific modes drive bifurcations and if it is a consistent pattern.
Title of Project: Examining the effects of behavioral synchrony on White people’s compassion for Black people’s pain

Project Summary:

Compassion is an important emotion that can motivate people to help others who are suffering. Unfortunately, people do not always feel similar levels of compassion for everyone. Instead, research indicates that people tend to feel more compassion for pain experienced by others who are from their own racial group and less for those from different racial groups (Azevedo et al., 2013; Forgiarini, Gallucci, & Maravita, 2011; Avenanti, Sirigu, & Aglioti, 2010). In the present research, we will attempt to decrease racial biases in the experience of compassion for others who are experiencing pain. In particular, we will test whether behavioral synchrony with people from other racial groups may decrease racial biases in the experience of compassion for pain.

Mimicry and behavioral synchrony (i.e., moving one’s body similarly to another person) are associated with myriad beneficial interpersonal outcomes. For example, when people are subtly mimicked by another person, they tend to report liking that person more (Stel & Vonk, 2010). Likewise, when two people move in synchrony (e.g., rocking at the same cadence in a rocking chair), they then perform subsequent joint tasks more effectively than when they engage in behaviors that lack synchrony (i.e., rocking out of rhythm with another person; Valdesolo et al., 2010). Most relevant to our project’s focus on racial biases in compassion for others, research indicates that when White people behaviorally synchronize with a Black person (versus a White person) that this leads to decreases in implicit racial prejudice (Inzlicht, Gutsell, & Legault, 2012). Thus, we reason that behavioral synchrony may also decrease racial biases in the experience of compassion for people experiencing painful events.

Although the experience of compassion can be measured through self-reports of emotional experiences, recent research has illuminated more subtle and embodied ways to measure compassion. Steller and colleagues (2015) find that the experience of compassion is associated with specific changes in cardiovascular functioning—in particular, increases in an index of cardiovascular health called heart rate variability (HRV). Interestingly, higher HRV is not only associated with the experience of compassion, but also to the daily experiences of positive social connections more generally. Fredrickson and colleagues (2010) found that daily reports of positive social connections over a period of weeks was associated with increases in HRV over time. Because behavioral synchrony is known to facilitate social connections, we reason that synchronizing movements with others may increase HRV (from baseline levels)—regardless of the race of the interaction partner. However, we also expect that when White people engage in behavioral synchrony with a Black person (vs. a White person or a no synchrony control condition), that this should increase feelings of social connection to Black people in particular. As a result, mimicking a Black person may specifically increase compassion toward a Black person in pain and minimize racial biases in the experience of pain.

In addition to measuring HRV, we will also measure compassion in several other ways: galvanic skin conductance (GSC), facial muscle movements, and self-reports. First, higher GSC is associated with activation in what has been called the pain matrix of the brain (i.e., anterior cingulate cortex; Lamm, Porges, Cacioppo, & Decety, 2008). Thus, higher GSC while viewing others in pain has been interpreted as greater compassion or empathy for their pain (Forgiarini et al., 2011). Second, Lamm and colleagues (2008) found that two facial muscles, the orbicularis oculi and corrugator supercillii are activated while watching others in pain. Thus, activation in these muscles while viewing others in pain should indicate greater compassion or empathy.

This study is ongoing, and we aim to collect and analyze data of roughly 100 participants throughout the next two semesters. We predict that when White people engage in behavioral synchrony with Black people, that this may increase perceived closeness to Black people in general and, thus, increase compassion for pain experienced by Black people. We also expect that behavioral synchrony with others should have beneficial effects on cardiovascular health more generally. Given recent media coverage of lethal force used by law enforcement against Black men, we hope to better understand how White people emotionally respond to these events.
Studies on cities in upstate New York have shown a steady decline in the quality of life, as they have steadily shifted from being the prominent business and cultural hubs they once were. Buffalo’s 2000 census is an attest to that, citing almost a decline to half of its population since 1950, and ranking fourth in the country with the highest rate of population decline. Utica and Syracuse follow close by on the ranking for population rate decline, with a 34 and 33 percent population respectively. Subsequently, residents within these cities also face high levels of poverty, and rank above average on the indices of social stress (Hevesi, 2004). In stark contrast, New York City has managed to maintain a steady rate of population growth, and as a result substantial job growth. From 1980 to 2010, New York City population increased by 15.6%, but also faced a 26.9% increase in job gains (Napoli, 2012).

Thus based on the evidence given by the literature reviewed, I argued that immigrants moving into the cities in upstate New York, namely Utica, Syracuse, and Buffalo could help improve the declining economy, with comparisons to the example of New York City and its large immigration influx. Although the data found was a combination of both quantitative and qualitative resources, New York City undoubtedly stood out as an anomaly in comparison to the three upstate cities. This is in particular regard to the positive increment of the population in the city since 1980, as well as a comparatively low unemployment rate standing at 8.5%. With such large immigrant populations in NYC, there is subsequently a larger amount of resources allocated to the accommodation of both immigrants and refugees. This is also evident in the number of institutions whose mission is to assist this demographic, with about 23 listed in the data as opposed to 7, 7, and 4 for Utica, Syracuse and Buffalo. Other trends to note were that those organizations within Utica, Syracuse and Buffalo placed a greater emphasis on refugee resettlement whilst institutions in NYC focused more on any kind of incoming migrants.

Conclusively, immigrants and refugees may have a negative reputation under the current political sphere for supposedly exacerbating unemployment; nonetheless studies aforementioned refute that claim with New York City as the prime illustration of growth correlating with the welcome of immigrants. Furthermore, the challenges that face the influx of people have been cited as plentiful, and thus institutions are crucial within this assisted phase. Suggestions for local and state governments in the future might be to cater the declining resources towards supporting immigrants in these areas.
Research Fellow: Weilin “Emily” Gu (2017)  Concentration(s): Economics; Mathematics  
Faculty Mentor: Yang Song  Department: Economics  
Title of Project: Family Background and School Choice Behavior: Evidence from Urban China  
Project Summary:  
Recent decades have seen an increasing popularity of school choice reforms in both developed and developing countries. The purpose is to provide choices for parents and students across the socioeconomic spectrum with equal opportunity for quality education and to foster competition among schools. However, research studies show that school choice reform led to an increase in sorting and stratification in many countries, including Chile and Argentina. Studies in various settings (such as Boston, Kenya, and Beijing) document that when given school choices, students with lower socioeconomic status tend to choose lower quality schools.  
Motivated by the existing literature, this study investigates the factors that affect students’ school choice behavior in an urban China setting. The study includes two parts of analysis, statistical analysis using administrative data set and fieldwork involving questionnaire collection.  
To understand how student characteristics are correlated with their school choice, we analyze a comprehensive administrative data set obtained from the education bureau. The data set contains information on student demographic information, academic performance, family background, and school choice. By regressing various measures of school choice quality on student characteristics, we find that, students with lower socioeconomic status are 8.52%-11.9% less likely to choose a high-quality school given the same choice set, controlling for elementary school fixed effects, academic performance, and other demographics.  
We also collected questionnaires from nine elementary schools across different districts in the city. Information obtained from the questionnaires allows us to further understand the relationship between students’ family background and how informed they are about the school choice process as well as differences in the choice school quality. Analysis on the questionnaire data shows that students with lower socioeconomic status, i.e. those without local household registration or with lower parental education level and income level, are less familiar with both the school choice process and school quality, as illustrated in the following two graphs.  

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  ☒ Other (specify): Lampert Institute for Civic and Global Affairs
Title of Project: Mapping of the Informative Value of Early Visual Evoked Potentials: The C1 Component

Project Summary:

Try looking around you. What is the foremost aspect of the scenery that you perceive? Is it the colors? The objects? The outlines of the objects? The general categorization of the scenery you are looking at — an office, kitchen, department store, campus or forest? You will quickly realize that this task can be quite difficult. For example, you might believe that the first aspect you perceive is objects, but these might have only become clear after the overall structure of the scene was perceived. The brain processes the world around us so quickly, on the order of milliseconds, that discerning the order of processing different aspects of scenes remains unclear. The concept of the foremost step in this process of scene perception and categorization is still being heavily debated. In hopes of eventually deducing this early aspect, we directed our focus to a distinct electrical potential that can be measured around 50-80 ms post-stimulus in the primary visual cortex known as the C1 component. Over the course of the summer, we therefore investigated the C1 component in two Electroencephalography (EEG) experiments aimed at 1) better understanding how the C1 expresses itself on the scalp surface, and 2) measuring the extent to which the magnitude of that component could differentiate between different visual scene categories.

Experiment 1: Depending on the angle and relative position of a static object from the center of a scenery or screen (eccentricity), the magnitude of the C1 in the primary visual cortex varies. Additionally, a strong C1 component from a stimuli in the upper visual field is expected to be negative while a strong C1 from a stimuli in the lower visual field is expected to be positive. However, what is not known is how that component expresses itself when there is visual information presented in both the upper and lower portions of the visual field. We predicted that presenting two stimuli simultaneously, one in the upper field and one in the lower, would evoke the same C1 potential as presenting the two stimuli separately and summing the resulting component. If this expectation holds true, then systematically measuring the C1 with simultaneous upper and lower visual field stimuli would enable researchers to predict how the C1 would be expressed with full-field stimuli (stimuli with visual information at many angles and eccentricities), thereby allowing for a more precise measure of this component on a participant-by-participant basis. Preliminary results were promising (albeit noisy) in that several participant data sets could reliably predict C1 cancellation.

Experiment 2: Previous work from Professor Hansen’s lab has shown that the C1 component can be decoded to better understand scene processing and categorization. Here we explored those findings further by testing how well the C1 component can predict, through decoding, scene category by briefly (500 ms) presenting participants with images of scenes from 30 different categories. We found that the accuracies were much higher than statistically expected, suggesting the C1 component corresponds to early aspects of visual processes. Prior work from Professor Hansen’s lab had also decoded a later, more well-known visual component, P200. In observing the pattern of confusions the C1 and P200 predicted, it was clear that the P200 more separably predicted categories; in other words, 200 ms after stimulus onset, the brain is better at correctly separating categories from one another than at 50-80 ms. We hypothesize, as is supported by the aforementioned decoding results, that the C1 component corresponds to the original processing of a scene and the P200 to later processing which further differentiates between the categories. Furthermore, we believe that the first aspect of scene categorization is global structure, followed by functionality. Although we did not establish an experiment to test this prediction, we began abstracting such a paradigm.

References
During my time as a Summer Field School Fellow for the Upstate Institute I worked for the nonprofit Cornell Cooperative Extension Hops Program. The purpose of the Hops Program is to encourage the growth of the recently developed, modern New York hops growing industry. To continue the growth of the industry, the Hops Program gathers and shares information on all aspects of hops cultivation and production to both experienced and new hops growers. My contribution to the Hops Program’s purpose of gathering and sharing information involved working on two distinct projects. One project was to create an annotated bibliography of hops production resources, and the other was to statistically analyze and present the data from the results of a survey filled out by hops growers.

The first project, the annotated bibliography, was based on a list of resources already compiled by the students of a hops growing course at Morrisville State College. For each week of the class, each of these students had submitted a summary of a book, website, news article, magazine article, or scientific journal article on the topic of hops production being studied that week. Forming the annotated bibliography involved me reading each student submitted resource, checking its relevance to hops production, and writing a new summary for the resource. The goal of creating this bibliography was to provide a compiled list of easily accessible resources on different areas of hops production. This information could then be utilized by hops growers to potentially increase their yields, which would then improve the New York State hops industry.

My second project involved analyzing the data from a hops grower’s survey, created and distributed by the Hops Program. Analyzing the data obtained from the survey was significant to the Hops Program since it would reflect the state in which the New York State hops industry was in, and highlight any problems faced by hops growers. The results of the survey were analyzed using Microsoft Excel, which previously I had little experience in. Although it was challenging at first, my supervisor helped me understand how to successfully use Excel to collate and interpret the data. Once the data was collated, I presented the data as a statistical report with both written explanations and graphical illustrations. This report was created with the help of my supervisor, who advised me how to organize and write sections of the report, and how to use certain features of Microsoft Word. The result of this project was a statistical report that reflected the needs and concerns of hops growers, and the growth of the industry.

Overall, working on these projects for the Hops Program was a great opportunity. As a Field School Fellow, I was able to both contribute to the local community, as well as improve my ability to use Microsoft Excel and Word. My time as a Field School Fellow has been one of my most rewarding experiences.

☑ Other (specify): Upstate Institute
Research Fellow: Jacqueline “Jackie” Hanrahan (2018)   Concentration(s): Psychology; Economics
Faculty Mentor: Julie Dudrick   Department: Upstate Institute

Title of Project: Rural Healthcare in Chenango County

Project Summary:

Throughout the United States, people are constantly struggling to access and afford healthcare. Despite many political and social efforts to improve overall accessibility of healthcare in the United States, many areas remain unreached or unaware of progress that has been made. These problems are magnetized in rural areas known for higher poverty rates, larger elderly populations, poorer health, and higher uninsured rates. Additionally, there are fewer physician practices, hospitals, and other health services available in these areas. Partnering with the Chenango United Way, I was able to take an active role in bringing no-cost healthcare to Chenango County through an Innovative Readiness Training (IRT). IRT events give military personnel on-the-ground training opportunities while also providing in-need communities with services that they desperately need. In both 2015 and 2016, Chenango County was awarded with a medical IRT. Throughout Chenango County, there is an urgent need for improved health care. This county has a 15.7% poverty rate coupled with a 5.9% unemployment rate. Of the unemployed, 33.1% are without health insurance. Of those employed, the median household income is only $44,427 and 11.7% are without health insurance. Furthermore, 13.3% of residents 65 and under are living with a disability.

Working on the civilian side of the Greater Chenango Cares IRT, I worked with the Chenango United Way to register and recruit close to 400 volunteers. Prior to the event, I designed and presented a volunteer orientation relevant for every volunteer to prepare them for the event and train them for any potential situations. Throughout the ten day IRT, I oversaw and organized the volunteers to ensure that the event ran as smoothly and efficiently as possible.

Over 1,000 patients completed a survey upon entering the event, and revealed that only 54.9% saw a doctor twice per year. However, this group primarily only saw a primary doctor twice per year, and were unable or unwilling to ever see a dentist or optometrist. Furthermore, of the 45% who do not see a doctor twice per year, this is due primarily to a lack of insurance or funds. Even with insurance, patients felt that there were no providers available to them. The overall lack of sufficient health care and insurance exemplifies the norms of rural health care. While primary doctors may be available locally, specialized dental or optical facilities are missing in Chenango County. Patients further demonstrated the lack of dental care, by requesting information for dental follow-up appointments more than any other service.

The Greater Chenango Cares IRT was an enormous success and served 1,850 individual patients, provided 10,310 individual services, and saved the community $914,094. The no-cost services included, but were not limited to, medical, dental, optical, and veterinary. Many of the services are hard, if not impossible to find in Chenango County especially without health care or proper access to transportation. The hard work of the community and the Chenango United Way allowed for many to receive services they had not dreamed of for years, and very likely contributed to saving multiple lives.

Title of Project: Polar Bond Hydrogenation through CNN-pincer Catalysts

Project Summary:

Traditional techniques of polar bond hydrogenation have low atom economy and produce undesirable wastes. In 1980, Noyori developed a catalyst for aldehyde/ketone hydrogenation. Based on his findings, scientists modified Ru catalysts for aldehyde/ketone and ester hydrogenation. Our research (Fig.2) is based on Song’s catalyst (Fig.1) in 2011:

By substituting the side groups Ar on the benzimidazole and the two R groups on the amine side, we studied the effects of these groups have on catalytic hydrogenation. Previous research has shown that when Ar=mesityl and the amine side is diethylamine, we have a very effective catalyst. This summer, my research is focused on the xyl-substituted compound (Fig.3), which we previous had difficulty with its synthesis. The reaction scheme with worked previously for Mesityl-substituted ligand does not work very well, as the xyl-substituted ligand does not bind to the metal very well. It was solved by Prof. Buck’s idea of adding extra AgCl, which expedited my synthesis by removing ligands on the Ru precursor more effectively. As a result, I was able to isolate this complex and run preliminary catalysis. Here is the comparison of percentage yield of the catalytic hydrogenation of ethyl benzoate:

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<th>Substrate : Catalyst</th>
<th>Yield (Xyl-substituted)/%</th>
<th>Yield (Mesityl-Substituted)/%</th>
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It seems that the xyl-substituted complex is less effective than the mesityl-substituted complex, but I need further catalysis to confirm this conclusion.

Project Summary:

This summer, I worked with the National Abolition Hall of Fame and Museum (NAHOF), located in Peterboro, NY. The National Abolition Hall of Fame and Museum honors antislavery abolitionists, their work to end slavery, and the legacy of that struggle, and strives to complete the second and ongoing abolition— the moral conviction to end racism. Members of the museum have been doing great work in their community and the surrounding areas for about a decade now, since the creation of the museum in 2004. This summer, I worked directly under Dot Willsey, the former President of the Cabinet of Freedom. My main tasks included hosting the museum on a daily basis, attending various weekend events, and collecting and analyzing data regarding visitors’ experiences and motivations to commit to the “Second Abolition,” the eradication of racism.

Coming in with little knowledge of 19th century reform movements, I was a little worried that I would struggle in certain aspects of my job that I thought may require this historical knowledge, but I found that not to be the case. So many people came to the museum with little to no knowledge of 19th century reform movements, or even 20th century reform movements at that. This has been a learning experience for me, and I have come to realize that historical events and individuals from the past tend to get mythologized, and in order to truly learn about our history, we have to make these events and individuals real. I believe that the National Abolition Hall of Fame and Museum has the resources to make this history real in a sense for its visitors; it has for me.

My main project this summer was to conduct research on visitors’ experiences with an exhibit that NAHOF loaned from the Smithsonian’s National Museum of African American History and Culture, called Changing America: The Emancipation Proclamation, 1863, and the March on Washington, 1963. One hundred years separate the Emancipation Proclamation and the March on Washington, yet they are profoundly linked together, as both grew out of decades of people demanding justice, resisting, and taking bold actions in the hopes that they would create some sort of lasting change. It is no secret that our nation has a very ugly history of systematic oppression, particularly of black folks, but as a Sociology major who has taken various courses that tackle issues of racism, mass incarceration, and social inequality, I find it very eye opening to be able to make connections between the past and the present. My experience with the Changing America exhibit this summer has allowed me to clearly see how the systems of the past such as slavery and Jim Crow are truly the roots to many of our problems today.

I have enjoyed being an Upstate Institute Summer Field School Fellow this summer. I learned a lot about the very region that I grew up in, and I admire that the Field School relies on a community-based approach to research.
Title of Project: Abraham House Guest Records 2008-2016; Analysis and Projection

Project Summary:

When dealing with a terminal illness, it takes courage to decide when it is time to enter palliative care. Palliative medicine focuses on pain management, rather than treatment, of patients with terminal illnesses. Comfort Care homes help make this transition a little easier by providing a peaceful environment for their final days of life. Abraham House is a non-profit comfort care home located in Utica, NY that provides its guests services free of charge. Typically, a patient with a terminal illness will enter into Hospice Care and can choose to have outpatient medical treatment at home, or relocate to a facility. Abraham House differs in that the organization provides a welcoming home to guests, while providing medical services through Hospice & Palliative Care. Donated by Dr. Albert Shaheen in 1998 and Abraham House has been serving guest the terminally ill with 3 months or less to live ever since.

Even though there are only two beds, Abraham House, the organization has made a huge impact on guests and their families over the past 18 years. My project entailed gathering information from previous guest records to predict and analyze trends involving who the organization serves. Unfortunately, I was only able to recover medical and guest records dating back to 2008. Luckily, 8.5 years of records provided enough data to make accurate predictions and summarize the general population Abraham House serves. This information provides stable evidence to justify expansion of the organization and a need to target certain populations.

Data from paper records were computerized revealed that Abraham House served residents from Oneida, Herkimer, Madison, Onondaga, Otsego, Oswego, Montgomery, Washington, and Schoharie in the past 8.5 years. In those years, 221 guests have passed through the home. The average guest arrived from a hospital, was white, and was 75 years old. Of the more pertinent analysis, there is a growing demand for Abraham House to serve more guests. On average, Abraham House serves around 25 guests a year. However, this number is projected to increase, (Figure 1). This works out to be about 13 guests per bed per year. Approximately two more guests are served every year at Abraham House and 2016 is projected to serve 30. If Abraham House were to expand by adding two beds, the number of guests served per year would range from a low of 44 guests, to a high of 58. The more people Abraham House can provide services to help the local communities and a larger section of the terminally ill population.

Other interesting data includes how often a bed was unoccupied in the home. This varied based on the transition time between each guest and if there was a waiting list. I called this the guest turnover rate. However, on average, beds were unoccupied 36.41% of the time with an average of 5.55 days between guests. 2015 holds the highest year of vacancy at 47.26%. Current projections for 2016 indicate Abraham House will only be unoccupied 12.60% of the year with 1.53 days between each guest.

The main reason why these stats are so important is that they reflect potential financial growth and savings. Abraham House relies strongly on donations in order to cover their operating costs. These donations often come from the family and friends of the guests that pass at Abraham House as well as when Abraham House is mentioned in an obituary. On average, each guest generates $325.83 in revenue, based on $71,356 collected from memorial donations for 219 guests. In terms of expanding, adding two beds would increase overall guest revenue by $8,276.08 a year. It is important for the families of the guests to mention Abraham House in the obituary to receive donations in lieu of flowers since those that do, generate $767 per guest, while those who do not request Abraham House donations only generate $246 per guest.
Title of Project: The Effects of Clomipramine Treatment on Anxiety and Dnmt3a Expression in the Medial Prefrontal Cortex in Male vs. Female Rats

Project Summary:

Anxiety represents a broad spectrum of mental disorders that affect ~18% of American adults. Women meet the DSM-IV criteria for anxiety disorders 1.5 - 2 times as often as men; despite this startling fact, male animals are studied five times more often than female animals in biomedical and neuroscientific research. In addition to sex differences in prevalence of anxiety, sex differences exist in response to treatment for anxiety with anxiolytic and antidepressant drugs, with males exhibiting greater responsivity to tricyclic antidepressants (TCAs) compared to females. Clomipramine (CLM) is one such TCA that non-selectively inhibits the serotonin transporter, and it has been well profiled that acute treatment with CLM can induce or exacerbate anxiety-like behavior. While the factors involved in the pathology of anxiety disorders remain poorly understood, a relatively new and promising target for investigation has emerged with epigenetics. Epigenetic modification of the genome has been implicated in the etiology of anxiety disorders. Specifically, DNA methyltransferase 3a (Dnmt3a) is an enzyme that catalyzes the de novo methylation of DNA at CpG sites and is downregulated within the medial prefrontal cortex (mPFC) in stressed and anxious animals compared to controls. This study aims to investigate potential sex differences in anxiety-like behavior, Dnmt3a expression within the mPFC in response to low and high-dose CLM treatment, and acute vs. chronic treatment.

To investigate the involvement of Dnmt3a in the mPFC on sex differences in anxiety-like behavior and clomipramine treatment, adult male and female Sprague-Dawley rats (n = 82) were first tested on the commonly used Elevated Plus Maze (EPM) to determine baseline anxiety levels; animals that spend more time in the closed, walled arms of the maze are interpreted as having higher levels of anxiety. Low or high-dose intraperitoneal injections of clomipramine or saline control were administered for either 1 day (acute) or 21 days (chronic). The Light-Dark Box (LDB) anxiety test was performed 30 minutes after the last injection; animals that spend more time in the dark chamber are interpreted as having higher levels of anxiety. Immediately after, animals were sacrificed and their brains dissected.

At baseline, females were more anxious than males (Figure 1). Female rats spent significantly more time in the closed arms of the EPM than did male rats, supporting previous work that shows women are anxious more often than men. Acute treatment groups, regardless of sex, displayed no significant difference on time spent in the light chamber of the LDB (Figure 2). Chronic/high-dose treatment group animals made significantly fewer entries into the light chamber of the LDB than both the acute/low-dose and acute/high-dose treatment group animals (Figure 3). This result runs contrary to previous observations that CLM treatment on an acute basis can induce or exacerbate anxiety-like behavior. Since female animals displayed greater levels of anxiety-like behavior to begin with, perhaps CLM treatment could reduce anxiety-like behavior more for the female animals than it could for the already low-anxious males—suggesting that CLM treatment may only benefit individuals who are already anxious.

Figure 1: Female rats spend significantly more time in the closed arm during EPM testing than did males (t_{75} = 2.12, p < 0.04).

Figure 2: Effects of acute CLM treatment on time spent in the light chamber. There was no significant difference amongst acute treatment groups on LDB (F(2, 39) = 0.50, p < 0.61).

Figure 3: Effects of treatment on light chamber entries. The chronic high treatment group animals made significantly fewer light entries than both the acute low-dose and acute high-dose treatment group animals (t_{24} = 2.65 p < 0.01) and the acute high treatment group animals (t_{23} = 2.07 p < 0.05). There was no significant difference in time spent in light chamber amongst treatment groups (F(5, 75) = 0.56, p < 0.73, not shown).
Title of Project: Across Languages and Disciplines: Translating Japanese research to better understand how we understand language

Project Summary:

This project focused on the translation of research articles written in Japanese into English, to better incorporate the Japanese and English literature on particular phenomena called the McGurk effect and phonemic restoration. Both of these phenomena occur during speech perception and processing, and significant differences in the English and Japanese languages necessitate the incorporation of these two bodies of literature on these phenomena.

The McGurk effect is a phenomenon by which visual information such as lip movements or other facial information interferes with audio input in the brain, producing the perception of a sound that is different than what was present. Phonemic restoration is when a sound is completely blocked out by an interference but is perceived as one continuous sound bridging preceding and subsequent stimuli. The brain uses contextual information to substitute in the sound it expects to hear, thereby creating the perception of continuity of sound or speech.

The first step in researching these phenomena was to find articles in Japanese. These articles are: Kaheki Kazuhiko, 2011; Masayo Kajimura & Haruyuki Kojima 2010; and Sekiyama Kaoru, 2011. To get a better idea of the content of the articles, the first step was to do a sort of broad reading of the articles. This involves reading or translating key portions of each article, such as section headings, titles, and included figures, to understand some of the key points included in the text.

One of the biggest linguistic challenges in translating these articles was the difference in sentence structure between Japanese and English. In Japanese, there is a tendency to use many dependent clauses to provide supporting information around the main idea of the sentence, and although this does exist in English, it arguably occurs more in scientific literature in Japanese than it does in English scientific literature. This presented a unique challenge when translating this literature into English, and in some cases it was much more natural to split these long sentences into several shorter ones for clarity and flow.

One of the main findings from the translation work of the above articles was that between the two research literatures, the presentation of facts and findings was nearly identical. The same flow of ideas and facts from introduction and background information to methodologies, then to results and conclusions. This is likely due to the large impact that Western and American research traditions have permeated the Japanese scientific community and standardization of scientific articles across countries.

In addition, the Japanese literature contained insights into population differences between English and Japanese speakers with regards to the McGurk effect and phonemic restoration, indicating that Japanese native speakers are less reliant on visual information when processing speech, resulting in lessened McGurk effects in Japanese native speakers, even when speaking English. These differences are significant and are only found in the Japanese research translated, making differences such as these important to integrate between the two bodies of literature.

Title of Project: Investigation of the Insertion of Nickel into C₆F₅-N-Confused Porphyrin

Project Summary:

Our research group is interested in the synthesis and metalation of N-confused porphyrin, an isomer of porphyrin, where one of the smaller pyrrole rings (shown in red) is positioned such that the macrocycle core contains a carbon atom rather than all nitrogen atoms. The binding of a metal ion into the core of an N-confused porphyrin can afford a complex with a carbon-metal bond (an organometallic complex).

A previous student from our group investigated four conditions for the insertion of Ni(II) into an N-confused porphyrin bearing strongly electron-withdrawing pentafluorophenyl (-C₆F₅) substituents. This study was prompted by a collaborator’s unsuccessful attempts to insert nickel into C₆F₅-NCP following a published method.

Our work this summer began with the synthesis of additional C₆F₅-NCP to support metalation experiments. The C₆F₅-NCP was prepared using methodology recently developed by our group. Next, we examined five conditions for the insertion of nickel into C₆F₅-NCP. Most of the conditions utilized polar solvents that would likely favor nickel insertion as the outer tautomeric form of NCP, presumably required for metalation with nickel, predominates in polar solvents. The exception was a published method using CH₂Cl₂ which our collaborator found to work poorly. Conditions were identified that afforded quantitative formation of Ni(II)-C₆F₅-NCP. Using the best condition on an 80 mg scale of C₆F₅-NCP, we obtained Ni(II)-C₆F₅-NCP in a yield of 97% after chromatography and 75% after crystallization. UV-vis and ¹H NMR analyses were consistent with published values.

☒ Other (specify): Miller-Cochran Fund
Title of Project: Metamorphism of Adirondack Anorthosite

Project Summary:

The Adirondack High Peaks are home of massif anorthosite intrusion and granulite facies metamorphism. The Adirondack anorthosite massif is made of igneous rocks containing >90% plagioclase and spans across hundreds of square kilometers. While the origin of the Adirondack Anorthosite is still debated, most geologists believe anorthosite plutons formed when plagioclase rich magmas rose from stratified magma chambers near the mantle due to their low density.

Following the intrusion of the Adirondack Anorthosite, the High Peaks have undergone several high-grade metamorphic events. However, the timing, pressures, and temperatures of the metamorphic events in this region are poorly understood. This summer, I collected samples from various regions within the Adirondack Anorthosite in hopes of collecting data to constrain the timing of metamorphic events as well as the pressure and temperatures at which these rock formed. Samples collected contain garnet coronas around Ilmenite and pyroxene crystals, which hopefully will be found to contain metamorphic zircons.

The samples examined were collected by myself and fellow research students, Oleg Kozel and Alexander Taylor. Samples collected from the Adirondack High Peaks by James McLelland and previous students were also examined. Of all the rocks studied, thirty were chosen to be cut and made into petrographic thin sections. Small pieces of each sample were mounted to a glass slide and ground to 30 microns and examined at using a petrographic microscope. Half of those thin sections were chosen to be polished and examined using a Scanning Electron Microscope (SEM). Each sample was carbon coated and back-scattered electron detection and x-ray analysis were used to identify the minerals present in each sample. Emphasis was put on finding metamorphic zircon coronas around Fe-Ti oxides that have been reported in several studies of granulite facies rocks.

The results of the x-ray analysis showed the presence of metamorphic zircons and zircon coronas around Fe-Ti oxides in several samples. This will be used to determine the timing of metamorphic events using U-Pb geochronology this fall. For future research, classical barometers and thermometers will be used to constrain the pressures and temperatures at which different minerals crystallized in these rocks.

Research Fellow(s): Christopher Huber (2017) Concentration: Neuroscience
Benjamin “Ben” Phelps (2018) Concentration(s): Psychology; Music

Faculty Mentor(s): Bruce C. Hansen Department(s): Neuroscience; Psychology
Douglas “Doug” Johnson Department: Psychology

Title of Project: Change Blindness: The Role of Implicit and Explicit Change Detection

Project Summary:

In recent decades, a growing body of research regarding the ability to detect change in our environment has presented many claims about visual perception. It is an interesting paradox, in that we believe we are constantly attending to every stimulus in our immediate environment, yet research shows that humans consistently overrate their performance at detecting changes. With an apparently flawed visual system, researchers have begun to explore the mechanisms that our visual system relies upon. Through investigation, researchers can identify potential points in our circuitry that break down in instances where we do not notice a change has taken place. Researchers have articulated two disparate processes that allow the subject to detect a change. The first system is explicit change detection, which occurs when the subject is consciously aware of changing stimulus. The other system is implicit change detection, which implies an unconscious monitoring system that accumulates information, although this information is not consciously available, it contributes to detection of the changing stimulus. Our summer project sought to identify whether an implicit change detection system exists, and the extent to which it informs change detection.

To investigate the question given above, we used a variation of flicker task that Rensink (1997) popularized, in which two displays (A and A') have identical items except for one item that is unique. If the images were alternated constantly from A to A' to A, then the change detection task is markedly simple because the abrupt visual onset creates a ‘jump’ of the object that is changing between displays. However, when a brief inter-stimulus interval (ISI) is inserted between each display screen (e.g., A to ISI to A’ to ISI to A…) detection of the changing item becomes very difficult. The main independent variables were set size and change size. Set size is operationalized as the number of items in a given display; the current study used 9, 12, and 15 item displays. Change size is operationalized as the number of features that are unique in the changing item. The grounding assumptions are that larger display sizes will be more difficult relative to smaller set sizes, as there are more items to sort through. Second, smaller changes are more difficult to detect relative to larger feature changes, as more features are moving. The main dependent variables are scan path data (recorded with an eye-tracker) and the reaction time for detecting the change. To evaluate the results, our experiment plots set size by reaction time and evaluates the slope differences between large and small changes. Previous research displays that linear slopes indicate a serial self-terminating process. For our purposes, we primarily examined the efficiency of the search task relative to set size. If the larger changes produce a shallower slope than the smaller changes, then it is logical to assume that searching for the larger changes is becoming more efficient relative to the smaller changes, hence supporting an extant implicit system. Our pilot data revealed a trend towards shallower slope for the larger changes relative to smaller changes. Further, the scan path data yielded rapid convergence on the changing target before the target was detected. Together, the findings suggest that change detection involves both an explicit and implicit process.

In the coming months we will begin gathering a complete data set for the initial part of our experiment. If the data continue to support the involvement of an implicit process in change detection, then our follow up experiment will integrate dual tasking to investigate whether cognitive load is a contributing factor to either process of change detection (implicit or explicit).

☐ Other (specify):
Title of Project: Reimagining Colgate’s LGBTQ Sensitivity Training

Project Summary:

My summer research project began as a simple frustration with the SafeZone workshop provided by LGBTQ Initiatives. I am an intern for the office and have coordinated dozens of the trainings for the past two years but felt that nothing was coming of them. The SafeZone curriculum seemed to be missing some major points in educating students, staff, and faculty about the LGBTQ community at Colgate. I knew that something needed to change in order for this campus to become more accepting of diverse sexualities and for our efforts as interns not to feel wasted.

I started my project by reading and analyzing critical pedagogical theories like Freire and Hegel. I gained from this the understanding that the SafeZone trainings ought to be more interactive and discussion based in order for the trainees to develop a personal attachment to the issues.

I then dug deeper into the history of the LGBTQ Initiatives office at Colgate and learned that the SafeZone training has been given at Colgate since at least 2002. In that time the actual curriculum and activities utilized haven’t changed much. I spoke to many of the past directors of the office and learned that they were dealing with issues of LGBTQ visibility and not so much as acceptance. This is why the trainings were set up to teach what I would call the “basics” of sexual diversity. This involved what each letter of LGBTQ stood for, what were the possible consequences one could deal with if they came out of the closet in a hostile environment, and how to be a supportive ally to an LGBTQ friend. Not that this information is still not pertinent but the way it was discussed in trainings was a bit outdated. We needed new objectives for a now better informed Colgate.

After that, I tried getting in contact with different universities with similar and contrasting student demographics. Unfortunately, most of the coordinators of LGBTQ/multicultural offices were not able to get back in contact with me due to the summer break. There was one LGBTQ office director from a historically black university who spoke with me about how her SafeZone training program. She explained to me that her program and the programs of other universities she knows of are in their preliminary stages of offering trainings to the student body. This led me to believe that Colgate was ahead of the curve.

From there I redesigned the SafeZone Guidebook with new and improved activities that could better facilitate discussions about heteronormativity and privilege in Colgate’s context.
**Research Fellow:** James Hurst (2018)  
**Concentration:** Philosophy  

**Faculty Mentor:** Edward “Ed” Witherspoon  
**Department:** Philosophy  

**Title of Project:** Spinoza's *Ethics* and the Principles of Nihilism

**Project Summary:**

Spinoza’s philosophical system pivots on one central idea: that in all of existence there is only one thing and this one thing he calls *substance*. From this idea, the rest of Spinoza’s philosophical system begins to unpick itself. Spinoza’s explanation for the solitary existence of one substance stems from the idea that nothing in reality seems to truly cause itself. Thus, there must be some infinitely causal principle which unites existence as a singular substance. This singular substance Spinoza calls God or Nature interchangeably. It follows from this reasoning that everything that either has, will have, or has had existence is a part of that causally unified substance—in other words, everything is, through causation, a part of God or Nature. To put it succinctly, God or Nature is an infinite causal chain which encompasses everything. All things are effects of God for which Spinoza uses the terms *mode* and *attribute*. This philosophical view is a type of monism.

The idea which this project has attempted to put Spinoza’s monism in conversation with is nihilism. Nihilism, quite broadly, is the belief that nothing has meaning or value. Nihilism manifests itself in many ways, but the manifestations of nihilism that this project has been concerned with are moral nihilism and epistemological nihilism. Moral nihilism is the position that nothing is moral or immoral, or, in other words, that nothing is right or wrong. Epistemological nihilism is the philosophical position that no real knowledge can be possessed; in other words, there is no knowledge to be had.

This paper demonstrates how Spinoza’s philosophical system (monism) is conducive to epistemological and moral nihilism. For Spinoza, in order to truly know something you must know all of its causes (this is called Spinoza’s Principle of Sufficient Reason or PSR for short)—all of its causes being infinite by necessity in Spinoza’s system. This requirement for real knowledge makes knowledge acquisition not only a daunting challenge, but this paper argues that it is a challenge that is insurmountable and thus leads us to a form of epistemological nihilism. It seems beyond our ability to understand all of the causes of any one thing so it would follow that for Spinoza we, in fact, can know nothing.

Spinoza’s moral nihilism, this work argues, is derived from the idea in Spinoza that if everything simply exists in an infinite causal relationship, then none of the supposedly moral judgements we make have any value or validity. Rather moral judgements are the result of our striving, or *conatus* as Spinoza calls it, brushing up against reality. For Spinoza, these moral judgements are formed when we come into contact with things in the world that do not agree with our nature—a nature which is only an effect of an infinite causal chain—and we respond to these disagreeable natures by forming moral judgements. We, in effect, create or fabricate moral judgements such as “good,” “evil,” “bad,” etc. Thus for Spinoza, there is nothing we can say about the moral status of phenomena, but rather there is only describing things with what seems to be moral language based on our perspectives. In this work, the relationship between Nietzsche and Spinoza is also drawn out briefly on these grounds.

**Source of Support:**  
- [ ] AHUM Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [x] Other (specify): J. Curtiss Taylor ’54 Endowed Student Research Fund
Small mammals typically have lower whole-animal metabolic rates and shorter lifespans while larger animals have higher whole-animal metabolic rates and longer lifespans. However, the opposite trend is true in dogs: large breed dogs have higher whole-animal metabolic rates, but have shorter lifespans and small breed dogs with lower whole-animal metabolic rates and longer lifespans. Primary dermal fibroblasts were isolated and grown through tissue culture from canine skin samples that were obtained from routine, noninvasive medical procedures. Several aspects of cellular metabolic rate were measured with a plate reader using fluorescent spectroscopy and several parameters of oxidative phosphorylation and glycolysis were measured using a Seahorse XF96 oxygen flux analyzer. Preliminary results, while mostly not statistically significant due to a small sample size, reveal several interesting trends. In each parameter of oxygen consumption rate, small breed dogs had increased rates as they aged whereas large breed dogs had decreased rates as they aged. Rates of glycolysis were measured for each age and size class in order to fully encompass cellular respiration. We see that as both size classes age, rates of glycolysis tend to increase. We see that as puppies the two size classes for dogs have similar starting concentrations of GPx, a highly effective antioxidant, and that this pattern is maintained throughout their lifespan. Larger dogs appear to have a higher overall concentration of GPx in both age categories. Puppies for both age classes have similar starting concentrations of mitochondria and ROS production, and that small breed dogs have a higher concentration of mitochondria later in life than do large dogs. Additionally, large breed dogs seem to have a much higher production of ROS later in life than do small dogs leading to the potential for more damage later in life. Large puppies seem to have a much higher maximal capacity for lipid peroxidation and thus damage early in life. These rates of maximal LPO decrease for both small and large dogs as they age. We have evidence to suggest that as both small breed dogs and large breed dogs age they are upregulating their glycolytic pathways. We also see that in large breed dogs there is a reduction in oxygen consumption pathways as they age indicating that they are relying less on oxidative phosphorylation as the main source of ATP production in cellular respiration. In small breed dogs both oxygen consumption and glycolysis are upregulated as they age; however, their ROS production decreases which may give us some indication as to how small breed dogs are able to live longer than large breed dogs. Additionally, we are beginning to see some general oxidative stress patterns that indicate that large breed dogs have a higher capacity to do oxidative damage early in life (higher rates of ROS production later in life and higher maximal rates of LPO as puppies). This seems to make sense as large breed dogs have a higher whole-animal metabolic rate and a faster growth trajectories then do small breed dogs. Thus, large dogs are able to do much more damage early in life which we believe leads to them having a shorter lifespan.
Project Summary:

The introduction of nuclear power plants radically transforms local host communities in numbers of ways, including changing the built environment, economic bases, demographic compositions, and social fabric. Nevertheless, the current social scientific literature on nuclear power typically focus on the rights and wrongs of nuclear power, severe accidents and consequences, anti-nuclear movements, and political economic dynamics surrounding nuclear power. What is critically lacking in the literature, especially in the context of non-western countries, is how inhabitants of nuclear host communities deal with the presence of nuclear power plants in their everyday lives. In this study, I focus on communal organizations and practices in Bukmyun, South Korea, in which the first nuclear reactor was built in 1988, and explore how the local resident of these host communities, as active agents, skillfully maintain and negotiate their community and community practices despite the challenges posed by the nuclear power plants.

The presence of nuclear power plants may result in two contrasting effects on existing communal organizations and traditions in host communities. On one hand it may act as a threat to such organizations and traditions because of increased outsiders and cultural modernization. On the other hand generous “nuclear money” (e.g., donations from power plants and government compensations) may promote the maintenance or even up-scaling of such traditions although at the risk of eroding the autonomy of local agents. At a glance, the village-wide ancestral worship practice has been subjected to the former effect, while the latter has been the case for some of the local communal traditions, such as a village sport festival and the 4.13 Independent Festival, in Bukmyun. However, the ancestral worship practice has been surprisingly resilient, and has continued until now without relying on the funds from the nuclear power plant.

In order to seek the source and implications of the resilience of the communal practice, with the help from Lampert Civic and Global Affairs Summer Fellowship, I interviewed a total of eighteen residents of Bukmyun City in Uljin County, which is one of the four counties that host nuclear power plants in South Korea. The ages of my interviewees were between 50 to 80 years old and the occupation ranged from owners of a small construction company to small-scale farmers. These interviews were recorded, transcribed, and incorporated into my final project essay to submit to Lampert.

So, how and why is the ancestral worship resilient? Village-wide ancestral worship has played an important part in forming and strengthening the social connections between the villagers. One interviewee stated that he is in debt to many of his villagers because they helped out his farm in various occasions. While reminding themselves of these accumulated experiences, the preparation and conducting of the ancestral worship reaffirms their social bonds amongst each other. In order to cope with the decreasing interest in the practice, the villagers have made three adjustments in the ancestral worship to adapt to the changing number of participants: (1) changed the nominating system of the ritual leaders, which lessens the villagers’ for having to find appropriate people to continue the worship; (2) decreased the ancestral worship to once a year instead of at least twice a year; and (3) incorporated modern facilities (such as showers, clocks, cars, etc.) into the ancestral worship and loosening the side rules, which lessens the time and physical burdens for the villagers. It is critical for policy makers and scholars who study regional development to study how the community reacted to the nuclear power plants’ impacts. By understanding and learning the dynamic actions that are taking place, policy makers are able to be more informed on creating effective strategies for regional development without sacrificing the values and culture that host communities have been painfully sustaining till this day.

Research Fellow: Adrielle Jefferson (2017)  
Concentration: English

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Grant Writing for Chenango Nursery School

Project Summary:

Chenango Nursery School (CNS) founded in 1948, is a non-profit, cooperative nursery school for children in Hamilton, NY and surrounding communities. CNS has grown and changed through the years in response to the needs of the community. CNS is known for its warm and welcoming community where children and families make life-long friends. It remains a fully cooperative effort of concerned parents, as it has been from the beginning, a corporation owned and operated by the parents of the children attending the school. A Board of Directors comprised of parents and community members, establishes school policies and programs.

As a Field School Fellow at CNS, I have researched and written grants for capital projects at CNS based on a list of needs. Some of those capital projects have included funding requests for professional development opportunities, playground revitalization and technology. I have worked closely with the directors and assistant directors to locate larger grant opportunities and used Colgate University’s library as a resource. Some days I have had the opportunity to observe CNS classrooms and interact with the students, which has been a rewarding experience.

I was interested in becoming a Field School Fellow this summer because it is a unique opportunity to use the skills I have developed as an undergraduate at Colgate University to assist organizations in the surrounding area. I wanted to build relationships with members of the local community and focus on regional projects that would have a direct effect on the community. As an Upstate Institute Fellow, I aimed to learn more about the ways in which effective community organizations can be agents of change. As a rising senior, interested in nonprofits and considering entering the education sector after graduation, working at CNS was a perfect match. While working at CNS, I learned a lot about the challenges small nonprofits can face as well as the power of community organizing and advocacy.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
Regeneration is a field of research that offers huge potential to the advancement of human welfare, as even though humans are capable of successfully regenerating a multitude of tissue, humans have limited regeneration abilities for limbs, and other tissue like the retina or the inner ear to functional levels. These regenerative limitations, however, are not a biological rule, for researchers have identified that different species of organisms retain the ability to regenerate tissue that humans can’t.

Studying the organisms capable of regeneration would hence give us better understanding of the manipulations these organisms apply to their cellular processes toward regeneration, and hence guide us to manipulate our own cells for the purpose of regeneration. One widely vertebrate model organism in the study of regeneration is the Zebrafish. Native to the Himalayan regions, zebrafish are a good model organism due to their high regenerative abilities, the availability of multiple genetic tools to be used on them and the relative ease of breeding and obtaining offspring from them.

During the summer my focus was on the lateral line system of the zebrafish. The lateral line system is a system of neuromasts distributed in lines along both sides of the fish. The sensory cell in these neuromast is the hair cell. The hair cell, have hair-like extensions composed of cilia and stereocilia. These ‘hairs’ respond to the movement of water, and allow the hair cells to provide input to the nervous system regarding the magnitude and direction of water movement. The integral role of hair cell in the lateral line system makes this system worthy for studying because the hair cells in the lateral line are homologous to the hair cells in the auditory system.

My study on the lateral line system focused on understanding the role that the signals important to the neuromast formation play in a developed neuromast. The rationale behind such an approach is that if a system is capable of regeneration then the signaling pathways used in the system’s formation must to some extent continue to be active in a sense in order to ensure future regeneration. The signaling pathways I focused on during my investigation were FGF signaling, a signal important for the rosette organization of the neuromast during its formation, and Notch signaling which is important in limiting the number of hair cells during neuromast formation.

Through pharmacological manipulation, I was able to inhibit, both of these signaling pathways in the developed neuromasts of 48 hours old embryos. Such manipulations resulted in multiple bundles of hair cells per neuromast as opposed to the usual single bundle, and in a wavier phenotype observed in interneuromast cells, which are typically a straight line of neuromast progenitor cells connecting all the neuromasts. Further investigation was done using time-lapse confocal microscopy, which allows us to observe cellular changes over time. The results showcased a rapid increase in the number of hair cells coupled with erratic movement of interneuromast cells.

I plan to further investigate the role these signaling pathways are playing in the developed neuromast, and the underlying interactions between them. Such investigation I believe, is of great importance as not only does it study a relevant system, but also sheds light on the different roles developmental signaling pathways can play during different parts of development, and on the potential of understanding regeneration through the study of interactions between developmental pathways in mature tissue.

□ Other (specify):
Title of Project: Contending Narratives on the ‘Comfort Women’ Issue in South Korea and Japan

Project Summary:

On December 28th, 2015, the South Korean and Japanese government signed the ‘Comfort Women’ Agreement. The term ‘comfort women,’ a euphemism for women who were forced to serve sexual demands of the Japanese military during the World War Two, reminds us that historical narratives are ways people structure the past. Some events are remembered, some forgotten, but all contribute to the formation of identity, shape contemporary perceptions, and privilege certain interpretations of the past over others. South Korea and Japan’s governments, non-governmental organizations, and scholars have to “settle” the issues of historical responsibility that stem from Japan’s colonization of Korea (or Chosun) from 1910 to 1945. ‘Comfort women’ has become one symbolic issue that represents Japan’s brutal treatment of Koreans during the colonial period, and its long-lasting influences. Narratives in South Korea has described the ‘comfort women’ system as one of many cases that the Japanese deliberately tried to erase the Korean-ness during the colonial period, as with forced labor, ban on Korean language, and pressuring to change names into Japanese ones. In Japan it did not receive much attention compared to the horrific consequences of atomic bomb attacks.

Number of contending narratives on the ‘comfort women’ issue sprang out from political liberalization and development in communication technologies. During the 1990s, both South Korea and Japan saw dramatic improvement in communication technologies, which led to diverse modes of communication and diverse ideas. Indeed, people began to express views on ‘comfort women’, which clashed with the government views that had dominated the dialogue for 50 years. This diversification of narratives continues today.

This research explores why contending views among the two national governments, non-governmental organizations, scholars, and public views on the ‘comfort women’ issue have emerged. It looks at how different narratives are regenerated and communicated through museums, memorial sites, history textbooks, and the Internet and how they affect public’s perception of the ‘comfort women’ issue. This research offers a way to interpret complicated debates and events surrounding the ‘comfort women’ issue.

Nationalism and feminism narratives both have contributed to publicizing the ‘comfort women’ issue in different ways. Nationalism narratives made South Koreans connect with the survivors under shared sufferings from Japan’s colonization even though the vast majority of the SK population never lived under Japanese rule. Feminism narratives helped people acknowledge the oppressive system within both Japan and South Korea that kept survivors silent for so many years, and raised awareness about women’s rights that are most easily violated during wartime. However, each narrative had limitations. Nationalism narratives appeal only to those who share the same nationality and hid misogyny in South Korea and Japan. Focus on state power led the South Korean government to prioritize its defense against North Korea and China through military alliance with the United States and Japan; it also led the revisionists and right-wingers to deny the ‘comfort women’ system and attack survivors and supporters in Japan. Earlier feminism narrative created a misleading ‘virgin/whore’ dichotomy to defend non-Japanese ‘comfort women’ survivors from criticism and thus disregarded survivors that do not fit the ‘model victim’ narrative. Indeed, different narratives react differently to trials to settle the issue, showing that the plurality of views surrounding the ‘comfort women’ issue is better represented on a spectrum rather than a binary between nationalism and feminism.

After all, historical narratives are ways how experiences and events are remembered throughout different generations. As long as the ‘comfort women’ issue is remembered and remains a topic of discussion, new historical narratives will emerge and hopefully a different solution to the issue as well.

Title of Project: SNP located in a regulatory element may affect STC2 expression

Project Summary:

Purebred dogs are excellent model organisms for studying complex traits like body size due to the comparably smaller number of genes that contribute to that phenotype. I explored how a single nucleotide change in a non-coding part of the genome could affect the size of dogs. A previous study identified about a half dozen genes in which variation is associated with size in dogs. One variant found is a single nucleotide that dogs may possess a different version of called a SNP (single nucleotide polymorphism). The SNP of interest is located 20,000 bp away from the Sanniocalcin 2 (STC2) gene, a gene that has been associated with reduced size in mice. An ancestral T is changed to A in some small dogs. Mice overexpressing STC2 were found to be reduced 45% in size and mice that did not express STC2 (knockout mice) were 15% larger than the wild-type. It has been proposed that STC2 can affect the size of an organism by affecting signaling by the insulin-like growth factor and this effect is dependent on the amount of STC2 produced. Changes to regulatory regions like enhancers or silencers can cause a change in the amount of gene product produced. In order to see if the SNP can cause a change in gene expression, qPCR was used, a method that quantifies the level of gene expression.

In order to explore if the SNP’s location in the genome could possibly affect the expression of STC2, I used the UCSC genome browser, an annotated database of genomes, and found the location comparable to the SNP of interest in the human genome. This can provide information about the SNP in dogs due to the high level of conservation between species and as the human genome is much better annotated it will provide more information about the locus than a similar investigation in the dog genome. The area the SNP is found in was identified as a possible regulatory element based on information from previous studies. These results suggest that it is likely that the SNP could directly affect the amount of STC2 in the cell.

If gene expression levels for STC2 were altered, it could possibly lead to a change in body size. To detect a change in gene expression levels between the two variants, qPCR can be used. In order to perform qPCR, first poodles were genotyped at the SNP of interest to determine the variant they carried. QPCR primers were then designed using Primer 3 to detect the presence of STC2 and tested to ensure that they were functional. Then RNA was prepared from dogs belonging to the three variants and reverse transcribed into cDNA. Primer and cDNA concentration were optimized to best detect gene expression, however issues with nonspecific amplification were observed. In order to address these issues, an experiment to clone the DNA of the qPCR products using plasmid vectors is being performed in order to create a DNA standard to work from. Once qPCR can accurately detect STC2 levels, a larger experiment will be conducted to see if there are observable differences in gene expression levels. I will continue this research as my senior thesis. Possible future directions for this research include using the same techniques to explore how other variations associated with body size in dogs located in noncoding portions of the genome may influence body size. For example, a deletion located downstream of the SMAD2 gene has been linked to dog body size. Additionally, further research can be done to determine how the SNP may cause a change in gene expression.
Project Summary:

When someone waves, you intuitively know that's a form of greeting, regardless of any language barrier. Computers lack such tacit knowledge and therefore respond inappropriately or not at all. They can, at the current state of the art, successfully track the motion of a rigid object in a video stream, but doing so for an object deforming as an hand does in most gestures, is beyond them. Separating a human hand gesture from the arm, torso, face and other elements of the background can be in unrestricted context challenging.

Computer vision is notoriously underdetermined: advancing research often depends on finding an unexpected regularity in the application domain. The regularity we have identified is that of human body proportions, which helps discrimination because it is rare to find a human body in isolation, at least a part that is functioning normally. We believe that proportions can give us a rough segmentation by body part, after which smaller granularity features can be followed using conventional algorithms.

Our approach relies on the existence of average proportions in the human body. Ratios between body part proportions were systematized in the first century BCE by Vitruvius as a foundation for architecture, a foundation that is currently taught to every architect. Indeed based on Vitruvius' writings, Leonardo da Vinci drew the ideal human form, the iconic body whose symmetry fits in a circle. For example, Vitruvius determined that the ideal body is about eight heads high. Thus, we are developing an algorithm to extract human figures and to size their limbs according to such proportions. Gaining a sense of the relationship between the proportions of the limbs, as silhouettes change in the video frames we can focus on area of interest such as the hand and its finger signals. We hope to implement an approach that is more flexible and robust than those currently in use.

This summer we built a framework that tracks the motion of limbs, heads and hands based on skin color. Our first result shows promise for our on-going research, which is to extend Vitruvius-like proportions to precisely follow fingers and palms so as to read hand gestures.
Title of Project: TIMING IS EVERYTHING: Circadian Effects on Athletic and Academic Performance of Division I Athletes

Project Summary:

Almost all organisms are governed by their circadian rhythms - physical, physiological, and behavioral patterns regulated by a 24-hour cycle. These rhythms influence important aspects of life, like sleep-wake cycles, digestion and hormone release. Researchers have also found a correlation between abnormal circadian rhythms and health issues such as obesity, cancer, and psychological disorders. Previous studies have determined that individuals have a single central clock, the suprachiasmatic nucleus (SCN) in the hypothalamus, as well as many peripheral clocks which can be found in the liver, fat tissue, hair follicles, and other regions of the body. These peripheral clocks allow for a non-invasive way of measuring the cycling of the central SCN. By having the participants complete a short survey that analyzes their natural behaviors, we can also get a sense of their rhythm, called a chronotype. A chronotype describes a person’s morning or evening preference, and may represent their underlying molecular rhythms. An individual with a morning preference is labeled a lark and an individual with an evening preference is labeled an owl. In our study, we test the effects of chronotype and time of day, and their interaction, on athletic and academic performance of Division I student athletes on Colgate University’s football team.

We predicted that athletic and academic performance will be higher at peak circadian time for larks and owls; larks will run faster and exert less effort in morning session, and vice versa with owls. It was also hypothesized that owls will perform better at cognitive task and exert less effort in the evening session, and have higher grades in afternoon classes, and effects will be greater for owls due to both circadian and homeostatic effects. We expected to find phase differences in the oscillation of the PERIOD 3 (PER3) gene between self-reported larks and owls that represent a biological delay in circadian rhythms in owls. The frequency of the G allele in PER3 was expected to be higher in owls, as shown in previous studies.

Our preliminary results supported several of our hypotheses. We found significant differences in athletic performance in owls who exerted less effort and performed better in the evening session. When asked to self-report their level of physical exhaustion, interestingly enough owls stated that they were more tired in the evening session even though biologically they appeared to expend less energy. We also found a significant interaction in cognitive performance. Both owls and larks perform significantly better at their peak circadian time. Looking at the biological indicators for chronotypes, we studied the PER3 gene and found that the larks and owls have approximately a three hour difference in the timing of their biological rhythms. Analysis of the participants’ PER3 gene also showed that the frequency of a G-allele (a variant associated with eveningness) increased in chronotypes whose peak circadian times were later in the day. When we looked at the student athletes’ grades, we found that owls had significantly lower grades in morning classes with respect to their overall GPA, but did not show a significant difference in grades for afternoon classes. This effect was not seen when we analyzed the larks’ grades.

Due to our small sample size, we hope to continue sampling with Colgate’s football and potentially other Division I sports teams on campus.

☐ Other (specify):
Research Fellow:  Emelei Klein (2019)  
Concentration:  Undeclared

Faculty Mentor:  Jason Meyers  
Department(s):  Biology; Neuroscience

Title of Project:  Role of Notch Signaling and Wnt Signaling in Retinal Regeneration

Project Summary:
Zebrafish provide an excellent model to study stem cells because of their ability to regenerate. One of the systems that zebrafish are able to regenerate is their retina. The retina, located in the back of the eye is made up of cells known as photoreceptors. These photoreceptors make it possible for the brain to process visual images. In humans, damage to the retina is permanent, but a specialized cell known as the Muller glia can repair damage in the zebrafish retina. Muller glial cells possess stem cell-like characteristics, which allow them to replace damaged cells. How the Muller glia cells are able replace damaged photoreceptors is still under investigation. One pathway that has been linked to the Muller glia is Notch signaling. Inhibition Notch signaling has been found to cause those Muller glia cells to start dividing and eventually replace the lost photoreceptors. This summer, we looked at how the Notch signaling pathway is involved retinal regeneration, but we also integrated another signal pathway known as Wnt, to see how the two pathways interacted with each other.

Initial experiments explored how inhibition of Notch affects retinal response to light damage. The photoreceptors in the retina were damaged using a light lesion protocol. Larvae 3 days post fertilization were exposed to intense UV light for about twenty minutes. The fish were then placed in LY, a Notch inhibitor. Three days later, the fish were fixed in 4% paraformaldehyde and cryosectioned, so they could be stained and analyzed. Immunocytochemistry revealed that the LY increased proliferation of the Muller Gila cells in the outer nuclear layer photoreceptor layer (figure 1). Using Zpr1 to label photoreceptors, photoreceptor damage was confirmed. The UV light did destroy photoreceptors, creating a gap in the outer nuclear layer. PCNA was used to label proliferating cells. There is an overall increase of proliferating cells in the LY treated retina compared to the control retinas, but proliferation is especially strong in the ONL layer even in places where damage has not occurred. The Muller glial seemed to have migrated from the inner nuclear layer to the outer nuclear layer since there were gaps in the Muller glia of the inner nuclear layer (figure 1). Therefore, inhibition of notch signaling increases proliferation in the outer nuclear layer.

Subsequent experiments integrated Wnt signaling with Notch signaling. The methods were kept the same except two additional drug treatments were added. In addition to the control and LY, fish were treated with either AZ, a Wnt activator or PD, a Wnt inhibitor combined with LY. Zpr1 staining showed that while the lesions were not as strong as the LY only experiments, damage to photoreceptors did occur. PCNA staining showed that proliferation of cells in LY+PD condition was consistent with what was happening in the LY treatment (figure 1). There is an increased proliferation of cells in the ONL. Proliferating cells can be seen in the INL as well, reaching towards the ONL. From the GFP tagged cells, gaps in Muller glia of the inner nuclear layer were visible. This suggests Muller glia migrated to the ONL where they proliferated (figure 1). The LY+AZ treatment appeared to have results more similar to the control. Zpr1 shows that there is a lesion in LY+AZ treatments (figure 1). However, PCNA shows fewer the proliferating cells than the LY and LY+PD treatments. The proliferating cells are mostly in the INL and only a small portion is found in the ONL (figure 1). Therefore, it appears activating Wnt signaling while inhibiting Notch signaling seems to cancel out the increased proliferation that inhibiting Notch causes. Regardless Notch Signaling and Wnt signaling seemed to be interconnected.


Figure 1

Control  
LY  
LY+PD  
LY+AZ
Research Fellow: Oleg Kozel (2017)  
Concentration: Geology  
Faculty Mentor: William Peck  
Department: Geology  
Title of Project: Metamorphism of Adirondack Anorthosite  

Project Summary:
My summer research involved collecting (Fig 1), testing, and analyzing a number of rock samples from the northeast portion of the Adirondack Mountains, slightly south of the High Peaks region (Fig. 2). Geologically, this area is composed of a type of rock known as anorthosite (Fig. 3), which formed in the Earth 1.15 billion years ago. Since then, this mass of anorthosite has experienced further geologic activity, having been reburied several times. Reburial subjected the rock mass to elevated pressures and temperatures. Under these conditions, the suite of minerals in a given rock often convert into a different suite of minerals. In other words, rocks change their structural makeup on the atomic level under intense heat and pressure. This process is known as metamorphism. My project is based on the premise that the specific minerals present within the metamorphosed anorthosite today can tell us the temperature and pressure conditions that the rock once experienced.

The anorthosites show beautiful garnet coronas surrounding pyroxenes and oxides (Fig. 3). Many of the coronitic oxides, especially those made out of ilmenite, bear zircons that may be eventually dated using U-Pb geochronology. This dating will provide better time constraints on the metamorphic events of the Adirondacks, especially when used in conjunction with the pressure and temperature data derived from compositional analysis.

The chemical compositions of the anorthosites were acquired using X-Ray Fluorescence, a method of determining the major cation chemistry of the rock. The hydrous component of the samples was determined by mass difference after heat treatment (loss on ignition). These data were then inputted in a thermodynamic software program (Theriak-Domino), which creates individual mineral assemblage phase diagrams for each sample (Fig. 4). The end goal of the project is to match each sample to its position in the pressure-temperature space of its mineral assemblage phase diagram, and then compare these data amongst the entire suite of rock samples. Ideally, we will end up with a range of temperatures and pressures that correlate to the metamorphic events experienced by these anorthosites.

☑ Other (specify): Doug Rankin '53 Endowment-Appalachian Research; Doug Rankin '53 Endowment-Geology Research
Aerosol particles play an important role in the atmosphere. They affect the Earth’s radiation budget through scattering of radiation and serve as cloud condensation nuclei. Additionally, aerosol particles play host to a wide range of chemical reactions that alter the composition of the atmosphere. The reaction of volatile and semivolatile organic compounds by gas phase oxidizers, such as OH, Cl, NO₃, and O₃, produce non-volatile species that condense into the particle phase. This secondary organic aerosol (SOA) represents a large fraction of the overall organic aerosol burden. Although these species play an important role in direct climate forcing through scattering and absorption and indirect climate forcing through the hydrological cycle, the processes that lead to aerosol production and growth are poorly understood. Our ultimate project considers a photochemical pathway to SOA wherein excited triplet states or other nascent photoproducts react with volatile organic compounds to produce SOA.

We produce an atmospheric pressure flow of aerosol particles created from an aqueous solution of salt (NaCl) and/or sodium anthraquinone sulfonate (SAS). An atomizer produces a dense stream of droplets which we dry by passing them through a desiccant-containing diffusion dryer and are size-selected by a differential mobility analyzer (DMA) prior to analysis. We generate a relative humidity (RH)-controlled flow by mixing dry air with air that has been saturated with water vapor using a Nafion membrane. In the ionization cell, a 355-nm laser excites the SAS, creating the triplet state through internal conversion. Another, 230-nm or 247.5-nm laser ionizes the excited triplet SAS. The aerosols then carry a net positive charge. We monitor this charge using an electrometer while scanning the delay between the lasers.

This experiment monitors directly the lifetime of electronically excited triplets and other transient photoproducts in aerosol. These measurements will help reveal the conditions and components that promote photochemical SOA formation. Our experiments show that excited triplets are sensitive to the RH (Figure 1). An increase in the RH decreases the lifetime of the triplet state (Figure 1). The reaction of the triplet with water is faster than with any other solutes added. Consequently, the lifetime of the triplet does not depend on the solute present. The triplet reacts with water, and we can either monitor both the triplet and the reaction product. The water reaction product can react with 2,6 dimethoxyphenol (DMP) to produce SOA precursors. The lifetime of the water reaction product decreases with an increase in DMP concentration (Figure 2). Future studies will further examine the kinetics of the water reaction product and uncover their unidentified structure.

Project Summary:

This research project sought to answer the question: What role do LGBTQI individuals play in the pro-LGBTQI initiatives that are increasingly present in their communities? Historically in Ghana, there is huge stigma against homosexual activity, and people suspected of being homosexual are discriminated against and occasionally abused. As a result, there was little opportunity for substantial pro-LGBTQI work to take place in the country, and for LGBTQI people to take part in it. In recent years however, there has been an emergence of a number of covert initiatives, spearheaded by foreign organizations and private non-governmental organizations, designed to promote and protect the wellbeing of sexual minorities in Ghana. In light of the recent change in tides, I wanted to find out the capacities in which sexual minorities contribute to this emerging fight for change. How effective is the action they take, and how does their involvement affect their daily, lived experiences? In addition, I sought to explore the relations between local LGBTQI organizations and the foreign bodies that support them. How do these foreign gay rights organizations influence the agenda and action plans of local initiatives on the ground? To what extent do they shape the identities of LGBTQI peoples who participate in these initiatives?

The advocacy work carried out by these organizations largely focus on education and empowerment of LGBTQI peoples. Due to the potential danger of any sort of public advocacy work, many of the activities are carried out in discreet fashion and among LGBTQI peoples. This has contributed to the emergence of an LGBTQI community, strengthening ties between LGBTQI peoples across the capital and the country. Local organizations depend heavily on foreign donors in order to carry out large-scale programming, as many potential local donors are unwilling to support pro-LGBTQI work. Advocates are also actively building a network consisting of key allies across societal institutions, so that in the event where it is safe enough to take the advocacy to a more vocal and public level, LGBTQI advocacy in Ghana would have the support it needs to create significant change.

I focused my research on urban communities in Accra, the capital. During my fieldwork, I worked mainly with two local organizations who work directly with sexual minorities. These organizations have established various initiatives in select urban communities in the capital, which they hope to replicate in all regions of the country. Such initiatives include conducting security training for LGBTQI individuals, establishing paralegal/psychosocial support systems for individuals who have been attacked, and building partnerships with community leaders. They also focus on sexual health rights and services for sexual minorities. I volunteered with these two organizations, with their understanding that I would primarily be engaging in fieldwork for my research. The main methodological techniques I used were participant-observation and interviewing. For interviews, I identified key people within the groups that I worked with, people who worked as LGBTQI/human rights activists, and members of the LGBTQI community in general. I hoped to better understand the lived experiences of LGBTQI individuals in the targeted urban communities: the kinds of acts of violence, marginalization and exclusion that they experience, and how they physically and emotionally respond to them.

Title of Project: A Mössbauer Study of Nitrogen Reduction by Iron Complexes

Project Summary:

Nitrogen is necessary for life, as an element essential for the biosynthesis of amino acids and proteins. Nitrogen gas is chemically inert and cannot be used by most organisms without prior conversion to an easily absorbable form ammonium, nitrite and nitrate ions. This is commonly known as nitrogen fixation—a process catalyzed by the enzyme nitrogenase in some bacteria present in nodules on roots of legumes. To investigate the catalytic mechanism of nitrogenase and the potential of iron compounds for nitrogen reduction and activation, we conducted Mössbauer spectroscopy studies on a series of novel synthetic iron (II) and iron (I) complexes, synthesized by our collaborators at the Pacific Northwest National Laboratory. Fe-N2 complexes are rare and their chemistry not well understood.

Fe-Mössbauer spectroscopy is based on recoilless gamma-ray absorption by iron nuclei, which can yield high-resolution data for solid samples. Among the parameters determined from the spectra, two are widely used in determining oxidation and spin state of the iron species in the sample. The isomer shift reports on the s-electron density at the nucleus and the quadrupole splitting, reports on the interaction of the nuclear quadrupole moment with the electric field gradient around caused by the electrons. Together, these parameters were used to determine oxidation states and spin states of precursors for Fe-N2 complexes.

We recorded the Mössbauer spectra of four compounds in applied fields of 0 and 700 G at variable temperatures in the 7-295 K range. Compound 1 is a FeII compound with an isomer shift of 0.40 mm/s, which can be assigned to a ferrous site with either high-spin or low-spin configuration. More studies in variable field and variable temperature are required to determine the precise spin state, because of possibilities of spin crossover. For Compounds 1-3, an almost constant isomer shift indicates that the electron density at the iron nucleus does not changed significantly during the sequential chemical reactions investigated. Studies continue on the series, including the nitrogen-binding compounds, which will be reported in an upcoming publication.

ENT Other (specify): National Science Foundation

Gene expression is inherently stochastic and it is unclear how stochasticity is created and suppressed in biological systems. Cell-to-cell variability can be quantified and analyzed, which can lead to a deeper understanding of the underlying mechanisms that dictate gene expression in the system. One of the most fascinating aspects of variability in gene expression is the robust and precise formation of patterns during embryonic development despite the strong presence of noise. In particular, in our system of interest, zebrafish segmentation clock, a group of cells are segmented into somites, which later give rise to important structures such as the vertebral column, and we detect a significant amount of noise in their gene expression.

This summer, I worked with Professor Ahmet Ay and Professor Ertugrul M. Ozbudak (Albert Einstein School of Medicine) in investigating the origin and buffering mechanism of variability in gene expression in zebrafish segmentation clock, which drives the precise pattern formation in PSM (pre-somitic mesoderm). Using smFISH (single molecule fluorescent in situ hybridization), our collaborators were able to detect and count transcripts of segmentation clock genes. Given the data, we processed and analyzed variability in gene expression using statistical analysis and parameter estimation methods. We used SPSS for statistical analysis and Python and MATLAB for data processing, visualization, and parameter estimation.

Our results demonstrate that our genes of interest have low RNA amplitudes and that transcriptional bursts caused by gene extrinsic sources drive the variability in expression. We also show that noise increases in space from posterior progenitor zone to anterior segmentation zone and that Notch signaling increases transcription burst frequencies and limits extrinsic noise, thus suppressing the overall expression variability. We hope that our work can lead to building an accurate computational model that reflects the patterns in noise and elucidating how natural clocks in multicellular systems are regulated. We also hope to encourage engineering of robust synthetic oscillators inspired by natural clocks.
Project Summary:

The project focuses on the use of ruthenium-containing compounds that catalyze the reduction of polar bonds using hydrogen, with an emphasis on two classes of organic compounds: esters and alcohols. In research as well as industrial processes, compounds with the C=O bond are very important in organic synthesis. These bonds usually undergo reduction reactions where hydrogen atoms are added, but current methods generate a large amount of waste, which are harmful to the environment. In addition, methods using conventional reducing reagents like lithium aluminum hydride (LiAlH₄) suffer from a low atom economy, where only the four H atoms are incorporated into the reactant while the Li and Al become waste. Thus, there is an increasing need to develop a catalyst that speeds up the reaction, but is used in small quantities to minimize the amount of hazardous waste produced.

Our previous work with complex 1 indicates that it is a good hydrogenation catalyst for non-methyl esters in the presence of a strong base. With PPh₃ and base, 1 rearranges into 2, which is a less active catalyst than 1. However, 2 can hydrogenate esters in the absence of a strong base, an important property in cases where the substrate can react with bases. This also offers a glimpse at the possible mechanism of the reaction, because it is possible that the active catalyst generated from 1 is dechelated in a manner similar to 2, where the amine arm no longer binds to the ruthenium center.

To probe the function of the amine arm, complex 3 was synthesized, where the NEt₂ portion was replaced with a PPh₃ ligand. The complex was observed to undergo rearrangement in a similar manner to 1 to form 4, but the product slowly decomposes in solution. A possible explanation for the difference in stability between 2 and 4 can be attributed to the imidazole ring, which is known to undergo rearrangement instead of the intended flipping of the pyridine ring on the complex. Current efforts aim at synthesizing the benzimidazole version of the ligand, which will lead to the synthesis of the direct benzimidazole analog of 2, where the only difference is the absence of the dangling NEt₂ group.
Title of Project: The Influences of Personality on Patterns of Social Conformity in Zebra Finches

Project Summary:

The purpose of our experiment was to investigate the effect of personality on social conformity in zebra finches. Zebra finches are a species of bird native to Australia that live in habitats ranging from grasslands to forests (Figure 1). In a previous study overseen by Dr. Richard Braaten, zebra finches were found to socially conform, similar to humans and monkeys. The extent to which each zebra finch conformed, however, varied. With this in mind, we conducted our experiment in order to determine if individual personality influenced the extent of conformity behavior in a scenario involving food preference. We used two measures in order to determine the relative boldness (personality) of each finch. First we introduced each finch to a novel environment (Figure 2), followed by being presented with a novel object. Using video recording equipment, we tracked and recorded their movements around the novel environment, and their interactions with the novel object. Using these measures, we ranked the finches according to their personality as measured by boldness. Next the finches were separated into co-ed cages of eight. Each respective cage was taught to eat either green or brown food. Finally, each bird, one at a time, was switched into a cage that liked the opposite colored food. Social conformity was measured by the time it took for each finch to conform to the type of food eaten by the majority of the cage, the opposite of what it had been trained to eat. The data has been compiled and is currently being analyzed by Professor Braaten. We hypothesize that the less bold finches will have conformed more, whereas, the bolder finches will have conformed less.
Title of Project: Mathematical Modeling of Human Behavior

Project Summary:

The human circadian clock controls daily patterns of sleep-wake and activity cycles. Circadian clock malfunctions can lead to serious pathologies, ranging from obesity and diabetes to cancer (Takahashi et al. 2008). The human circadian clock is composed of a gene regulatory network and its downstream targets. The \( \text{per}3 \) gene is often believed to be unimportant to this network, since the biological clock continues to function in the absence of \( \text{per}3 \). However, recent research has causally linked \( \text{per}3 \) to numerous sleep disorders and behavioral conditions (Zhang et al. 2016). In this project, we developed a comprehensive mathematical model of the circadian clock consisting of nine genes, including \( \text{per}3 \). We are currently using this model to represent \( \text{per}3 \) mutations that have been linked to human sleep and behavioral disorders.

Our model is an extension of a model proposed by Jae Kyoung Kim and Daniel Forger (2012). Our updated model includes 208 equations and 101 parameters, and the model accurately describes all available experimental observations. Below are some of our results: four separate mRNA concentrations, oscillating at a biologically feasible period, which fit every condition suggested by experimental data. Our next step is to test our model with conditions relating to mutations in the \( \text{per}3 \) gene, which have been linked to seasonal affective disorder, anxiety, familial advanced sleep phase syndrome, and many others (Zhang et al. 2016).

References


Title of Project: Analysis of a Greedy-Algorithm Framework for Network Probing-Path Selection

Project Summary:

Probing is a technique used in network monitoring to detect performance anomalies and to verify compliance with service level agreements. Probing involves sending test packets across the network to detect faults and evaluate network performance. However, the introduction of these test packets induces an overhead on the network hence, there is need for well-designed probing strategies that induce the least amount of overhead whilst effectively monitoring the entire network.

Each probing strategy dictates a means of selecting, from all the available paths through a network, which paths to probe at any given time. Previous work on probing-path selection sought to minimize the number of probing-paths or to minimize probing delay, but failed to analyze the network overhead imposed by the probing strategy. Our work details a general greedy-algorithm framework for probing-path selection that can simultaneously consider multiple optimization goals. The algorithm repeatedly builds up to a set of probing paths by picking the best path during each iteration. The quality of a path is decided by a score function that reflects the optimization objectives. Besides the number of probing paths used, one might wish to optimize the additional load imposed on network devices and links, or the number of beacons, source and destination points for the probing packets. The score function assigns each path a score based on how well it suits the optimization goals.

The algorithm takes as its input a set of available probing paths, covering the entire network, and a value $A$, $0 \leq A \leq 1$, which represents the level of load optimization. $A$ is used in the score function to assign scores to every path in the set from which the greedy algorithm picks from. Since during each iteration of the algorithm there can exist multiple paths with the best score, we implemented and tested different tie breaking systems, one random, one based on beacons, another on edge coverage and another on edge load, and observed that different tie breaking systems seem to only affect the extreme values i.e. when $A = 0$ and when $A = 1$. Our framework shows a decrease in load (probing overhead) compared to the standard greedy-algorithm approach to probing-path selection and can be customized to balance the number of probing paths used with different optimization objectives.
Research Fellow: Jiachen “Ed” Liu (2018)  
Concentration: Chemistry

Faculty Mentor: Anthony Chianese  
Department: Chemistry

Title of Project: Ester Hydrogenation by Ru CNN Pincer Complexes

Project Summary:

The reduction of carbonyl groups is a huge problem in synthetic organic chemistry. Stoichiometric reduction method using NaBH₄ and LiAlH₄ has several problems including low atom economy and very large amount of waste in the form of inorganic salts. Previous researchers have developed various catalysts that can reduce aldehydes and ketones in 1980s. The ruthenium pincer catalyst that can reduce esters, however, was not well investigated until 2006. The Chianese research group has been working on synthesizing and applying different ruthenium pincer complexes 1a-f to reduce carbonyl groups catalytically.

![Chemical structures of complexes 1a-f](image)

Complex 1-a and 1-b were previously synthesized. Complex 1-a and 1-b displayed significant difference in their ability to catalyze ester hydrogenation reactions, especially the ones of methyl esters. Therefore, we decided to make more adjustments in the structures of catalysts to further understand the mechanism of ester hydrogenation reactions by Ru CNNDEA pincer complexes. As a result, the complex 1-f synthesized by me displayed greater ability to catalyze ester hydrogenation reactions comparing to complex 1-b. Other group members worked on synthesizing complexes 1-c, 1-d, and 1-e.

Moreover, a rearranged compound 2 of the 1-a complex when reacted with PPh₃ was observed during previous synthesis. This rearranged complex was also able to catalyze ester hydrogenation reactions, without addition of base. Although the rearranged complex did not give very high turnovers comparing with the original 1-a catalyst, it was still an important discovery because previous found catalysts require addition of many equivalences of base. The addition of many equivalences of base results in producing a lot of inorganic salts which are usually waste. Also, it was previously proposed by some researchers that the ester hydrogenation reaction using Ru pincer catalysts involved in a heterolytical cleavage of H₂ molecule by a pair of Lewis acid and base. In this scenario, the catalyst may act as both a Lewis acid and base by itself, or has some different mechanism of doing the catalysis. In the future, I will be working on synthesizing the rearranged compound of 1-f complex and study its catalytic ability for ester hydrogenation reactions.

□ Other (specify):
Project Summary:

The juvenile justice system in the United States was developed as an alternative to the more punitive system for adult offenders as a means to rehabilitate juvenile delinquents before they turn into habitual criminals who go through the revolving door of the criminal justice system. Unfortunately, our juvenile justice system is failing to fulfill its purpose as juvenile recidivism is extremely high, it's estimated that between two-thirds and three-fourths of all youth who enter the criminal justice system end up back in it within a year of release. The longer youth stay in the judicial system, the worse the effects are for them. These effects can include lower educational achievement, limited employment opportunities, and a higher likelihood of ending up in the adult criminal system. The successes and failures of the juvenile justice system can be observed by looking at recidivism rates, which gauge how frequently an individual who has previously committed a crime reenters the justice system. My research helps to understand the problem of juvenile recidivism, including evaluating its causes and how it can be reduced.

The research itself is broken down into two parts. The first section of the paper utilizes academic research to provide a theoretical understanding of recidivism. This section includes a historical background on the juvenile justice system, a definition of recidivism (how it's measured and what is the recidivism rate), a review of the topic literature to better know why juveniles recidivate at such high levels, an analysis of past attempts at reducing recidivism, and a hypothesis that programs targeting behavioral problems, mental health issues, and poverty will show success at reducing recidivism. The second part of the paper attempts to confirm the hypothesis using an in-depth case study of the James B. Moran Center for Youth Advocacy, an organization dedicated to advocating for troubled youth in Evanston, Illinois. The case study has several facets. It provides a summary of the services the Center provides to juveniles. It includes interviews with two Center staff to get an insider perspective on how the Center operates and how/why it’s been successful. Additionally, it features a comparison of recidivism rates of Moran Center clients, formulated through a quantitative analysis of the juvenile records of seventy Center clients, to available recidivism data from Cook County, Illinois and Virginia, Maine, and Washington.

While this case study found Moran Center recidivism rates to be higher than those of Cook County, Virginia, Maine, and Washington; the results were ultimately inconclusive because the lack of standardized national and county level recidivism data made an accurate comparison/analysis impossible. This paper recommends that to study the effectiveness of programs like the Moran Center more conclusively, a standardized way of measuring juvenile recidivism rates must be established throughout the country. The only way recidivism will ever be lowered is by understanding what programs are effective and why they are effective which can only be accomplished with better data.

Faculty Mentor: Jason Keith  Department: Chemistry

Title of Project: Applications of Density Functional Theory to O₂ Activation Reaction Mechanisms

Project Summary:

O₂ activation is known to have many significant applications in society, including pharmaceuticals and alternative energy. The primary goal of my project this summer was to map out the reaction pathway for a specific reaction that involved the insertion of molecular oxygen into a platinum-methyl bond to form a platinum methylperoxo complex. The successful formation of (PN)PtMe(OOMe) (PN = 2-((di-tert-butylphosphino)methyl)pyridine) from (PN)PtMe₂ was initially published by Kyle A. Grice and Karen I. Goldberg in 2009. The reaction proceeded in benzene and in the presence of ambient light, suggesting the need for light in the visible range to carry out the reaction. There was also evidence to suggest the presence of a radical chain reaction. The figure below represents the general reaction.


I primarily worked with Gaussian09 software and the Linux operating system to apply Density Functional Theory in order to elucidate the proper reaction pathway. Initially, I focused on optimizing the geometries of the possible reactants, products, and intermediates of the mechanisms that seemed to be the most plausible. After comparing the relative energies of these structures, the possible mechanisms were further narrowed down and I shifted toward finding the transition state structures that connected these intermediates. The importance of ambient light was also taken into account, and I ran TDDFT calculations to determine the possible excited states of the reactant that would initiate the reaction pathway. By the end of the summer I was able to outline a plausible pathway, and I plan to continue with my research with the hope of isolating all intermediates and transition states.

  ☑ Other (specify): Warren-Anderson Fund
Project Summary:

There is a history of intense violence between groups in many areas of the world. The present research explores whether basic differences in the way people think about the experiences of groups (as compared to the experiences of individuals) might accentuate violence between groups. We propose that while people may easily perceive an individual as experiencing pain, people may have difficulty perceiving groups as having a mind capable of experiencing pain. As a result, groups may, at times, be psychologically easier to harm—despite the fact that more people are objectively being harmed.

Research on the perception of the mental capabilities of others proposes two dimensions by which mental capacities, or mind, can be perceived—perceptions of the capacity to have experiences (e.g., experiences of pain and pleasure) and perceptions of the capacity to have agency (e.g., intentions, plans; Gray, Gray, & Wegner, 2007). Most of this research on mind perception has examined how people perceive mind in individuals. However, people also think of groups as having minds. For example, when we talk about whether corporations are people or the plans of terrorist groups, we are making inferences about the mind of groups of people. Research on group mind reveals that although people will attribute mental capacities to groups, they tend to perceive groups as having less of a capacity for mental experiences than individuals (Knobe & Prinz, 2008). The explanations for this asymmetry in mind attributed to groups versus an individual are various, ranging from groups’ lack of body (Gray et al., 2011), to the qualities of specific group members (Waytz & Young, 2012); both of these explanations propose that the perception of groups as having less mind than an individual is inevitable. We suspect, however, that it is the lack of consideration of the members of a group that leads people to see a group as mind-less. If so, then slight shifts in framing from “a group of people” to “people in a group” should lead groups to be ascribed mind that is comparable to, rather than less than, an individual mind. In Study 1 we test whether the framing of groups affects whether people perceive them as having a mind as well as consequences for whether people think groups can experience physical pain. In Study 2 we apply these findings to understand conflict between Turkish and Kurdish people in Turkey.

Study 1 examined whether the way people think about the victim(s) of a drone strike affects whether they perceive the victim(s) as having a mind, as well as how much pain they think victim(s) experienced. Participants were told to imagine that North Korea recently launched a violent attack on a nearby country and that the nearby country responded by launching a drone attack on North Korea. Participants were randomly assigned to learn that there was one victim, 30 victims, or that the victim was a group of 30 people. We predicted that slight shifts in framing would matter such that a group of a 30 people would be attributed less mind than an individual; but that 30 people would be attributed similar mind to an individual. Results were as predicted. Participants who were led to focus on a group (i.e., a group of 30 people) perceived the group as having significantly less mental capacity for experiences than people who read about 30 individuals or an individual. Furthermore, these framing-related shifts in mind perception mediated how much pain people thought the victims experienced as a result of the drone strike: a group was perceived as experiencing significantly less pain than 30 people or an individual. We conclude that minor shifts in framing of foreign policy could affect how people think about drastic choices such as launching a drone.

Study 2 aims to extend the findings of Study 1 to understand actual global conflict between Turkish people and Kurdish people in Turkey. Turkish and Kurdish participants will report the degree to which they think of both their own group and the other group as united groups or collections of disparate individuals. They will also report perceived mental capacities of Turkish and Kurdish people and endorsement of harm toward the other group. We predict that to the degree that Turkish or Kurdish people view the other group as a unified, homogenous group, the less mind they will perceive the group as having and the more moral they will think harming that group is. Data collection for Study 2 is still in progress. Together this research hopes to unveil basic psychological mechanisms behind large-scale intergroup conflict.
At Colgate University, the Living Writers program brings ten award-winning authors to campus to discuss their works and their creative processes with the student body and the Colgate community as a whole. Through the Living Writers class, enrolled students get to explore the works of these authors on an academic and intellectual level in order to analyze their form and the content, as well as to consider their significance within the contemporary world. Each of the authors comes to campus to give a public reading and Q&A session, allowing both students and members of the Hamilton community to interact with them in person. Additionally, lectures given by the authors are all live streamed and archived on the Living Writers website, allowing members of the Colgate and Hamilton communities to access these discussions either as they occur or after they are finished.

As the Living Writers fellow, one of my primary jobs was to read the selected works of these ten authors and analyze them in collaboration with Professor Brice. Each week, I would read the works of two of the authors, and then meet up with Professor Brice in order to discuss points of interest and concepts relevant to the Living Writers course. Our analysis would often focus on plot, form, content, character development, and the historical context as we dissected these works and considered their overall importance and significance. Additionally, I did extensive research on both the authors and their works in order to compile as complete a list of resources as I could. Through my research, I located reviews, interviews, profiles, lectures, discussions, and podcasts that function as supplementary materials to the works themselves. I also searched for contextual materials related to the historical time period to critical concepts within the works. In order to conduct all of this research, I spent most of my time looking through newspaper articles, magazine articles, online databases, encyclopedias, and other reputable sources in order to assemble the most comprehensive list of resources possible.

Once I had completed my research for a single author, my job was to upload links to the resources onto the Edge.edX Living Writers course website. This platform is open to members of the Colgate and Hamilton communities, alumni, and friends of the school who are interested in participating in the Living Writers course. I helped to organize and label the materials on the platform in addition to uploading the resources in a clean and consistent fashion. This website is meant to be easily accessible and navigable to everyone enrolled in the course, and my job was to present the course materials in a way that makes this possible. In order to accomplish this goal, I worked alongside members of the IT department as well as members of the Living Writers team to get all of the resource links uploaded onto the website for all ten authors.

Additionally, I helped run the Living Writers table at reunion in order to spread the word to alumni and members of the Hamilton community who may not have otherwise been aware of the program. Along with Stephanie McClintick and Professor Brice, we were able to spark interest in a wide variety of people of many different ages and encourage them to spread the word even further. The Living Writers program is open to any and all people who are even semi-interested in participating, and the more people who enroll in the course and are exposed to the works of these impressive authors, the better. Overall, working for the Living Writers program was an experience that stretched me intellectually, and allowed me to think outside of the texts in thinking critically about their meaning and significance. The program brought me closer to the authors themselves, and gave me a sense for the entire process that goes into creating a text.
Nestled between the two volcanoes of San Cristóbal Island in the Galápagos is a series of curiously young basaltic lava flows. These flows are not vegetated and have well-preserved flow tops, indicating that they are a rejuvenescent phase of volcanism. The young lava region covers 70 km² of the NW coast and consists of five flow fields from 5 to 17 km². We report new cosmogenic helium exposure ages that indicate emplacement occurred 9 to 15 ka, and that the surrounding area was active since 174 ka; a hiatus in activity may have occurred between 174 and 15 ka. These dates contrast with the fact that San Cristóbal is one of the oldest islands in the archipelago, with several K-Ar ages >2 Ma. Petrographically, the young lavas are mostly olivine-phyric (1-5 mm, average 5% abundance). Plagioclase phenocrysts are small (<1 mm) and rarely exceed 3% in abundance. Some flows range in their crystal cargo over rather short distances (<30 m). Compositional variation of this small set of young flows encompasses the compositional range exhibited by lavas from across the island. Rare earth element patterns are flat to LREE-enriched, even within the same flow field. Incompatible trace element ratios (e.g., La/Sm) indicate a wide range in extents of melting at relatively shallow depths (e.g., low Sm/Yb), comparable to conditions observed at Floreana Island. Compositions are consistent with a source that is a mixture of Galápagos plume and ancient, recycled oceanic crust (FLO source of Harpp and White, 2001). The contribution from the plume source is notable given the island’s location in the eastern archipelago, where plume influence is normally lower than in the western islands. The young lavas are primitive compared to the majority of the archipelago and to other lavas on San Cristóbal, having only crystallized olivine and sparse CPX. These observations are consistent with a model in which melts pass through the crust relatively quickly, without extensive fractionation or homogenization prior to eruption. Because late stage lavas in the Galápagos have similar source compositions to the rest of the island, we propose that the mechanism for rejuvenescent volcanism in the Galápagos differs from that proposed for other ocean island systems, such as Hawaii.
Title of Project: Working with Hudson Headwaters to Improve the Adirondack Health System

Project Summary:

This summer I had the opportunity to work as a Fellow with Hudson Headwaters Health Network through the Upstate Institute’s Field School. Hudson Headwaters is a large non-profit health network in the Adirondack region that covers an area of around 5,000 square miles and serves a population of around 80,000 people. Hudson Headwaters provides comprehensive and coordinated healthcare services to this population including primary care, urgent care and specialty services. In doing so, it seeks to provide each person with access to quality preventative care to ensure that they, and the population as a whole, are as healthy as possible. Hudson Headwaters serves a rural area that is at risk of being underserved by the healthcare system. While Hudson Headwaters serves a heterogeneous patient population, many of its patients are low income and are at risk of falling through the cracks. To combat this, Hudson Headwaters provides millions of dollars worth of uncompensated care and pharmacy discounts every year. Healthcare is constantly changing. Regulations are updated; new laws are enacted; new treatments are developed; new technologies are invented. While working at Hudson Headwaters this summer I have seen the inner workings of a system continuously in motion and the constant innovation that is necessary to move the healthcare system in the right direction.

My work this summer has been part of this larger effort to stay on the cutting edge of rural healthcare. While I have had the opportunity to observe and tangentially work on a variety of new developments, my focus this summer has been on two projects dealing with new treatments and technologies that have the potential to improve care.

The first project was to analyze the rollout of a handheld ultrasound device. Hudson Headwaters physicians have been piloting the device in collaboration with the device’s manufacturer. This technology is new to primary care and the aim of this pilot project is to assess how useful the device is in certain clinical scenarios and to determine where it adds value by possibly increasing patient satisfaction and convenience, reducing ER utilization, cutting readmission rates or eliminating the need for advanced imaging. I compiled and analyzed data to develop an assessment of the frequency and area of the device’s use as well as an estimation of its added value. Using this analysis in conjunction with the comments of the physicians involved in the pilot, I drafted a report to the manufacturer and helped to write proposals to secure funding to expand the network’s handheld ultrasound program going forward. The device has the possibility to expand a primary care physician’s capability in an office visit and its widespread implementation could help increase the ability of primary care physicians across the network to provide excellent care.

The second project was to help develop a strategy to treat Hepatitis C (HepC) in primary care. HepC is a disease that affects around 1% of the population and last year killed more people than any other infectious disease. Approximately half the people who have HepC are undiagnosed and of the people who are diagnosed, an even smaller number have been treated. HepC has also become more easily treatable in recent years with the invention of new but expensive drugs. With these facts in mind, I helped to begin to create a system to identify patients through the electronic medical record, refine the patient list to those who are good candidates for treatment in primary care, acquire prior authorization to treat from insurers and work with specialists to provide the necessary level of care. As this program expands in the coming years, it will hopefully lead to improved patient population health by expanding the local healthcare system’s ability to treat HepC.

Title of Project: Morrisville/Eaton Food Study

Project Summary:

In May of 2015, the Village of Morrisville lost its only grocery store within an approximately 7-mile radius of the community, limiting access to groceries in the area. This left residents of Morrisville and the greater town of Eaton with little choice but to leave the community in order to purchase groceries. While there is a Dollar General store and two convenience stores located in Morrisville—which sell snacks, dried goods, and a limited assortment of dairy products--individuals still have to leave the town in order to purchase fresh meat or produce. This is especially problematic for those who have little to no access to transportation or are immobile and may have a difficult time leaving the community, particularly during the tougher winter months. Other concerns raised about a lack of a grocery store in the community centered on issues of a loss of tax revenue and business in the community, as well as concerns about health issues resulting from the lack of fresh produce purchased and consumed. As a result, a working group--made up of key stakeholders within the community--gathered to resolve this issue. The Morrisville and Eaton Food Study was thus a project proposed to assess the grocery needs and desires of individuals living and working in the community. Facilitated by the Upstate Institute and the Madison County Planning Department, the project aimed to research and recommend alternative retail options for bringing fresh produce to this community.

Through our research project, my supervisor and I looked at several alternative models that other communities had started when access to a local grocery store was limited in the area, in both urban and rural settings. We found solutions ranging from small, local business owners opening up a store that catered to the community’s needs, to more collaborative grassroots ventures, like a mobile food truck delivering freshly grown foods from local farmers to the town. With each model, we saw that there were various challenges and benefits that resulted and affected the success of these different community projects, and we used this research to help us better understand what could or could not potentially be started in Morrisville and Eaton.

After reading about alternative fresh food retail models, we worked on community outreach to gain a better understanding of the desires and needs specific to individuals living in the community. The process of trying to understand the perspectives of community members was mainly threefold: through interviews with community stakeholders involved in the project or related to the community, a survey for residents of Morrisville and Eaton, and a community workshop held to better understand the views of residents.

Following this outreach and an analysis of the data we collected, we came up with alternative recommendations for the community, which we felt would be most viable and aligned (as realistically as possible) with what residents were looking for. While a great majority of individuals, from the survey and community workshop, indicated that they thought a chain grocery store would be best for this community and that they would be most willing to shop there, we did not see this as the most realistic option for the community. With a limited population and traffic in the area, and the previous grocery store closing its doors, chain grocery stores are not likely to come into the area. At a presentation that we held in the community, and in a report that is soon to be released, we recommended that the community work on a project based off of one of the following models: a farmers market in collaboration with the local college, a food cooperative, a distribution center located at a business that already exists within the community, or a small, locally-owned business. It is our hope that this research and recommendations will spur continued dialogue and awareness of this ongoing project, and that this will help members of the community start up a model of their own.

Title of Project: STEAM Education in the Mohawk Valley

Project Summary:

It's no revelation that STEM people are incredibly important to the global economy and that they engage in work that is crucial to the progression of humanity. So why is it that STEM attrition exists in colleges and so many students find it difficult to pursue or finish a STEM degree? Where is the educational support for students who wish to enter a STEM field if we value these careers so highly?

In a recent report produced by the Mohawk Valley Regional Economic Development Council, findings showed that the region could potentially be the East Coast response to Silicon Valley. Many technology companies have set up shop in the area because of its abundant water resources and diverse population. Nanotechnology, in particular, stands to become a major presence in the Mohawk Valley.

During the summer, I had the privilege of working at the Utica Children’s Museum (UCM) on a project proposed by interim director Elizabeth Brando to establish the museum as the beginning of a workforce development pipeline. In theory, young children would come to the UCM to learn about STEAM (Science, Technology, Engineering, Arts, Math) concepts and become familiarized with skills that will one day be useful in these fields. The idea is that if children can be introduced to these concepts in a fun and hands-on way, they will be much more likely to stay interested in STEAM, pursue degrees in these fields, and find careers in the Mohawk Valley area.

The Utica Children’s Museum is a small non-profit in the heart of the Bagg’s Square district of Utica, devoted to supporting every child’s natural curiosity to learn through hands-on, play-based exploration. It has had a troubled past and was closed for almost a year, but the new director, board members, staff and many volunteers have worked hard to move on from its mistakes and rebuild the museum as a beacon of educational value in Utica.

The 3rd floor of the museum is currently home to a temporary exhibit called “It’s a Nano World,” which introduces kids to the nanoscale and teaches them about nanobiology. When this exhibit leaves, UCM hopes to create a Maker Space for children ages 0-10. I mainly worked on identifying companies and groups to reach out to for support in formulating plans for the new exhibit. At the end of the summer, I compiled a database of community contacts who are willing to help UCM build their Maker Space and/or lead classes or events when it opens. As a secondary project, I analyzed zip code data from visitor logs in order to determine how many patrons the museum draws from outside of Utica and outside of NY. This data will be used in future grant proposals and marketing strategies to increase visitation to the museum.
Title of Project: Sources of Rifting in the East African Rift System from Rayleigh Wave Tomography

Project Summary:

The East African Rift System (EARS) is a system of continental rift segments that stretches along the eastern portion of the African continent, from the Afar Triple Junction in Ethiopia southward, where it eventually terminates in Mozambique. The EARS is unique in that it displays variation in rifting style along the rift, particularly within the central EARS. For example, the Eastern Rift Branch is likely undergoing magma-assisted rifting with widespread volcanic activity, while the Western Rift Branch appears to be magma-poor, with higher rates of seismicity and much less volcanic activity.

The velocity structure of the upper mantle beneath the EARS is investigated using the Automatic Generalized Seismological Data Function (AGSDF) method (Jin & Gaherty, 2015). This method cross-correlates filtered and windowed waveforms from proximal stations to measure phase delay times for teleseismic Rayleigh and Love waves. Data from all available seismic networks in the central EARS are combined to include as many events, and to cover as many terrains, as possible. These data will be inverted with the AGSDF method for preliminary Rayleigh wave phase velocity models to explore the causes of rifting beneath the EARS.

The ability of this method to examine both Rayleigh waves, which provide a better measurement of SV velocity, and Love waves, which provide a better SH velocity measurement, makes it a unique and flexible tool. Future studies will combine these Rayleigh wave phase velocity models with Love wave phase velocity models that will be developed using this same method in order to study radial anisotropy beneath the EARS.

□ Other (specify):
Research Fellow: Markus Miranda (2019)  
Concentration: Undeclared

Faculty Mentor: Jason Keith  
Department: Chemistry

Title of Project: Insertion of Molecular O₂ into Rhodium III Complexes

Project Summary:

Using advanced computing technology, we studied the reaction pathways of a chemical reaction (not performed) between molecular oxygen (O₂) and Rhodium III complexes, specifically the insertion of O₂. The resulting molecules can be used as catalysts in aerobic oxidation chemistry. The study was carried out in the X11 terminal on computers that were connected to a supercluster, where calculations were performed on molecular models to assess stability on the basis of Density Functional Theory (DFT). The applications used to model and interpret the data were Gaussian suite '09. The study is still ongoing to build further support around the collected data.

For most of the study, we examined a Rhodium-cyclam complex, shown below. Cyclam is a ligand that surrounds the equatorial plane in the Rh molecule. Calculations were carried out where other substituents were added and removed from the molecule, but the cyclam ligand was involved in all reaction calculations. Additionally, calculations were set up so that the solution in which the reaction would be occurring in were taken into account, to account for the solvent-solution interactions. The objectives of running these calculations were to construct potential energy surface (PES) diagrams illustrating the different energies of intermediates and transition states and to determine the reaction pathways.

To understand the role the cyclam ligand plays in the insertion of molecular oxygen into Rhodium III complexes, we began to look at a Rhodium-porphyrin complex. Porphyrin is a larger ligand surrounding the equatorial plane of the molecule, leaving space for substituents. Similar to the cyclam calculations, substituents were added and removed to understand whether variations of the molecule would result in preferred (lower energy) pathways. This part of the experiment was conducted in the same way the cyclam calculations were conducted. This part of the study is in progress. The below molecules were modeled using Gaussian suite '09.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  ☒ Other (specify): American Chemical Society Petroleum Research Fund
Title of Project: The long-term impacts of mentoring on low-income, rural youth

Project Summary:

Youth mentoring has been an important part of American life since the early 20th century as urbanization brought about concern for children becoming lost in the shuffle of the city. As youth mentoring has evolved over time, its impact on the lives of young people has been the subject of plenty of sociological research. However, given mentoring’s urban roots and an overall trend of focusing on the plight of urban residents, research on mentoring has not been as focused on mentoring programs that serve rural youth. Given the unique disadvantages that rural youth face, the specific benefits that mentoring programs provide to youth in rural communities may be of particular significance but remain largely unexplored. Additionally, while existing research has supported the short-term benefits of mentoring on its young participants, the long-term impacts of mentoring have been remain less known. This study seeks to address these gaps by studying the long-term impact that a mentoring program in rural Madison County has had on its participants.

In order to investigate the long-term implications of mentoring relationships on the lives of low-income, rural youth, I conducted qualitative phone interviews with twelve young adults, ages 18-22, who participated in the Madison County Community Action Partnership’s mentoring program during adolescence. I find that all students positively reflected on participation in the program and program benefits, including having a positive role model and being exposed to new opportunities. While all participants seemed to enjoy the mentoring experience, those who were able to recall aspects of their mentoring relationship that went beyond fun and recreation, discussing the supportive nature of the relationship, developed stronger coping strategies to deal with the challenges they face in the transition to adulthood, while those who simply recall their mentoring experience as fun or recreational demonstrate less resiliency. This finding underscores the importance of mentor relationship quality in understanding the long-term benefits of mentoring for lower-income rural youth and has implications for how best to train mentors for this important role.

Diethylstilbestrol (DES) is a synthetic form of the female hormone estrogen. It was prescribed to women between 1940-1971 to prevent miscarriage and other pregnancy complications (Ibarreta and Swan, 2002).

Impact In Humans- In utero exposure to DES leads to reproductive disorders and immune abnormalities in humans. DES daughters, women exposed to DES while in the womb, have higher rates of vaginal and breast cancers, abnormal reproductive organs, high-risk pregnancies and infertility (Colborn, 1996). The health repercussions of DES on third generation granddaughters are still unknown. The median dose prescribed for pregnant women ranged between 3650-4000 mg (Reed et al. 2013).

Previous research using C. elegans- Tominaga et al. (2002) measured the number of offspring produced by C. elegans exposed at 0.5µm and 5µm concentrations to find that DES does suppress the fecundity rate in a dose dependent manner.

Previous research found that C. elegans exposed to concentrations higher than 1.25µg/ml of DES could not effectively pair homologous chromosomes and that there was a simultaneous decrease in fertility (Goldstein et al. 1986).

In this experiment, C. elegans were exposed to a control and varying concentration of DES (0, 0.5, 5, 10, 20, 50) over two generations. I planned to observe the effects of DES on progeny count while also, observing the effects of DES on C. elegans lifespan, an experiment not yet perfected. I expected to find that higher concentrations of DES would negatively affect both progeny count and lifespan.

In this study, I found that indirect exposure to high doses of DES increased both progeny count and lifespan. Although my results were contrary to my hypothesis and previous research, I believe these results may have caused due to unexpected ratio of male C. elegans in my testing samples or inaccurate levels of DES in my media.

Possible aims for the future studies on this experiment include:

- Continue generational progeny counts until control levels are obtained
- Determine a more efficient procedure to measure impacts of DES on lifespan
- Focus on target tissue pathways affected and the health of DES grandchildren
- Measure changes in DNA structure and changes of expression due to DES

Title of Project: Accelerating Dynamically-Typed Languages with a Virtual Function Cache

Project Summary:

Dynamically-typed languages are becoming increasingly prevalent in the computing community with languages such as Python and JavaScript being widely used within application and web development. These languages do not require unchanging types (static types like Java or C++) resulting in ease of use of the language and allowing quicker writing of code while still maintaining complex features of object-oriented programming such as inheritance. However the tradeoff for their convenience is the extensive use of expensive virtual functions and type validation. In this project, we studied the application of a virtual function cache to dynamically typed languages in order to find a way to support virtual function calls and as a consequence, reduce their cost.

Our project focused on applying the virtual function cache to V8, the engine behind Google Chrome. We investigated the means by which V8 avoids using the virtual function calls and then using that information to inform the reconfiguration of the virtual function cache for use with V8. Through analyzing the source code and debugging the system, we were able to identify that virtual function jumps, though used frequently by the engine, were not supported by our original simulation. As such, reconfigurations were made to virtual function cache to work the V8. However the results that we collected reflected that the engine did not run faster with the support of the virtual function cache. This suggests that further implementation and testing of the virtual function cache is necessary to determine whether it is a viable option for improving the performance of dynamically-typed languages.

Even though the results did not come out as we expected, we were able to learn a lot about compilers and how they work. We were also able to search through source code and debug in the Linux environment, gaining valuable skills in the process. Altogether, it was a very enriching summer experience.

Title of Project: The Role of Maternal Care and Early Anti-Depressant Exposure on Later Offspring Anxiety in Laboratory Rats

Project Summary:

The early environment strongly influences later behavior and thus, in this study we examined the interaction between natural variations in maternal behavior coupled with tricyclic anti-depressant (Clomipramine) exposure on anxiety-like behaviors in adolescence and adulthood. Previous studies have shown mixed results when pups were exposed to anti-depressants in infancy, where only some pups show vulnerability to the exposure (Glover and Clinton 2016; Glover et al. 2015). Variation in results could be due to the natural variation of the maternal environment. Anxiety can be transmitted from dams to offspring, where pups of highly anxious dams are more likely to exhibit anxiety-like behavior as well (Champagne 2003; Lovic et al. 2010). This study aims to determine if maternal behaviors, such as grooming, and nursing, can provide offspring with the means to regulate the expression of induced anxiety. The study identified that clomipramine exposure alone does not explain the development of anxiety in adolescence, however incorporation of maternal behavior analysis provides a clearer picture, with a nurturing early environment possibly counteracting the effect of clomipramine exposure. Further, female pups showed more susceptible to the effects of the maternal environment.

Eight litters of four females and four males of Sprague-Dawley rats were observed on postnatal days 4, 6, 8, 10 for four 30-minute long observations, during which maternal behaviors were timed and recorded including arch-back nursing and over nursing, body licks, anogenital licks, time away from nest, dam's rears, and time spent exploring. Pup treatment was randomly assigned so that, per litter, two males and two females were injected with Clomipramine (15 mg/kg), with the other four pups receiving injections of saline as a control. In adolescence, the pups were tested for 10 minutes in the elevated plus maze (EPM) at 1800h, and anxiety-like behaviors were recorded, such as time spent in open arm and latency to enter open arm. In adulthood, the pups were tested for 5 minutes in the open field maze (OFM) at 1800h and once again anxiety-like behaviors were recorded, such as latency to novel object and number of approaches.

It was found that maternal care varied naturally across litters and within litters. Clomipramine exposed pups did not show different anxiety levels from control pups in adolescence, except in number of rears in the EPM, t(61)=2.92 p<0.005. Clomipramine exposed pups did not show different anxiety levels from control pups in adulthood testing in the OFM. When considering the effect of the maternal environment in adolescence, results suggest that pups of mothers who licked all pups in the litter evenly, had a longer latency to enter the open arm, t(52)=2.12 p<0.04. Also, the more time mothers spent exploring, the less time offspring spent in the open arm of the EPM R56=.37 p<0.004. High exploration by mothers was anxiolytic in adolescence for Clomipramine-exposed offspring F(1,3.79) p<0.057. In adulthood, the more time a mother spent with the litter, the shorter the latency to approach the novel object R51=.41 p<0.003. For the litters where a mother evenly distributed her licks, the males and females showed similar anxiety levels in adolescence, versus litters where a mother unevenly distributed licks, females were less anxious than males in adolescence F(1,4.69) p<0.035. Females of low exploratory mothers spent more time in the open arms than males of low exploring mother in adolescence t(27)=1.89 p<0.07. Females of mothers with high likelihood of being maternal after being away showed less anxiety compared to males and females of low likelihood mothers F(1,4.40) p<0.04.

Studies must consider the impact the early environment has on the development of future psychological conditions, including anxiety. Similar studies are necessary to broaden the depth of information for mothers determining whether or not to continue pharmacological depression treatment during pregnancy and while nursing. Future directions involve identifying why females are more susceptible to the effects of the early environment, and at what periods the maternal environment effects peak and lessen.

A Third Culture Kid (TCK) is defined as someone “who has spent a significant part of his or her developmental years outside [their] parents’ culture” (Pollock, 2009). The “third” culture refers to the mixing of the host country’s culture (the country he or she lives in) and his or her parents’ culture. They often seem to lack a sense of belonging because of their inability to fully identity with one culture. Culture is a large part of people’s identities, so for those who do not identify with a distinct culture, what other parts of their identity take precedent and are important?

My study set out to understand how Third Culture Kids form their personal identity, especially their cultural and racial identity before and after starting college. It was important to understand the participants’ identity before college in order to determine whether there was a shift in identity after they left home and moved to college and whether certain factors influenced the way one identified once starting college.

The research is based on interviews I conducted in Singapore with six men and six women between the ages of 19 - 22 who self-identify as Third Culture Kids. All twelve participants attended at least one year of school in Singapore before attending a predominantly White University; this was a requirement because I wanted to study whether a shift in racial and ethnic environment would affect the way TCKs self-identify. The interviews were structured by a series of general questions and pre-selected topics including cultural and racial self-identification, general experience in college and more specifically, whether they experienced any shift in their ethnic, cultural, and racial identity.

There were four main aspects of the participants’ environment that impacted the way they identified before university. Firstly, every participant grew up in racially and culturally diverse environments which helped lead to an unclear sense of what culture they belonged to and a somewhat racially neutral identity. The socially constructed identity of racial neutrality means that people were quite unaware of their or their peers skin color and race. Their middle-upper/ upper-class backgrounds also contributed to a racially neutral identity because there was no perceived difference of resources due to race. Additionally, one’s language ability (mother tongue) and family cultural influence affected the strength of one’s connection with their parents’ culture - the more an individual’s family imparted cultural knowledge through cultural traditions, food, and language for example, to their child, the more secure their child felt in their cultural identity.

Most of the participants experienced a shift in the way they self-identified after they began college. The shift in a racial, cultural, and socioeconomic background played a large role in creating these shifts in identity. Most more strongly identified with the being a Third Culture Kid because they were suddenly not surrounded by TCKs. The vast majority of the non-White participants of color developed a heightened awareness of their race, ethnicity and parents’ culture because they were suddenly a minority in a predominantly White American homogenous population. They had not felt different from their peers growing up but many felt like an outsider very often in college. Overall, those who felt more like outsiders to their college and new country’s culture experienced a larger shift in self-identity. The extent of the shift, however, varied on a number of factors such as how strongly they connected to those certain identities (such as race) before coming to college.
Like many of other countries in Southeast Asia, Vietnam is a multiethnic country, with 54 ethnic groups officially recognized by the government. Among these ethnicities, the Kinh, or ethnic Viet, accounts for the majority of the population and is considered the dominant group due to: being the majority of the population, controlling the dominant culture, and occupying most of the lowland areas where opportunities for economic, social and cultural development abounds. The other ethnic groups (ethnic minority) exist in smaller number, occupy less land, wealth, and power in the socioeconomic structure of the country, and mostly live in the uplands where there are fewer opportunities for development due to the regions’ mountainous geography. Because of this mismatch in socio-economic progress and the underrepresentation in population, ethnic minorities are placed at a disadvantaged, especially in comparison to the Kinh. There is a push for development of the upland areas, with special attention to the ethnic minority groups in these areas. However, many of these policies are based on the values of the lowlanders, commonly associated as the Kinh, and assume that members of ethnic minority groups need to become more advanced. In other words, to assimilate to the standards of the dominant group (Rambo & Jamieson, 2003).

In this research, multiculturalism is viewed as the premise that pushes back against the assimilation of ethnic minorities into the dominant culture in education and emphasizes that the educational system should allow and empower students of ethnic minorities to embrace their ethnicities while enabling them to participate in the society. Through the lenses of multiculturalism, this research analyzes Vietnam’s current educational system and seeks to understand how teachers’ instruction and experience reflects, as well as shaped by, the pattern of assimilation and what can be done to promote multiculturalism in school. Within the period of three months, I conducted interviews with teachers from two schools in Hoa Binh, a province with a high number of ethnic minorities in Vietnam, and had multiple informal conversations with provincial and state officials. Moreover, data analysis includes data drawn from primary documents (e.g., national textbooks, law cases, and education reports) that attempts to triangulate data from the interviews. By coding and analyzing the gathered data, I learned that despite many initiatives to improve the structural and institutional system regarding ethnic minorities, most of them focused on the economic aspect rather than promoting multiculturalism. In addition, there was a lack of awareness of cultural differences and the power dynamics among the teachers interviewed and the scope of diversity/local-based programs was contained within just ethnic studies, that is, surface learning of cultural practices and customs.

Through this study, I also understood how the existing theories on multiculturalism did not provide a solid foundation for understanding and researching the education in Vietnam. The focus of current literature on the experiences of immigrants and students of color in these Western (USA, Canada, Australia, and England) countries seemed inadequate when applied to the analysis of the education system in Vietnam, given the different and unique history and demography of the country in particular and of the Southeast Asian region in general. Therefore, in order to further promote multiculturalism in Vietnam, there is a need for further research that draws on the sociocultural resources and characteristics of the country and the region so that multiculturalism can provide a better theoretical lenses for future study as well as policy making.
In order to understand the phenomena women in Nigeria both experience and are active participants, I participated in a qualitative study. Interviewing 29 young men and women between the ages of 18 to 31 in Lagos and Abuja Nigeria, my research situates their responses within feminist power discourse. In Moya Lloyd’s article, Power, Politics, Domination, and Oppression she presents four debated conceptions of power within feminist literature (Lloyd 2013, 111). These theories are power as a resource, power as domination/power over, power as capacity/power to and power as productive. Power as a resource treats power as a resource that is unequally distributed in society. Within this structure men are uneven beneficiaries (Lloyd 2013, 111). Power as domination, hinges on a didactic conception of male domination and female subordination (Allen, 2008). Power as capacity is argued in more idealistic terms as empowerment (Lloyd 2013, 112). Finally, Power as Productive refers to a Foucauldian feminist conception of power as everywhere but nowhere at the same time (Cooper 1994, 435). As a means of understanding powers construction, I situate myself within the socio-historical literature.

Focusing close attention to colonialism, militarization, and patronage, I am able to map out the terrain in which young Nigerian women find themselves. Colonialism and militarization aid in the institutionalization of Eurocentric gender identities (Steady, 2005; Okonjo, 2005; Sudarkasa, 1986; Mba, 1989), while patronage delegitimizes political power in the eyes of young Nigerian women. Though colonialism and militarization introduced and solidified European notions of gender and the public vs. private, these structures did not wipe away pre-colonial notions of power. As such, gender relations and constructions are far more complicated than male vs. female or man over woman. Power as domination fails to unravel the complexities of this reality, essentializing women’s experiences as well as victimizing them as a whole. Because patronage in Nigeria is rooted in oil politics, resource becomes an important lens by which we must consider the construction of power.

Distancing myself from previous research on women in politics in Nigeria that emphasis women’s insecurities or women’s negative perceptions of politics, I argue that political power in Nigeria is so delegitimized that young women find difficulty actively running and participating in the formal sphere. Most importantly, young women harness their social power as sisters, mothers, and daughters to enact change by playing the support role in civil society organizations, advocacy groups, and the family. This social power is better understood within the lens of power as capacity or empowerment. Though women find authority through their gender identity, there conceptualization of power provides an avenue by which power may work against them. Following Foucault’s argument that individuals both create power and are a manifestation of power (Foucault, 1976), the dominant conversation in my interviews centered around the idea that “women don’t support women”. “Women don’t support women” due to the same reasons expressed by both women’s advocacy groups and individual women as the nature of their authority in society.

In essence no one feminist theory of power can be applied to Nigeria because each has its limitations. In my analysis parts of each theory working in tandem with each other provide a more coherent depiction of power in Nigeria. Davina Coopers construction of power as productive as well as relational and in conversation with resources provides a more nuanced understanding of power that can be applied to the Nigerien state, leaving space for the ways in which young women in Nigeria define their authority. Understanding how young Nigerian women experience power provides an avenue for exploring the seemingly complex state of gender relations in Nigeria. Most importantly, at the center of modern politics is power, and since power and gender are inadvertently related conceptualizing power in Nigeria provides insight into the position of both men and women.

☑ Other (specify): Lampert Institute for Civic and Global Affairs
Title of Project: Photochemically-Initiated Formation of Secondary Organic Aerosols (SOA)

Project Summary:
Aerosol particles play an important role in the atmosphere. They affect Earth’s radiation budget, serve as cloud condensation nuclei and are involved in a wide range of chemical reactions that alter the composition of the atmosphere. Although these species play such an important role in direct climate, the processes that lead to aerosol production and growth are poorly understood. Our research considers a photochemical pathway to SOA wherein excited triplet states or other nascent photoproducts react with volatile organic compounds to produce SOA. We consider what factors may control the lifetime of these SOA precursors, and, thus, the initiation step in this process.

We produce an atmospheric pressure flow of aerosol particles created from an aqueous solution of salt NaCl and sodium anthraquinone sulfonate (SAS). An atomizer produces a dense stream of droplets which we dry by passing them through a desiccant-containing diffusion dryer and are size-selected by a differential mobility analyzer (DMA) prior to analysis. We generate a relative humidity (RH)-controlled flow by mixing dry air with air that has been saturated with water vapor using a Nafion membrane. In the ionization cell, a 355-nm laser excites the SAS, creating the triplet state through internal conversion. Another, 230-nm or 247.5-nm laser ionizes the excited triplet SAS. The aerosols then carry a net positive charge. We monitor this charge using an electrometer while scanning the delay between the lasers. Figure 1 shows a schematic diagram of the experimental approach.

Result
• The lifetime of the triplet state is not sensitive to the presence of adsorbed water (0 to 25% RH), but aqueous particles (50% RH) have drastically reduced lifetimes for triplet SAS.
• The triplet state forms water adducts which are named B and C. Selectivity in ionization lets us probe either C kinetics or triplet kinetics.
• 2,6-dimethoxyphenol (DMP) quenching of the water adduct is the same for a pH of 3, 4 and 7. Prior to a saturation point, as the concentration of DMP increases, the lifetime of the water adduct decreases.
• The reaction of the triplet with water is faster than reaction with other solutes. The lifetime does not depend on the solute present.

Our experiment is the first to monitor directly the lifetime of electronically excited triplets and other transient photoproducts in aerosol. These measurements will help elucidate the components and conditions that promote photochemical SOA formation. These experiments show that an increase in the RH decreases the lifetime of the triplet state, and the lifetime of the water adduct C decreases with an increase in DMP concentration. Future experiments would further examine the kinetics of B and C and their reactivity with DMP, and also examine gas phase volatile organic compounds.

Title of Project: Investigating the role of klf17 in the development of the zebrafish lateral line

Project Summary:

Due to their high breeding rate, *Danio rerio*, or zebrafish, are a model organism frequently used to study development. The lateral line, composed of groups of cells known as neuromasts and INCs, is a fascinating system where much work is being done. Its development is unusual, as it is laid down by a crawling group of cells called the primordium. Wnt signaling is crucial to the proliferation of cells at the leading end of the primordium. In fact, this interacts with FGF signaling to produce to distinctive zones within the primordium: a leading and trailing zone. The signaling within the zone appears to be mutually exclusive, with Wnt signaling only appearing in the leading zone. This localization is crucial for the migration of the primordium and the deposition of neuromasts.

Interestingly, the krüppel-like factor, of klf, family of proteins is known to be associated with Wnt signaling. This is not surprising, as Wnt signaling is associate with proliferation due to activation of gene transcription and klf proteins are transcription factors associated with a variety of function including cellular proliferation! Due to this association, klf proteins are often expressed in Wnt-dependent locations. In fact, some studies of the Wnt signaling pathway and its importance to lateral line development, krüppel-like factor 17 has been used via in situ hybridization to mark the neuromasts. In fact, krüppel-like factor 17, or klf17, is highly expressed in the neuromasts of zebrafish.

To date, little is known about the role of klf17 within the neuromasts of zebrafish. It is largely just used as a marker. However, it is in a family of proteins known to be associated with the signaling pathways crucial to lateral line development. Moreover, it is located directly in the lateral line! In simpler terms, it is in the right place and is associated with the right signaling pathways. Thus, I wanted to explore its role in the lateral line development in zebrafish! It seemed as if knocking out klf17 would result in an underdeveloped lateral line with too few neuromasts and a stalled lateral line. Based on the interaction between other klf proteins and Wnt, this is due to the inability to regulate key gene transcription downstream of activated Wnt and β-catenin nuclear localization.

In order to discover the experimental effect, CRISPR-Cas9 was utilized to induce a deletion in klf17. Four different sgRNAs were transcribed to target various locations within klf17. The sgRNAs were selected from CHOP CHOP, seeking DNA templates that were “idealized” based on few off-target locations and the containment of ‘GG’. Moreover, multiple sgRNAs were selected to control for the off-target effects. In other words, four sgRNAs were utilized because if the same affect is observed with each separate klf17 site mutation, it is unlikely that it is due to an alternative gene modification.

Based on the results of Nakayama et al., zebrafish were injected one-hour post fertilization with 500 ng Cas9 and 250 ng sgRNA. Multiple sgRNAs were utilized to increase the likelihood of inducing a mutation. The zebrafish injected were from Brn:GFP x Cldn:GFP transgenic lines, as this allowed the lateral line and the sensory hair cells to be imaged. As an initial market for the success, pigment sgRNA was incorporated into the injection solution. This inclusion allowed for a quick indication at the frequency of klf17 mutations in the chimeric zebrafish. Early injections appear effective at inducing mutations, as a substantial number of treated embryos had altered pigmentation. To see the results in the klf17 gene specifically, T7 endonuclease was used to test the frequency of mutations. The injected embryos had a variety in this gene segment length, indicating that CRISPR Cas9 effectively deleted portions of the klf17 targeted regions.

These fish were examined quickly to see if klf17 has any obvious affect even in low-level chimeric mutations of the gene. Though they were only preliminary injections and observations, it appears that klf17 is involved with lateral line and eye development. Moreover, it seems to be important to hatching. However, due to the limited time frame, definitive correlations could not be concluded. I am continuing to work on this project this year, focusing on breeding injected fish to the G2 populations. Ideally, some klf17 mutations will have become introduced into the germ lining, allowing for the production of some klf17 -/- offspring. Genetic material taken from tail clips will be sequenced to ensure there was a homologous mutation in klf17. Though I will examine the effect of chimeric klf17 mutations, these are the primary fish that will be studied. Once there is a klf17 -/- knockout, the connection between the developmental abnormalities seen with the lateral line and klf17 will be much stronger.
Research Fellow: Jessica O’Malley (2017)  
Concentration: Physics  
Faculty Mentor: Rebecca Metzler  
Department: Physics and Astronomy  
Title of Project: Barnacle Exoskeleton Formation  
Project Summary:

Barnacles are sessile arthropods that start as cyprid larva. The cyprid finds a suitable place to settle, cements itself, and then secretes minerals that become the plates of the barnacle. In adult barnacles these plates are largely composed of calcium carbonate and aragonite. There is research that suggests that there is a precursor phase to calcium carbonate called amorphous calcium carbonate, which might account for the variation in hardness and crystal orientation of the calcium carbonate found in adult barnacle plates. As barnacles mature, the molecular composition, plate area and topography change.

In order to examine the process of barnacle formation cyprids were placed on slides and their growth was monitored. Some of the barnacles were grown in a calcium staining dye called calcein, which fluoresces green when hit with ≈500nm light. Three barnacles were monitored with a confocal microscope for 4 days. As seen in Figure 1, the calcium content of the base plate increases as the barnacle ages. The area of the base plate was measured at 30 minute intervals for the three barnacles. The barnacles grow following a logarithmic curve as seen in Figure 2. Barnacle 1 was 1 hour old when put under the confocal microscope and displays rapid growth for the first 4 hours of its life. Barnacles 2 and 3 were about 16 hours old, and follow a less steep logarithmic curve. Both display an interesting trend at the age of 42 hours, having a spurt of rapid growth followed by the growth slowing again. This trend should be examined further in future experiments. The future of this experiment involves more tests on the barnacles. As the barnacles grew, slides were pulled at different stages of barnacle growth, rinsed, and frozen. These barnacles will be tested using a scanning electron microscope to see the elements present in the shell and to study the topography of the shell. Also the barnacles will be tested with infrared spectroscopy to test whether the precursor ACC is present in the barnacle.

**Figure 1** shows the calcein fluorescence of a barnacle under the confocal microscope over the course of 70 hours.  
**Figure 2** shows a graph of the area of the base plate of three barnacles. Barnacle 1 is 1 hour old when put under confocal. Barnacles 2 and 3 were 16 hrs old when put under confocal.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: A New Force on Chiral Molecules

Project Summary:

This summer, I worked on this project dealing with chiral molecules with Professor Galvez and Professor Jones. Chiral molecules are molecules with identical bonds but different geometric structures. We specifically worked with enantiomers, which are molecules that are mirror images of each other but different and non-superimposable. We explored a force that was theorized to exist between two enantiomers. We hope to use this force to separate the two enantiomers. This is significant because enantiomers are notorious in chemical industries for being very difficult to separate. With this force we might be able to pave a way to facilitate this separation.

In this experiment, we used a Mach-Zehnder interferometer. This interferometer interferes two different types of light. The byproduct of this interference is the formation of a beam with a helicity gradient. This beam’s interference pattern is a circular beam with a dark circular spot near the center. The dark spot represents the helicity gradient. Using a piezoelectric mirror and power supply, we can adjust the angle of the helicity gradient. We used a 459 nm Ar Laser to create the interference pattern and effect the force. We passed this through a 10-cm long tubed sample of a racemic mixture of the enantiomers (we used BINOL or 1,1-bi-2-napthol dissolved in ethanol). We seek to observe our force with a 633 nm HeNe laser acting as a probe beam incident from the other direction. We try to look for a shift in the interference pattern created as indicative of a shift in concentration.

So far, this technique has met with limited results. This summer, we tried focusing down the pump beam (Ar beam) as it traveled through a 1 cm thick tube. However, when we did this, we observed a lensing effect on our probe beam. When the pump beam was incident on the racemic sample of BINOL, it caused the probe beam to expand as if the sample were acting as a diverging lens. It also created a hole in the middle of the beam and gave it an interference-like pattern. We will research the source of this issue and hopefully fix it for the future.

Throughout the summer, I built an optical tweezer setup. It uses translation stages to precisely focus a beam of light and recolumnize it. We do this with our Ar pump beam, ideally effecting a force in a sample of BINOL on a microscope slide. Light originating from the top of the tweezer setup is then passed down through an objective and is used to image what is on the sample. We focus is into a camera so that we can see the molecules on the slide. We are able to see micromolecules as small as 1 μm. This setup acts very similarly to a traditional microscope. We first tried using this optical tweezer setup to observe polarization shifts in the HeNe, which was incident from the top of the tweezer setup; we expected to see a gradient of polarization shift. We did not see any polarization shifts, however. One reason this may have occurred is because the level of optical activity in chiral molecules is directly dependent on the thickness of a sample.

Next we explored optical trapping where light that is focused to a small point is able to trap molecules inside of its edges because of radial radiation forces. We used an LED to provide the light for imaging the sample on the slide. We were able to get the pump beam to trap plastic microbeads. We used a gimbal mirror to move the beam around on the slide and the microbead moved along with it, always staying trapped within the beam’s circumference. We had problems with consistency, however. We wanted to use optical trapping to observe undissolved powdered sugar molecules with our optical tweezer. Due to the problems with the inconsistency, we were unable to observe the effect of interference patterns’ different polarizations on the sugar molecules. We were able to observe sugar molecules, however.

For the future, we want to try and troubleshoot the problems with the trapping system. We want to shed some light on the behavior of this force and eventually quantify it.
Micropaleontology is the study of microscopic fossils, which can be used as proxies for past climates. To understand present climate conditions and shifting climate regimes, scientists turn to paleoceanographic records to help gain a longer time scale perspective. Diatoms are microscopic algae with a silica skeleton that often is well preserved in the sedimentary record, and serves as proxy for past oceanographic conditions. Since diatom species are sensitive to environmental conditions such as nutrient concentration, light availability, and temperature, these microfossils are important indicators for reconstructing paleoclimate.

The East Antarctic margin is a remote section of Antarctica that presents challenges for scientific data collection due to its limited accessibility. This project focused on study of a sediment core collected from Iceberg Alley, on the Mac.Roberston Shelf, East Antarctica, during a 2001 research expedition (NBP0101 JPC41). This 24-meter core is comprised of highly biosiliceous, laminated sediments that record an approximately 2000-year history of high productivity during the Holocene.

My summer research included collecting quantitative diatom assemblage data from selected 15 cm sections of the core, with the goal of understanding the seasonal to annual pattern of productivity and sediment deposition recorded in this basin. The laminated sediments from Iceberg Alley are a high-resolution record of changing Holocene environmental conditions. Laminations from this core show seasonal to annual cycles of deposition, as recorded by the gradual transition from spring time lighter sediments with well-preserved diatoms, followed by summer time darker colored sediments that are characterized by a higher degree of diatom fragmentation, most likely due to grazing. The diatom assemblage is visually dominated through the majority of the core by the diatom Corethron pennatum, a species usually found in only low abundances in the sediment. This leads to questions regarding the unusual oceanic and climatic conditions in Iceberg Alley that drove the deposition of the marine sediment dominated by a single species. This study provides a comprehensive analysis of Iceberg Alley diatom assemblages and their paleoclimate implications for Holocene climate.
Research Fellow: Kristine “Kris” Pfister (2017)  
Concentration: Art and Arty History

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Artist Residency and Environmental Center

Project Summary:

This summer, I worked with two organizations as a returning Field School Fellow. At the Sam and Adele Golden Foundation for the Arts, I updated a vast contact database, posting events on community calendars, assisting resident artists, and filling paint for the Seconds paint program. At Rogers Environmental Education Center, I conducted research and collected information about the feasibility of an improved children’s play area.

Golden has an artist residency program in which artists stay at the Golden Foundation for four weeks, attend sessions to learn about the paint products Golden Artist Colors produces, and have time to experiment with their own work. My daily tasks at Golden varied depending on the needs of the Foundation and the resident artists. While I typically entered new contacts into a database quite regularly, I often changed tasks as the need arose. I thoroughly enjoyed working with the resident artists who travel to New Berlin, NY from around the world for this residency. These artists’ work are all completely different from each other, and every person has a unique perspective on art making. As an artist myself, it’s great for me to share time with these people and gain some insight into not only their own work and process, but also their experiences as a professional artist.

My daily tasks at Rogers tended to be more consistent. I primarily worked on a fencing project to contain a children’s play area near a waterfront. At the time, several chaperones were needed during playtime to ensure the children do not stray too close to the water, posing a safety hazard. The fence, once in place, will create a much safer play space. I used my previous research experience to determine the most economical option for materials, while surveying and mapping the area in order to make an accurate cost estimate for the project. My experience with researching the fencing has given me a much better idea of what regulations, codes, and practices organizations need to follow, even for something that seems as straightforward as fencing. I also completed a grant application for playground equipment that could be used in the children’s area.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
Research Fellow: Regina Pimentel Perez Olagaray (2018)  
Concentration: Geology

Faculty Mentor: Karen Harpp  
Department(s): Geology; Peace and Conflict Studies

Title of Project: Are you There Plume? It’s me, San Cristóbal

Project Summary:

San Cristóbal measures 570 km² and is the easternmost island of the Galápagos Archipelago. On the basis of magnetic stratigraphy and K-Ar ages, both parts of the island emerged at least 2.3 Ma m.y. ago (Geist et al., 1986). The SW volcano is a 730 m high, heavily weathered and vegetated shield, with cliffs along the south coast. The NE volcano is lower in elevation than the SW shield and dominated by fissure-fed flows. Two large palagonite cones are preserved along the coast, and at least 4 are located several km inland. Either a water source existed during the formation of the inland tuff cones, or the coastline differed from its current configuration at the time the cones were active. On the western flanks of the NE volcano, there are at least 5 preserved, sparsely vegetated flows that are significantly younger than the rest of the island, abundant with spatter cones and numerous ENE-aligned fissures (Mahr et al., this meeting).

Incompatible trace element ratios indicate that melts from both volcanoes are produced by variable extents of melting of the mantle source, but did not homogenize extensively prior to eruption. Both volcanoes display flat to light-REE enrichment patterns. On the NE volcano, however, lower Sm/Yb ratios suggest that melts were derived at shallower depths than those from the SW. Average depth of melting at San Cristóbal is comparable to that of Floreana, unlike other eastern islands. Major element analyses reveal a narrow range of primitive Mg# values (55-75), indicating that melts underwent low amounts of crystallization. Most lavas experienced olivine and cpx crystallization, with plagioclase crystallization slightly more prevalent in the SW. Incompatible trace element ratios indicate that the mantle source for San Cristóbal is a mixture of those supplying Fernandina (plume) and FLO (ancient recycled oceanic crust; Harpp et al., 2014), which contrasts the more depleted mantle signatures in the rest of the eastern Galápagos. Furthermore, FLO influences the NE volcano more than the SW structure. The NE volcano has primitive lava, with a Mg# over 70, while the SW evolved lavas range in Mg# from 65-48. San Cristóbal appears to be part of a province of volcanoes that have experienced similar wide variations in chemical compositions in as little as 2 million years of volcanic activity (i.e., Santiago, Santa Cruz).

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): National Science Foundation
Research Fellow: Emmanuel Poku (2019)  
Concentration: Undeclared

Faculty Mentor: Jason Meyers  
Department: Psychology; Neuroscience

Title of Project: Retinal development using zebrafish as a model

Project Summary:

Zebrafish are a very interesting organism. They regenerate limbs, retina and other parts of their body after sustaining significant injury. My research focused more on the retina. The retina if severely injured in a zebrafish, can fully regenerate within two to three days. My area of interest within the retina was the developmental stage. I was curious as to how important some developmental features would affect regeneration later on when the zebrafish became adults.

During the summer I mostly worked with the LY-411 drug which is a γ-Secretase Inhibitor. The LY-411 is a notch inhibitor and notch signaling has been identified as a very important pathway during regeneration. I inhibited notch in zebrafish that were about 24 hours old. The fishes were fixed in Ly and a control (DMSO). The results and effects of the drug were analyzed by first cryostating and then performing immunochemistry.

In the retina I focused mostly on how much the LY drug affected the photoreceptors and glia. After weeks of continuous trials I finally got the results I had been expecting. The figures below are a summary of the results. The photoreceptors that received the Ly drug were distorted during development and did not form the “clean” semi-circle shape that the control (figure 1) formed.

*Muller glia which is very important during regeneration was also affected by LY. Next I hope to inhibit WNT signaling which also plays a role in regeneration. The ultimate goal however is to eventually have the fishes receive the drugs during their developmental stages and then track them to see whether their regenerative capabilities are affected. The big picture is to learn exactly how the pathways in zebrafish, which are also in mammals, are activated and the variables which affect it so that they can be eventually be applied to humans.

☒ Other (specify): Science and Math Initiative-SMI

Figure 1. These are the control photoreceptors (DMSO).  
Figure 2. These photoreceptors received the LY drug and was clearly affected.
Research Fellow: Stephanie “Steph” Poland (2017)

Concentration: Political Science

Faculty Mentor: Julie Dudrick

Department: Upstate Institute

Title of Project: Consumer Bankruptcy Law Project

Project Summary:

This summer I had the opportunity to work at Legal Aid Society of Mid-New York (LASMNY) on the Consumer Bankruptcy Law Project and work directly with attorney Susan Conn, who created the project and also graduated from Colgate in 1979. LAMNY is a not-for-profit law office that offers free legal advice, information, and representation to individuals that cannot afford an attorney. The work done at LASMNY is important for the individuals that live in mid-New York because unfortunately many people are below the poverty line, and without LASMNY many residents would be unable to receive legal aid on civil (non-criminal) cases. LASMNY specifically serves the following counties: Broome, Cayuga, Chenango, Cortland, Delaware, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego and Otsego. Although there are multiple counties LASMNY serves, legal information is readily accessible due to the helpline that provides interpreters and offers over one hundred fifty languages, so that individuals from all backgrounds can receive legal advice. LASMNY offer advice regarding immigration, housing, employment benefits, family matters, domestic violence, welfare, debt issues, and bankruptcy.

Although Legal Aid Society addresses multiple issues, I specifically worked as a student paralegal on the Consumer Bankruptcy Law Project. The purpose of the project is to increase bankruptcy representation for low-income residents. I was first educated in legal ethics and bankruptcy law, and then once I received the adequate training, I went through all of the client’s forms and put the information in the corresponding bankruptcy schedules. Obtaining the information can often be a complex process because I must go through pay stubs as well as expenses, make sure all property is listed, and also identify the original creditor in a debt. Identifying the original creditor can be complicated because a credit card company will often sell the client’s debt to a debt collecting agency and the debt collecting agency must be listed as an additional notice. The debts must also be identified as collateral. Collateral is property that a creditor can take if a debt is not paid. Creditors without collateral are unsecured.

Once the information is properly separated, a series of phone interviews and face-to-face meeting were conducted to assure that the information was correct. While in the process of conducting interviews, I also manually input all of the date into the BestCase Bankruptcy Software, which is the software that helps create the electronic bankruptcy schedules. Schedule AB lists property, Schedule D lists all secured debt (such as a home or car), Schedule J lists expenses, Schedule I lists all forms of income, and Schedule F lists all unsecured debts (such as credit cards).

I additionally wrote a memo to a private attorney advocating for the case to be taken pro bono. The memo included the client’s background, financial debt, and any other crucial information the private attorney must know before taking the case. Before the case was sent off to the pro bono attorney I assisted the client while he or she took the online consumer counselor session, which is a prerequisite for filing for bankruptcy. Throughout the project Susan Conn oversaw each step and provided legal advice that only an attorney could give. The Consumer Bankruptcy Law Project truly allows clients to have a fresh start that they would not have been able to receive without the help of Legal Aid Society.

Title of Project: An Analysis of Bird Migration Patterns in Madison County using Citizen Science

Project Summary:

Bird migration represents a significant physiological challenge and is a contributing factor to oxidative stress; increasing ambient temperatures due to global climate change may add to birds’ physiological burden. An analysis of bird migration patterns in Madison County was completed utilizing the citizen-science network eBird and correlating these patterns to historical temperature data using weatherunderground.com.

The maximum, minimum, and mean temperatures in Madison County changed significantly over the past 45 years in Rome, NY, congruent with patterns of global climate change. Species of birds sighted in Madison County from 2010-2015 (N = 195) were categorized into year-round (N = 47), one-stop (N = 109), and two-stop groupings (N = 39) based on eBird sightings. For bird species in the one-stop category, the following observations were analyzed in relationship to temperature variables: first date seen/arrival date, last date seen/departure date, and number of days in Madison County. For bird species in the two-stop category, the aforementioned relationships were investigated for both the species’ first stop and second stop in Madison County. For one-stop and two-stop species, the greatest predictor of the number of days species’ spent in Madison County is the maximum and minimum temperature for the time spent in Madison (Figure 1).

Figure 1. A breakdown of the relationships analyzed for one-stop and two-stop birds. Linear regression tests using SPSS statistics program version 24 were completed for each relationship listed. Linear relationships were considered significant if p < 0.1. The number of significant species for each relationship is denoted in the figure.
Title of Project: Marijuana Use in Madison County

Project Summary:

My community partner for the summer was BRiDGES, the Madison County Council on Alcoholism and Substance Abuse located in Oneida. BRiDGES has for mission improve the quality of life of the residents of Madison County by providing services directed towards the community, as well as the workplace, families and individuals affected by addiction or abuse of different substances. They provide education, intervention and prevention through their many different programs.

My project for the summer looked mainly at marijuana use in Madison County. Because of the recent legalization in different states, namely Colorado, Alaska and Oregon, marijuana has increasingly been in the spotlight. The goal of my research was to gain a better understanding the public perception of marijuana, as well as the overall consumption of marijuana by residents of the county. In order to get this knowledge, I distributed over 180 surveys to residents of Madison County. These short surveys touched upon many aspects of marijuana, namely the rate of consumption, favorite method of consumption, as well as perception of risk and views on potential legalization. After a thorough analysis of the results, a few important conclusion came about. First, adult marijuana use in Madison county has very low occurrence, and alcohol is still far more commonly used by the residents of the county. That being said, residents responded in a majority saying that it was their belief that alcohol was more harmful to consume than marijuana. Perhaps the most important finding of this research was that an overwhelming 68% of respondents are in favor of the legalization of marijuana in New York State, even though a vast majority of those respondents don’t even use marijuana. Below is a graph that shows the percentage distribution of respondent’s answers to the question of marijuana legalization in New York State. Note that only 18% of respondents said that they were against the legalization of marijuana. This research will be useful for BRiDGES since it provides them with a better understanding of what the public perception is on Marijuana, and allows them to adapt and modify their approach to dealing with the use and abuse of marijuana.

Research Fellow: Ashlea Raemer (2018)  
Concentration: Environmental Studies

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Field School Fellow with Madison County Agriculture Economic Development

Project Summary:

Madison County Agriculture Economic Development (AED) was created in the form of an AED Specialist, housed out of Madison County Cornell Cooperative Extension, in 2006. This position was funded by the county as a result of 2005’s Madison County Agriculture and Farmland Protection Plan, which pointed to Agriculture Economic Development as a main goal. Today Madison County AED focuses on assisting local farmers of all experience levels, attracting new farmers to the area, and marketing Madison County agriculture to the community and beyond.

This summer I mainly focused on the marketing aspect, specifically focusing on agritourism in Madison County. My work with AED consisted of three main projects: assisting with the preparations for and analyzing survey data from Open Farm Day (an annual event in which farms throughout the county open themselves up to the public for a free day of tours and activities), developing a new agritourism program, and developing a Madison County farm directory.

The agritourism program I created will be a season-long program that complements Open Farm Day while putting more of an emphasis on purchasing from local producers. With the shift to a focus on purchasing we hoped to better promote local purchases in a way that could be sustained past the end date of the program. This shift also allowed us to include producers who may sell at local farmers’ markets or other vendors, but do not want people visiting their farms. By the end of the summer we had an outline of the potential program put together and the hope is for the program to start in Spring 2017.

For the creation of a Madison County farm directory I created forms to be distributed to farms that are potential participants after researching what would be the most important or useful information to include in a directory. The format of this directory will be a searchable online format with an interactive map to allow people to find their farmers as easily as possible. Along with the new and existing agritourism programs the farm directory aims to get more people to spend more money and develop a relationship with their local producers.

☑ Other (specify): Upstate Institute
Title of Project: Observing Molecular Clouds in the Infrared

Project Summary:

In the summer of 2016, I worked with Dr. Jeff Bary and three other students at Colgate University. Our research was on examining the spectra of stars behind dark molecular gas clouds. In our galaxy, there are regions of space where gas and dust is very dense, so much so it is impossible to look through with the light our eyes see. These clouds are gravitationally unstable and will eventually collapse, causing new stars to form. This is how our sun and every other star we know about was formed. It is useful to look at these dust clouds with near infrared light, simply because this light passes through the dust to help us see beyond the cloud at the stars behind it. These molecular clouds block all visible light from the stars beyond it, therefore we call that the extinction of light.

We did not care as much about actually seeing the stars as much as we wanted to obtain their spectra to determine their spectral type. This is called spectroscopy and it breaks up the light from a star into specific wavelengths. It is important to find the spectral type of a star because it determines how bright it is and its color. Since the dust makes the star behind it appear more red (called “reddening”), we could determine thicker parts of the dust cloud by how red it appeared to be. The empirical extinction law is a change in extinction with respect to its wavelength. The normal extinction law used is $A(\lambda)/A(V)$. Unfortunately, this can only be used for the interstellar medium, which gives us a value for the change in apparent magnitude (how bright it appears) over its visual extinction. For dense molecular clouds, we have to use the equation $\log(A(\lambda)/A_k) = a_0 + a_1 \log(\lambda) + a_2 \log^2(\lambda) + \ldots + a_n \log^n(\lambda)$, which is much more useful because $A_k$ is the extinction of a star at longer wavelengths, which we have to do in order to see the stars at all.

In late June, we travelled to Sunspot, New Mexico to collect data at Apache Point Observatory. For four half nights, we were able to observe the clouds L429C and CB188. We collected the data by a method called ABBA nodding. What that is, is we have the star on the left side of spectra slit (A position) then move it to the right side of the spectra slit (B position). For near infrared spectroscopy, it is important that you do this ABBA nodding because when you do the data reduction, you can combine the AB pairs together to make a better signal to noise ratio. After we collected the data, we used a software package called TripleSpec that helped us extract the spectra of stars we viewed at Apache Point.

To check our data reduction, we had two students extract the data separately and did a linear fit of the spectra using the computer language IDL. A lot of what we saw was that the signal to noise was much lower in the stars closer to the center of the dense molecular clouds due to them being denser at their center so it is harder for light from the stars behind it to pass through.

Research Fellow: Marissa Roberge (2017)  
Concentration: Peace and Conflict Studies

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: One World Artisan Micro-Enterprise Project

Project Summary:

The Mohawk Valley Resource Center (MVRCR) assists refugees, immigrants and LEP individuals with the community integration process by providing ESL classes, immigration and citizenship services and legal consultation in addition to programs designed to help individuals achieve independence and self-sufficiency. As an Upstate Fellow I worked the MVRCR to develop a program called One World Artisans that was focused on micro-enterprise growth within the refugee and immigrant community. The motivation behind this program began as way to help refugees become self-sufficient by creating a source of supplemental income that also allows them to continue to practice a traditional craft. By aiding artisans’ growth through micro-enterprise and introducing their products to the broader community of Utica for sale, the hope was also that this program would build a bridge between the refugee population and the city.

There is demand for this type of enterprise and integration of immigrant and refugee communities in Utica as 18.3% of population is foreign born, 27% of households speak a language other than English, there is a 30% poverty rate and 17.5% unemployment rate. To research and design the most effective way to develop a program with a successful educational and economic component I partnered with members of the community which included Utica City Hall and the ThINCubator. My individual researched consisted of reading about similar micro-enterprise programs for refugees to better understand best practices and which have been the most successful business ventures. I organized a meeting with the West Side Bazar in Buffalo, NY where we were able discussed their business model and curriculum for educating the refugees in their community about American business practice. Additionally, I collected information about the social benefits participants could be receiving that may be influenced by their work with One World Artisans. Outside of this research, my role was to be the point person for this project while we registered the small business as an LLC, started the onboarding process and ran our first sale on August 1st at the Levitt Concert Series.

The final product was the creation of a cart rental program that will be stationed at local farmers markets or similar community centered events. Participants in the program will have the opportunity to perfect and sell handicrafts. They will be trained with a curriculum that ThINCubator and ourselves have created reviewing the basics of business. As participants wish to take on greater management roles within the microenterprise the classes will become more detailed. The program will have vendor (those creating the merchandise), street team (those selling merchandise via custom carts built by The Oneida Square Project) and apprenticeship (those taking a larger management role) components. Participants can determine their desired level of involvement. The program is made up of artisans representing the Somali-Bantu community, Iraq, Chad, Bosnia, Ghana, Sudan, Kyrgyzstan, Palestine, Belarus, Yemen and the Dominican Republic.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Upstate Institute
Title of Project: A comparative survey of social roles and community engagement of adults with and without disabilities in rural upstate New York

Project Summary:

This summer, I conducted a research survey for Pathfinder Village, a planned residential community that supports people with Down Syndrome and other developmental disabilities. Much has been written about the importance of community life and social engagement of people who have a developmental disability. It has been suggested that people with disabilities who live in community based group homes experience a higher quality of life and valued social role than do persons with disabilities who live in congregate living settings. Because Pathfinder Village is a congregate living community, meaning that only people with disabilities live in the homes, it was important to look into the similarities and differences between the lives of people with disabilities living in the Individual Residential Alternatives (IRAs) at Pathfinder Village and people without disabilities living in the surrounding area.

The survey that I conducted sought to measure the presence or absence of key elements that have been identified by previous research as contributing to a person’s quality of life, such as social activities, hobbies, friendships, levels of employment, travel opportunities, engagement in church or spiritual linkages, etc. Previous research has shown that an important factor in quality of life is filling social roles. Pathfinder Village wanted to learn whether people living in the IRAs within the village had comparable social roles, daily life activities, and community engagement to people without disabilities living in the surrounding area. My supervisor and I designed a nine question survey to examine the demographics, activities, roles, and barriers experienced by participants. The survey was administered to 32 adults (with and without disabilities) between the ages of 18 and 62 years of age who live within a 15-mile radius of Edmeston, New York, where Pathfinder Village is located. All 16 of the participants with disabilities are diagnosed with Down syndrome and live in an IRA.

Ultimately, there is no one set of social roles or daily life activities that make a good quality of life, because an individual’s preferences and identity play a key role. However, having meaningful social roles and opportunities to engage in preferred activities are important factors to assuring one’s quality of life. The survey found that people with and without disabilities share many experiences and social roles, such as going out to eat, using a computer, going out with friends or family, traveling to a new place, volunteering, being a family member, being a friend, belonging to a church or religious group, or belonging to a club. In some cases, people with disabilities living in the IRAs at Pathfinder Village had more experiences or roles that indicate a better quality of life, such as having hobbies, spending more time with friends, going to the movies, taking a class in the community, and having networks to learn about events in the community. The survey also revealed areas where there were evident differences in the responses of people with and without disabilities, notably access to transportation and the percentage of people with disabilities who saw themselves as voters.

When looking at the results of the survey, it is important to keep in mind that we were working with a limited sample size of 32 participants. Many participants were also referred to us by people with connections to Pathfinder Village, so this was not a random sample of the community in and around Edmeston. Despite these limitations, the survey found there was no significant difference in the overall daily activities or meaningful social roles between participant groups with and without disabilities. This suggests that the nature of congregate living settings is not necessarily limiting to the experiences of people with disabilities. My supervisor and I hope that this survey may help to inform current and future community living support models for people with disabilities.
In exploring why bathrooms have become the battleground for the transgender rights movement, we must consider the space of the bathroom, its history and its connotations of privacy in public. Through these considerations we can see a connection to gender and its significance in these spaces.

The physical construction of the bathroom creates a conundrum for privacy measures. Stalls are in place, but there is enough of a crack to see through. This leaves users to create their own methods for maintaining privacy, choosing what acts they are willing to commit in this pseudo-private space. There is visual privacy, but what about sounds and smells? There is an understanding that sounds and smells cross the boundary of stall doors, thus destroying the facade of visual privacy.

In the bathroom, we are forced into contact with the public while performing extremely private bodily functions. The demand for privacy means that tensions are high, and there is increased pressure to adhere to societal norms, particularly norms about how bodies look.

Judith Butler (1990) says that gender is performative. In this sense, Butler means that gender is an act, comprised of how we walk, talk, dress, and interact with others. Yet, it is important to note that this theory of gender is not just an individual actor performing. Gender is also performed by the viewer who judges certain actions and characteristics and codes these actions as masculine or feminine, man or woman.

Much like the tension of privacy in public toilets, there is a tension between private and public surrounding gender. If gender is how one feels, an internal sense of self, then gender is a private, personal conception. However, the way that gender exists in our society is extremely public. The act of deciding another person’s gender does not necessarily correspond to how they self-identify. It is exclusively based in their public appearance and societal beliefs of how men and women look. With tensions between public and private spheres surrounding issues of toilets and gender, gender-segregated public restrooms are a contentious topic.

While conceptions of gender and sex remain tied to the body, we remain tied to the idea that transgender people are somehow illegitimate imposters. Transgender identities are narrated from an idea that one was “born male and is now a woman.” What changed besides their body? They are the same person. This narrative of being “born in the wrong body,” may be simpler for cisgender people to understand, but it is easier precisely because it is rooted in a cisgender conception of gender and the body. This very idea that certain bodies are gendered a certain way is what must be challenged in order to fully understand transgender identities. There is no one way to be a woman, feminism has certainly introduced us to that. Now, can we expand that a little further? Some women are fat, some are tall, some kind, some mean, some hairy, some small! Some have penises. It’s that simple.
This summer my colleagues and I worked on a research project studying the blazar OJ 287. Blazars are a type of active galactic nuclei (AGN), which have a supermassive black hole at their centers, an accretion disk of gas surrounding them and jets of relativistic particles beaming from their cores. Blazars are known for their exceptional brightness due to the electromagnetically charged particles in the jets that release photons pointing almost directly towards the observer.

Blazar OJ 287 has been an object of interest for many years due to its high variability on different time scales. This summer we compiled data taken at Colgate University’s Foggy Bottom Observatory since 1989, through June 2016. Besides looking at multi-decade and monthly light curves, we also looked at microvariability of OJ 287, in other words, the variations in brightness on an hourly scale.

We intensely observed OJ 287 during February and March of this year in order to study the microvariability in the span of about four to five hours. The left graphs below show the brightness variations of OJ 287 in the span of several hours while the graphs on the right display the same information for non-variable comparison star. Due to mirrored fluctuations in comparison star on March 4-5, we believe that OJ 287 does not exhibit microvariability on that night. On March 29-30 the data shows that OJ 287 displays an overall upward trend but still does not exhibit any hourly variations.

Title of Project: Adhesive and Shell Interactions in the Eastern Oyster

Project Summary:

The Eastern Oyster (*Crassostrea Virginica*) form a reef by creates an adhesive, which allows the oysters to stick to each other, and their environment. These reefs play a vital role in protecting ocean ecosystems. Oysters extract their food from the water by filter feeding consequently cleaning up to 50 gallons of water per day and promoting better habitats for other organisms. The reefs also provide protection from storm surges, as their adhesive is strong enough to absorb storm energy but flexible enough to move so that the reef stays intact. And yet despite all we know about the Eastern Oyster, how exactly it creates this adhesive and how it affects the shells it connects remains a mystery.

This summer, we attempted to determine how the adhesive of the oyster affects the shells on either side of it. Using the light microscope, at 5x magnification, a map was built of the areas which to indent using the micro-hardness tester. The two samples, CVCS4 and CVCS5, were then indented at approximately 10 um intervals over three lines across the shell and the adhesive. Based on the length of the diagonals a hardness value was assigned to each indent. Since the hardness values vary based on their location on the shell, the light microscope determined how far each indent was from the adhesive and once matched up with hardness values when graphed begin to show a semi-logarithmic pattern.

![Figure 1: CVCS5 Distance vs. Hardness](image1.png)

![Figure 2: CVCS4 Distance vs. Hardness](image2.png)

Originally the thought was to use Scanning Electron Microscope (SEM) to take better pictures of the indents and conduct energy-dispersive spectroscopy (EDS). However, while the higher resolution photos of the indents allow for more accurate measurements of the diagonals and therefore hardness values, the preliminary results from EDS reveal nothing new or out of the ordinary in terms of the elemental composition.

As the indents get closer to the adhesive they cross an area of the shells made up of large prisms. The indents in this area are softer than the rest of the shell and create further cracks under the pressure from the indenter. The appearance of the fractures around the indentations in the prismatic area was unexpected and more intriguing, the decision was made to focus on fracture radii rather than use the SEM. Pictures of the indentations were taken at 50x magnification on the light microscope and the fracture radii were measured using the imaging software ImageJ. Future research will continue to study these fractures to determine whether or not there is a distinct pattern to the radii of the fractures compared to the distance away from the adhesive.

![Figure 3: Fractures in prismatic areas](image3.png)

Source of Support:  

- AHUM Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  

☑️ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Introduction: Allergic diseases, including asthma, allergic dermatitis, and hay fever, have become highly prevalent in developed Western nations since the 1960s, and now affect an estimated 20-40% of children. Atopic disorders are significantly less prevalent in developing nations, but in the last 30 years, the prevalence of allergy among children in developing countries has increased, becoming an emergent public health concern. Parasitic infection, particularly by helminths, is one of many environmental exposures that have been associated with atopic disorders. Geohelminth infection is very common in Ethiopia; the WHO reports that 32.45% of school-aged Ethiopian children are affected, and estimates more than two thirds of Ethiopian schoolchildren are at risk of developing an infection and require preventative chemotherapy. Despite a large body of research in this area and an established consensus that geohelminth infection is associated with atopy, the direction of the association remains unclear.

Objective: Investigate the association(s) between helminth infection and atopy in Ethiopian schoolchildren.

Methods: We traveled to Ethiopia for a 5-week data collection period, then returned to Colgate for the remaining 5 weeks to perform statistical analysis and synthesize our findings into a poster and epidemiological manuscript. Data was collected from 2016 Ethiopian children ages 2-16 in the town Batu (Ziway), located in the East Oromia region and East Shewa zone of Ethiopia, June 6th - 22nd 2016. Data collected comprised of 1) an interviewer-administered questionnaire for self-reported allergic symptoms (wheezing, asthma, rash, hay fever), demographic and selected lifestyle characteristics; 2) a stool sample collection direct stool exam to identify any active parasitic infection (both helminth and non-helminth infections); and 3) a skin prick test (SPT) for the common allergens German Cockroach (GC) and D. pteronyssinus (DP) to determine atopy. Upon return to Colgate, univariate and multivariate analysis was performed using binomial logistic regression in SPSS version 20 software.

Results: During univariate analysis, crude odds ratio values were calculated to identify significant association(s) between atopy and parasitic infection, and any confounding variables. During univariate analysis, maternal education was identified as a significant confounding variable for SPT reactivity (OR= 0.39, p= 0.00), so it was included in multivariate analysis. Multivariate analysis did not reveal any significant associations between atopy and parasitic infection at the \( \alpha = 0.05 \) level.

Conclusion and Recommendation: We suspect that the relatively low helminth infection prevalence in the study (19%) compared to an estimated nationwide prevalence of 33% (WHO, 2015) may contribute to insufficient statistical power. Interestingly, current deworming practices do not seem to be effective in preventing helminth infection. A majority of subjects (63%) had been dewormed in the last 6 months, but there was no association between deworming and helminth infection (OR=1.83, p=0.30). We will notify local health authorizes of this finding so preventative deworming practices can be modified for increased efficacy.

Keywords: parasitic infection, helminth, Ethiopia, allergy, atopy

Title of Project: ‘Make in India’ and its impact on the Indian Handloom Industry

Project Summary:

The Indian handloom industry is one of the oldest industries in the country, with its roots dating back to Ancient India. In India, handloom weaving is one of the largest rural activities, second only to agriculture, and it provides employment to 43 lakh (4.3 million) workers. It contributes almost 15% to total cloth production in the country, while 95% of handloom cloth in the global market has been produced in India. While the handloom industry is based largely in a domestic, household set up, it is widely dispersed across a large number of villages and towns within the country. It clearly constitutes an important sector in the Indian context. Yet the five-year plans of the Indian government have not offered any concrete solutions directly to the handlooms. An industry which has supported the total textile production and employment of the economy for decades has been severely undermined and is considered a part of rural enterprises for policy purposes. Therefore, the policies towards the handlooms have not been conducive to encouraging growth in the sector and have worked counter-productively. Schemes and policies like the New Textile Policy of 1985 have led to the growth of powerlooms and had a de-skilling effect on the weavers.

Apart from the above mentioned, the handloom sector faces many other challenges like the lack of market demand for their products and a large number of government interventions, which have oversimplified the product and process of this sector. The weavers are also dependent on government support and interventions, killing any potential spirit of entrepreneurship and competition. The ‘Make in India’ initiative can be a potential up lifter of this sector by creating more, indiscriminate opportunities in the economy. Spill over effects from supporting activities and initiatives of the government, namely ‘Skill India’, ‘Digital India’ and the ‘Brand India’, which are not directed to a specific industry but rather to the entire economy, are already showing positive results which could prove to be beneficial for the economy. The revision of certain trade policies and tariffs, to support the manufacturing activities will also direct better incentives and incomes to the handloom industry.

While Foreign Direct Investment (FDI) channelled in through ‘Make in India’ might have a negative impact on traditional, small scale industries, this paper aims to discuss ways in which the initiative can bring about a much needed, positive change to this industry. The aim of this paper is to understand the ‘Make in India’ initiative with respect to the handloom sector in India and how it might benefit this sector, both economically and socially.

Project Summary:

I had the immense opportunity of working with the Lampert Institute for my summer research project. My research investigated the challenges of standardizing traditional medicine in Tanzania. I conducted 17 interviews with healers in the capital city of Dar Es Salaam and rural Babati. Participant observations also formed an integral part of the research methodology. I am currently in the process of compiling a 50 page report which I plan to use as my basis for my African studies thesis. There is little contemporary research on traditional medicine despite of its widespread use in most developing countries and the unequal exchange of biomedical materials and knowledge that occur between the North and the South. It is my hope that this work will help to bridge that gap as well as problematize our understanding of ownership and knowledge.

Standardizing traditional medicine involves processing and packaging material at an industrial level, with standard dosages that can be summarized into monographs. These monographs can be included in national pharmacopoeias and allow for the formal integration of traditional healing with the national healthcare system.

At the moment, Tanzania recognizes traditional medicine but it is not integrated with the national system of healthcare. What this means is that doctors can not formally refer patients to traditional medicine practitioners. Through the national research hospital, the government is in the process of registering healers and their medicines so as to generate medicinal monographs. This process has not been very successful due to the reluctance of healers to participate. The challenges are many including poor funding, lack of outreach programs to rural areas and the abasement of the trade. However, the most salient challenge was the patent system that failed to protect traditional knowledge and biodiversity. Under the TRIPS Agreement generated by the WTO, traditional knowledge is considered “nonrival” in nature because its use by other parties does not diminish the consumption possibilities for others. There are a number of documented cases where traditional knowledge was the basis for generating pharmaceutical drugs, like the rosy periwinkle for cancer treatment, or Artemisinin. Consequently, traditional healers in Tanzania saw no benefit to registering their medicine given the precarious legal systems for ownership rights. In my conclusion, I urge that it is necessary to generate a sustainable relationship between the North and South. The North depends on the South for its biodiversity and knowledge, while the South depends on the North for capital. If both parties are to move forward, traditional peoples should be well compensated for their contributions.
Title of Project: Visiting the Bones: How Americans Construct Science and Meaning from Dinosaurs

Project Summary:

This research project investigates the meaning of dinosaurs within American culture through conducting surveys, interviews, and observations in museums. The knowledge of dinosaurs has shifted and grown with the discoveries of their remains. Through engaging in the research I noticed a sense of mysticism that people often ponder when they picture the immense size of these creatures along with the unfamiliar landscape where they roamed. I found that the idea that dinosaurs roamed the earth has caught on so much partly because these animals combine the elements of mythical and monster producing an effect of quasi-scientific fiction that sparks the interest of many people. Culturally, this same wonder has created an outpouring of dinosaur-related media throughout the country. People can learn more about dinosaurs through watching TV shows such as Dinosaur Train, visiting natural history museums, and touring dinosaur trails. Through studying how this interest in dinosaurs has spread, one can decipher the inner workings of our society regarding the characteristics it values. For instance, many people value large size and ferocity.

For the research, we traveled to Colorado and conducted our field research at museums and dinosaur trail sites in the Denver, Colorado area. This area is important due to its variety of dinosaur remains and the fact that the institutions, which display these remains, are reachable for a wide public. The information visitors learn at these sites is very eye-opening since it alters their perception of Earth and life. Also, from a more local standpoint, people who are living in the Denver area gain a deeper understanding of what happened in their area, which can change their perceptions of how they view dinosaurs in their daily lives. Dinosaur remains could be in their backyards!

We gathered the information regarding the public view of dinosaurs by conducting surveys with visitors that probed why dinosaurs are so fascinating and the images that came to mind when people think of these animals. From my experience, many people either said T-Rex or responded with a word related to dinosaurs’ immense size. We also transcribed interviews and tours, which delved into these same conceptions. Following transcription, we coded this material using coding software called MaxQDA. The codes that came up the most frequently for me were exoticism/anti-exoticism and nature. The first refers to discussion of the world today and how different it is from the era that dinosaurs were living; this code also refers to comments on how the world is still the same. The code nature probes into how people conceive of the cycles of the natural world: cycles that include evolution and geological processes that shape the landscape. Some of the viewpoints included that dinosaurs, especially T-Rex, were immense, violent, powerful and carnivorous. Others ideas were about the swiftness, intellect, and hunting prowess of Velociraptor. People also emphasized that both of these dinosaurs were different from animals we have today. Both nature and anti-exoticism came together during an interview with a museum worker who described the evolutionary connection between dinosaurs and birds. Dinosaurs feel less exotic to many people when they know about their connection to modern birds. However other people believe that dinosaurs are unlike the animals they know today. Varied viewpoints like this could have arisen due to the influence that the 2015 movie, Jurassic World, has had on the public perception of dinosaurs regarding how strangely people compared them to the animals of the present time.
Research Fellow: Natalie Smith (2017)  
Concentration: Geology

Faculty Mentor: Bruce Selleck  
Department: Geology

Title of Project: A Small River with Big Consequences: Examining Flat Creek’s Health through Macroinvertebrates and Water Quality

Project Summary:

This past summer, I was an intern with Carlin Girard, the Water Resources Specialist, at Teton Conservation District in Jackson, WY. TCD is a government organization focused on conserving the natural resources of Teton County. TCD is special in that it is based next to Grand Teton National Park and it is a publicly funded organization (unlike many non-profit conservation groups funded by donations). My main goal for the summer was to learn about the job of a water resources specialist (as I am interested in hydrogeology), about how a place like the Teton Conservation District works, and learn about/receive data on Flat Creek and its impairment. While I could not focus all of my efforts on Flat Creek (which is the subject of my senior thesis), I learned a variety of valuable skills that will help me on my senior thesis and received 20 years of water chemistry and macroinvertebrate (bug) data on the watershed. Throughout the summer I learned a variety of technical skills related to field work, data analyses, and general office work.

In terms of field work, I participated in parts of three studies related to hydrogeology. I helped deploy temperature loggers along Flat Creek at the beginning of the summer, which will monitor temperature fluctuations until it freezes in the winter. The second study I helped with was a nutrient loading study with the Teton Village Water and Sewer District on Fish Creek. In order to corroborate the results TVWSD finds, Teton Conservation District is studying the nutrients and chemistry of Fish Creek above and below the wastewater plant. While in the field, we measured pH, temperature, dissolved oxygen, and specific conductivity on site. We also took grab samples to send to a lab in order to test the nutrient content of the water for nitrates. It is pretty incredible that the wastewater plant dedicated funds in order to measure its impact on Fish Creek, without being forced to do so. Before and after the field work, I also participated in calibrating instruments and setting up data sheets. I helped with this study twice. The third project in which I assisted the field work was a stream impairment study also on Fish Creek, however it was done by the Wyoming Department of Environmental Quality with supervisors from the EPA visiting. Teton Conservation District is helping the Wyoming DEQ with the study which will decide if Fish Creek should be on the impaired streams list. This field work required the previous skills I mentioned, but also I took discharge readings. The way in which Wyoming DEQ recorded the data was much more specific and lengthy. The field work skills I learned were important and will help me in future jobs.

The data analysis skills were equally important. While there, I began to learn R statistical programming—a coding language designed for statistically analyzing large data sets like my senior thesis data set. I learned how to call for data from SQL server, how to reorganize data depending on what I am looking for, how to run statistical tests (like a paired t test), and graph the results of those tests. I also began to learn how to create maps in ArcMap—a GIS program. This is helpful for my GIS course this semester and for my senior thesis. The maps I created built skills including creating insets and manipulating labels. The in-office skills are beneficial professionally and towards my senior thesis.

Finally, throughout the summer I created a research project that, while not related to my senior research, was helpful towards TCD’s outreach program. The research looked into the many types of household and backcountry filtration methods and devices and discussed how to purchase the right one.

Overall, the internship was extremely beneficial towards my professional growth and towards gaining an understanding of how to begin my senior research—what to look for, how to organize it, and why it matters.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Doug Rankin ’53 Endowment-Geology Research
Determining the age of rocks from other planetary bodies is an essential part of learning about the history of our solar system. In this project, we are supporting the development of a mass spectrometer capable of spaceflight. This would allow us to perform in-situ dating on the surface of other planets. The advantages of in-situ dating include increasing the variety and number of samples we can analyze, decreasing the cost associated with sample return missions, and locating areas of interest to make further in-depth research more efficient and effective.

In previous work, it was determined that a more accurate age could be obtained from an isochron constructed using only points containing atomically light minerals. When points containing atomically heavy minerals were included, the dates become less consistent with the known age of the sample. Initially, we used Singular Value Decomposition to look at lower dimensional projections of the data and try to find groupings indicative of the mineral composition of each point. We wrote clustering algorithms based on the k-means and DBSCAN methods in order to filter out the points with heavy minerals. While this did generally sort the data based on mineral composition, we found points that should be qualitatively different were being grouped together because of variations in the strength of the signal being received by the mass spectrometer. This led us to take a closer look at the rubidium and strontium signals over time and allowed us to find some interesting patterns.

We discovered that our rubidium signals decayed over time where there should have been a consistent reading over time on our standard. Additionally, we showed that the strontium signals on the very same sample appeared to be oscillating over time where there should have again been a consistent reading.

For the mass spectrometer to ever get off the ground, these power readings must be corrected. In future research, we hope to account for these fluctuations in order to provide consistent results and improve the accuracy of our dates. We also want to expand our work on Rb/Sr dating while also exploring U/Pb dating and continue to compare our results with the known ages of other samples.
Project Summary:

In the observable universe, some of most luminous sources of light come from the cores of extremely far away galaxies, typically on the scale of billions of light years away. These objects are grouped together in a class of Active Galactic Nuclei called quasars, short for Quasi-Stellar Radio Source. These galaxy cores contain a supermassive black hole, which through extreme gravitational fields accretes a massive disc and a large jet, both of which accelerate particles and emit high-energy photons. Quasars that have jets that are oriented towards Earth go through especially intense fluctuations in luminosity in all wavelengths, and are called blazars. Quasars and blazars have been studied by scientists around the world for decades and have been observed at the Colgate Foggy Bottom Observatory since 1989. Towards the end of the summer, during a routine observation of the quasar PKS 1749+096, it was found to be brighter than usual, and since then, the quasar has been monitored almost every night and continues to be a top priority in the observing schedule.

PKS 1749+096 is a BL Lacertate type object with a base magnitude of about 17.5 magnitude in the R filter. On July 1st, 1749+096 was reported by NASA’s Fermi Space Telescope to be flaring in gamma ray wavelength, and we immediately began optical observations. The source has been observed to be steadily brightening for several weeks, going from a magnitude of 16.125 ± 0.022 to 14.895 ± 0.011, which corresponds to a threelfold increase in the observed flux of the quasar. Because of the relatively faint overall magnitude of the quasar, long term light curves from this year were generated by stacking individual images in groups of 12, and then analyzing the one stacked image to get a more accurate value for the magnitude.

Pictured below is the 2016 Light Curve of PKS 1749+096 in the R filter. Observations will continue on this object throughout the rest of the summer and into the fall.
Title of Project: Genetic factors contributing to coat color in poodles

Project Summary:

The domesticated dog, *Canis lupus familiaris*, is a particularly useful model organism for understanding complex genetic interactions due to the large amount of variation in appearance between breeds. For my project, I was interested in looking at genetic factors that lead to differences in coat color in poodles. In particular, I focused on white, red, and apricot dogs, which have dramatically different pigmentation that cannot be explained using our current model of the genetic factors that affect coat color.

In order to identify novel loci associated with white color variation, we performed a Genome-Wide Association Study (GWAS), which looks for genetic variants (SNPs) that correlate with variation in a particular trait of interest. Comparing white and black dogs, we found SNPs that were significantly associated with color (\(-\log(p)>7\)) on chromosomes 4 and 5 and SNPs that were slightly associated (\(-\log(p)>6\)) on chromosomes 2, 8, 10, 13, 16, 25, and 33.

We picked representative SNPs in the regions of highest association on chromosomes 4 and 5 and genotyped them in red dogs. Of the three SNPs we genotyped on chromosome 5, none showed a significant difference between white and red dogs. Of the two SNPs that we genotyped on chromosome 4, one showed a significant difference (\(p<0.01\)) between white and red (Figure 1). While we have not yet been able to link this SNP to a gene of interest, we believe that a causative locus is most likely linked to this SNP.

We also looked at the K locus, CBD103, as a potential cause of red coloration. In dogs, two versions of this gene (\(K^b\) and \(k^r\)) are typically found. Surprisingly, we found that the genotype frequency that we observed in red and white dogs did not match the frequency we would have predicted based on the Hardy-Weinberg equilibrium equation (Figure 2). For the white and red dogs, we saw a significantly higher number of \(K^b k^r\) individuals than predicted and no \(k^r k^r\) individuals. This observation is surprising because we would not expect selection to take place on the K locus for red and white dogs due to epistatic effects of another locus, E. We are currently exploring possible explanations for this finding with further experiments.

These findings have helped to further our understanding of the genetics of dog coat color and will serve as a basis for future research on the subject.

Source of Support: ☑ AHUM Div. ☑ NASC Div. ☑ SOSC Div. ☑ UNST Div. ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Crustal extension is a geologic process that stretches the crust of the Earth. This typically happens along a series of normal faults. Crustal extension can sometimes lead to continental rifting. The Basin Range and Province in the Western US is one region where crustal extension has occurred in the past 30 Ma. A series of extreme normal faults have produced metamorphic core complexes in specific locations along the Basin Range and Province. Metamorphic core complexes exhume mid-crustal rocks rapidly to the surface through ductile and brittle faulting. During this process these high-grade mid-crustal metamorphic rocks are placed below detachment faults. Studying rock samples from around the detachment fault provides an opportunity to study the timing, rate, and temperature conditions of crustal extension.

My specific research this summer focused on the Harcuvar core complex in Arizona. The goal of my research is to assess the direction and temperature of shearing of a ductile shear zone at the Harcuvar core complex. To determine this, I combined optical and scanning electron microscopy. On the scanning electron microscope, I used a technique called electron backscatter diffraction (EBSD) to measure the lattice orientation of calcite and quartz in samples from the shear zone to assess the presence and type of lattice preferred orientation (LPO) in these minerals. Ductile deformation can impart a preferred orientation of the lattice in these minerals and this crystallographic alignment can reveal information about the temperature and type of shear that occurred in these rocks. These techniques were also used to assess the recrystallized grain size of these shear minerals, which previous work suggests is linked to the differential stress applied to these materials during deformation. Preliminary results suggest that these shear zone rocks record extensional faulting at mid-crustal depths. Calcite LPO results suggest that shearing in the parts of the shear zone composed by marble continued to very low temperatures (~150-200°C) at shallow structural levels. Small measured grain size in these materials suggests relatively high differential stress during shearing, suggesting that these faults had relatively high frictional values and required high stress in order to slip. Overall, these results suggest that crustal extension in the region was to accommodate a large extent on weak metasedimentary mylonites such as marble mylonites, even to quite shallow structural levels.
Title of Project: Orthopyroxene Megacrysts in Adirondack Anorthosites

Project Summary:

The Adirondack Mountains of northern New York are known for consisting largely of anorthosite, a type of rock whose origin and formation remains a puzzle for the geologic community. It is distinct for consisting almost entirely of the mineral plagioclase feldspar \((Ca,Na)(Si,Al)_{2}O_{8}\). The current most widely accepted model of anorthosite creation involves the “ponding” of a magma chamber at the base of the Earth’s crust, where it borders the mantle. While the magma sat there deep in the Earth, it began to cool and crystallize pyroxene, olivine, and plagioclase feldspar. It is believed that for the most part, the pyroxene and olivine crystals sank away into the mantle because of their higher density. The plagioclase, which is slightly lighter than mantle melt, is thought to float, and could have risen to the top of the magma chamber and then continued to rise up through the lower crust. These plagioclase crystal mushes were then emplaced in places like the Adirondacks and the Grenville Province of Canada. It is important to note that the formation of anorthosite appears to have occurred only during the Mesoproterozoic period, around 1.5 to 1.0 billion years ago. The fact that the Earth can no longer make this type of rock only adds to the mystery of anorthosite.

As the masses of plagioclase rose up through the crust, it appears that caught up with them were some large crystals of orthopyroxene \((Mg,Fe)SiO_3\). These megacrysts contain small amounts of aluminum, the amount of which varies depending on the pressure, or depth, at which each crystal formed. By examining this variable aluminum concentration, we hope to learn about the journey the anorthosite took as it ascended through the crust. I collected field data and samples of orthopyroxene megacrysts from three localities in the Adirondacks: Cascade Slide, Bennie’s Brook slide, and Mt. Algonquin. I analyzed these samples using X-ray fluorescence spectroscopy, as well as the ICP mass spectrometer. By combining these data with data from a previous student worker, Michael Dubois, I was able to build a set of aluminum data that ranged from 3.24 to 8.3 wt% Al\textsubscript{2}O\textsubscript{3}. On the graph below, these data show a trend that is consistent with a similar study of the Egersund-Ogna massif in Norway (Charlier et al. J. Pet. 2010). The Adirondack data, however, match closely rocks from the margin of the Egersund-Ogna massif, which suggests that there is something different between the two bodies of anorthosite, but that they followed similar paths through the crust. Trace element data from the ICP-MS corroborates existing models of megacryst formation. Moving forward, a larger collection of samples is necessary to generate more conclusive results. A study of their isotope geochemistry would be one way of learning more about how anorthosite form and interact with the crust.

Figure 1. Graph showing weight percent alumina vs. Magnesium number, a proxy for extent of crystallization.

Title of Project: Using Lead Isotopic Dating to Date Rocks in Space

Project Summary:

This work assists the development of an in situ dating mass spectrometer for spaceflight. We hope to send this technology into space and determine the ages of rocks on Mars or the Moon, by measuring isotopic abundances using resonance ionization mass spectrometry. From measured isotopic ratios, we are able to compute the age of a rock. Originally, we focused on analyzing rubidium and strontium isotopes. For this project, I rewrote the software for data analysis so it could interpret lead isotopes, and the program can now be easily changed to work with other isotopic dating systems as well. We acquired lead isotopic data on samples from Earth, the Moon, and Mars, and compared the ages we obtained with published ages. We found agreement with reported ages determined by Pb/Pb dating, although, as in other studies, the Pb ages of our Martian samples do not agree with their ages determined from other radio isotopic systems.
Title of Project: Radiolaria of the Sabrina Coast, East Antarctica

Project Summary:

Antarctica and the Southern Ocean display some of the most prominent expressions of anthropogenic climate change. One consequence of changes in oceanographic conditions, including changes in seawater temperature and salinity, and shifting oceanographic currents, is change in the distribution of organisms living in these regions. This summer, I have been working with modern radiolarians along the Sabrina Coast of the East Antarctic continental margin, from a marine sediment core collected during research cruise NBP1402.

Radiolaria are classified as zooplanktonic protozoa and their skeletons contribute to the ocean floor’s siliceous composition. Early radiolaria identification and classification occurred in the mid to late 1800’s. However, it was not until the 1950’s they were reconsidered as distinguishing organisms for scientific study, and further interest in taxonomy was pursued.

This summer I worked on developing quantitatively accurate and efficient methods of processing sediment samples for paleoenvironmental work with radiolaria as well as beginning a catalog of species present in this region of Antarctica. Finding an appropriate methodology for radiolaria processing involved reading through scientific papers on previous Antarctic radiolaria studies, consulting with a current radiolaria specialist, and testing a variety of approaches based on previous practices. In my processing experiments, I sampled with different weights of sediment, sieve sizes, settling times, and draining procedures, using common micropaleontology laboratory equipment. Using the microscope slides I produced from processing trials, I photographed images of radiolaria and began familiarizing myself with and identifying species, genera, and common forms. I used Antarctic radiolaria taxonomy literature and catalogs, images and descriptions from previous Antarctic radiolaria researchers, and online databases. As I continue to catalog radiolaria specimen from these samples, I will use existing information on diagnostic species to mark the presence of changing ocean properties. Radiolaria species exist at different depths in the water column and among unique bodies of ocean water and current. Identifying species from particular assemblages, such as a deep-water assemblage versus a shallow water assemblage, will help identify changes in water mass distribution that may be key to understand controls on glacial melting. In particular, deep-water assemblages provide insight into the movement of currents along the ocean floor. An important water body of the Antarctic region is Circumpolar Deep Water (CDW). Its temperatures are slightly warmer than shallow and intermediate Antarctic water bodies. Thus, when CDW is pushed up through the water column along the continental shelf, it can cause sea ice and glacial melting along the coast. My preliminary work reveals the modern presence of radiolarians that are more common to deeper water zones and CDW. My species catalog will help with future identification and data collection from these samples, which will help to better understand the represented species assemblage and their diagnostic properties.

☒ Other (specify): National Science Foundation
Title of Project: Sustainability at the Glimmerglass Festival

Project Summary:

The Glimmerglass Festival is a summer opera festival that takes place in Cooperstown, New York. The organization grows from 30 full-time staff to over 300, including artists, interns, and specialized staff to produce four main operas and a number of side performances. The festival was interested in understanding how they could improve environmental sustainability in their operations, specifically in regards to water, electricity, and waste. Because this was the first project at the festival focusing on sustainability, a number of observations and recommendations were included in the final report detailing how the festival can be responsible for their natural environment. Overall, the festival can include upgrades in water fixtures, lighting, and waste streaming, as well as taking on a number of projects that would both save money, increase environmental sustainability, and act as effective marketing techniques for the opera.

The festival houses the majority of summer staff in donated residential buildings (six in total). Additionally, another nine buildings are commercial in nature and function to ensure sufficient production of the operas. To determine electricity usage throughout the festival, municipal bills were obtained for the fifteen major buildings, and two major metrics were studied. Performance was measured in terms of kWh/square foot, or the efficiency of each building. This was obtained by dividing the average kWh usage by the size of each building. This metric is easy to compare across all fifteen buildings, and gives the organization an idea of how each building is performing relative to another. ENERGY STAR portfolio manager was utilized to determine the Green House Gas emissions (GHG) that each building emits into the atmosphere. This metric detailed the impact the building has on the environment, and can be compared to other buildings nationwide. Building walk-throughs were completed to determine what lighting upgrades could be made throughout the festival.

Water usage was a combination of municipal bills and building walk-throughs. Most buildings at Glimmerglass run off of a well and have no meter, so determining water usage is very difficult, and the help of a professional would be required. Four buildings were studied from municipal bills. All buildings were examined for upgrades in water fixtures, including faucet aerators, low-flow toilets, and shower heads. It was estimated that changing the faucet heads in one building would save 40 gallons of water per day.

Waste was examined in regards to infrastructure in each building. It was recorded which buildings had good containers for recycling and waste, and which buildings needed better signage and more room for waste. Concessions was also studied in detail to determine how the festival can create a clearer system for recycling and garbage. Recommendations for best practices were made based on these observations. It was also an important step to detail what exactly can be recycled in Otsego County.

Overall, the potential for sustainable initiatives at Glimmerglass is as endless as stakeholders choose. The company should first focus on money-saving initiatives, including lighting and water upgrades, and implement more recycling infrastructure. In the future, Glimmerglass could go as far as to install solar panels, host zero waste dinners, and be a major leader for environmental sustainability in the future.
Research Fellow: Samuel “Sam” Timothy (2019)  
Concentration: Undeclared  

Faculty Mentor: Martin Wong  
Department: Geology  

Title of Project: Geochemistry of samples from the Harcuvar core complex, AZ  

Project Summary:  

Crustal extension is a geologic process that stretches the crust of the Earth. This typically happens along a series of normal faults. Crustal extension can sometimes lead to continental rifting. The Basin Range and Province in the Western US is one region where crustal extension has occurred in the past 30 Ma. A series of extreme normal faults have produced metamorphic core complexes in specific locations along the Basin Range and Province. Metamorphic core complexes exhume mid-crustal rocks rapidly to the surface through ductile and brittle faulting. During this process these high-grade mid-crustal metamorphic rocks are placed below detachment faults. These features are controversial because of the high rate and magnitude of extension focused in these regions.  

Large magnitude extension in this region has exposed rocks that were formerly in the middle crust, providing a window into processes that take place at these depths. Much of the footwall of the core complex consists of plutonic rocks that are mainly Jurassic or Late Cretaceous in age. While previous work has constrained the age of these igneous units, little research has been conducted on their chemical composition, which may provide insight into the source(s) of melting and igneous processes that affected the melt after it had formed. This project conducted X-ray fluorescence spectrometry (XRF) on these samples to constrain their major and trace element composition. Although trace element analyses are still in progress, major element analyses indicate that both Jurassic and Cretaceous samples have high (>70%) SiO₂ contents, as well as high Al₂O₃ contents (13-16%). The high Al₂O₃ content of these samples is somewhat anomalous. To further assess this, we calculated the aluminum saturation index (ASI = Al₂O₃/(Na₂O+K₂O+CaO) of these samples, which ranged from 1.3-1.6 for all of the samples. This characterizes the samples as peraluminous granites. This geochemistry, together with the presence of igneous garnet and muscovite suggests that these melts may have been the result of melting of peraluminous sediments, such as pelitic shales. These results may support a model of crustal thickening during the Sevier orogeny, which triggered heating and local melting of the crust. It is unclear why Jurassic granites have the same geochemical signature, although they may also have melted from the same source.  

☒ Other (specify): National Science Foundation  

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Title of Project: Characterization of the dpy gene in let-7 biogenesis and *C. elegans* development

Project Summary:

Caenorhabditis elegans is a model organism used to investigate several biological processes common to other organisms, such as developmental timing. The project aimed at investigating a mutation of the worm *C. elegans* which results in dumpy (short and fat) worms and worms with roller phenotype when bred with wild-type worms. We investigated which genes had led to the mutation and whether or not the development of the worm was delayed or precocious. We limited the potential genes responsible for the mutation to three genes, Cuti-1, Dpy-14, and Let-607. We also determined that the mutation affected several microRNAs which are responsible for developmental timing in worms.

Previous work in the Van Wynsberghe Lab via SNP-SNP mapping allowed the localization of the mutation to two regions (12.1-12.4 Mbp and 6.3-6.9 Mbp) on Chromosome 1. As part of the project, we looked up published RNAi screens, focusing on genes whose knockout led to either roller or dumpy phenotype. These genes were compared to the two target regions of Chromosome 1. Only 3 genes - Cuti-1, Dpy-14, and Let-607 - fit both criteria. The potential genes were PCRed from Genomic DNA of both N2 (Wild Type) and dpy (Dumpy) worms. The samples were compared via electrophoresis but the bands for the Dpy and the N2 were the same. This indicated that no significant insertion or deletion was present in the Genomic DNA. Though there still is the possibility that significant mutation at the sequence level affects the gene function.

Seam cell fusion is one of the markers of proper development in *C. elegans*. The developmental timing of the worms was investigated using the wIS79 strain which allows for marking of seam cell borders and seam cell nuclei. RNA interference (RNAi) of heterochronic pathway members that would lead to either precocious (more fusion) phenotype or delayed (less fusion) phenotype were used to investigate the interactions of the mutation with the heterochronic pathway. The worms seam cells were analyzed at two time points, 28 hours and 40 hours. This was done for 10 worms for each RNAi for 40 hours and 20 worms for 28 hours. The viable data showed that the development in the mutant is retarded and that the dpy mutation interacts with lin-29 and lin-41 as the change in phenotype between the wild type and the mutant for those RNAi differed.

In the future, we will need to investigate the cDNA and then genotype the worm to verify which gene was mutated. Additionally, more samples of worms should be investigated with the wIS79 so that more viable data can be found.
Research Fellow: Talitha Angelica “Angel” Trazo (2017)

Faculty Mentor: Padma Kaimal

Title of Project: Visuality, Story-telling, and Movement at the Kailasanatha Temple, Kanchipuram

Project Summary:

My role as a student researcher was to collaborate with Professor Kaimal on creating technical illustrations for her manuscript on the Kailasanatha Temple. Dating back to 685-706 AD, the Kailasanatha temple is the oldest structure in Kanchipuram, a city located in India’s southern-most state of Tamilnadu. The Hindu temple is laden with ornate monuments. These monuments, in the form of carved sculpture and painting, cover the interior and exteriors of the structures within the temple.

Professor Kaimal’s research focuses on the significance of the temple’s structures (prakara, mandapa, vimana, linga shrines) and figures on, within, and around these architectural structures. An important goal of our diagrams is to show viewers how to move throughout the temple. When visiting a Hindu temple, the order by which one views the monument is very important, as many monuments tell stories. Thus, as well as orienting viewers and scholars, our diagrams also act as Kaimal’s visual evidence as she highlights the historical, royal, and religious stories, visual patterns, and themes conveyed throughout the temple. A main theme she argues about in her text is mangala versus amangala, which in Hindi means auspiciousness and inauspiciousness.

The challenge I faced as a graphic illustrator was translating the Kailsanatha Temple, a three-dimensional place, into two-dimensional illustrations. Illustrations were created using Adobe Photoshop and Illustrator and incorporate floor plans and photos from Kaimal and her fellow scholars. These challenges were rewarding as they sharpened my knowledge of these digital platforms. In addition, this research was a great experience as it enhanced my ability to create clear, informative visuals; it’s like storytelling without words. In art history, the most important evidence you have is visual evidence, and I was glad to have played a role in helping support Professor Kaimal’s arguments through my illustrations. Working with Professor Kaimal was a joy as she is highly passionate about her work, and I am happy to have been part of her research team this summer.

Project Summary:

New York State data on opioid use is currently being compiled at Bassett Research Institute, in collaboration with the Upstate Institute, to better understand the extent and factors contributing to the prescribed opioid and heroin epidemic. The data, some from government sources, such as SPARCS (Statewide Planning and Research Cooperative System), as well as OASAS (Office of Alcoholism and Substance Abuse Services), will help increase knowledge and understanding about opioid use, overdoses and hospital admissions related to opioids and may provide guidance for development of additional treatment programs.

This is a data collection and analysis project for all of New York State to help Bassett better understand the geographic and spatial changes in the epidemic over time. Our opioid research team is currently reviewing data to gauge I-STOP's effectiveness. I-STOP (Internet System for Tracking Over-Prescribing) is an expansion of the NYS Prescription Drug Monitoring Program (PDMP) Registry that took effect in 2013. The registry allows clinicians direct access to view dispensed controlled substance prescription histories for their patients. The information helps practitioners to more effectively evaluate their patients' treatment with controlled substances. It is intended to decrease the volume of prescriptions written for controlled opioids.

“As opioid use is impacting many families, it's important to review available data to see where its use is becoming worse, what the trends are and then try to get treatment programs in place," notes Moira Riley, PhD, junior research investigator at Bassett Research Institute. "We're plotting trends over time to see if there have been any changes since I-STOP's implementation. The results are being submitted to a peer-reviewed publication to share these findings. The opioid epidemic has national relevance and it is important for these findings to become a part of the national conversation.”

We are also using GIS mapping (geographic information systems), to map the SPARCS data to reveal the distribution of opioid and heroin problems statewide. With geospatial mapping we can analyze and model how events of opiate-related morbidity have spread over time and space throughout New York State and also determine if there is a relationship between the supply of particular retail opioids and opiate-related morbidity. What's coming through is that opioid morbidity is spreading from more urban to more rural areas, and even though opioid morbidity seems low in rural areas, when considering the low population density in rural areas, the proportion is as high in some rural counties as it is in more densely populated urban areas.

Research team member Richard Brown, MD, attending physician in Psychiatry at Bassett, says, "The prescription opioid and heroin epidemic is likely the most important story in health care in the last 15 years. There are many groups within Bassett that are working very hard at safe prescribing and an overall reduction of opioid use, easy access to medication return and safe disposal of unused medications, making Narcan readily available, as well as medically assisted treatment (MAT) and therapy for addictions available to our patients. Hopefully, these clinical efforts will be supported and informed by the ongoing research efforts.”

Future studies will examine prescribing patterns and how they impact rates of opioid and heroin overdoses. Compilation of this data is important as heroin use has increased among most demographic groups and is of epidemic proportions in our country, particularly in economically disadvantaged rural areas.

Research Fellow: Francesca Viola (2017)  
Concentration: Biochemistry

Faculty Mentor: Roger Rowlett  
Department: Chemistry

Title of Project: Cloning, Overexpression, and Purification of Silicase Carbonic Anhydrase Domain

Project Summary:

This project builds off of Megan Tigue’s work with the silicase protein. Silica is one of the most chemically robust substances on the Earth but can be broken down to silicic acid by a protein called silicase. Silicase is found in the siliceous sea sponge *Suberites domuncula*. Previous studies have found that one of the two domains in silicase resembles that of α-carbonic anhydrase, which catalyzes the reversible conversion of carbon dioxide and bicarbonate in many mammals. Examining the structural and functional similarities between silicase and carbonic anhydrase would allow for further investigation of the application of silicase in fields such as industry and medicine.

After the overexpression of silicase in *E. coli* cells, a significant amount of inclusion bodies formed. This complicated the production of the silicase enzyme and required testing different cloning and overexpression conditions so that a more efficient procedure could be developed. Instead of cloning the silicase carbonic anhydrase domain (SiCASEDOM) into a PRRX vector, it was cloned in to a pET-14b vector with a His Tag through a restriction digest followed by ligation. Cloning into the pET-14b vector is highly efficient and the His Tag is useful during purification of the protein. These adjustments could potentially reduce aggregate formation and increase protein yield.

SiCASEDOM was amplified through basic PCR and the products were used in a restriction digest. The restriction enzymes NdeI and BamHI were used to cut both the pET-14b vector and the SiCASEDOM PCR products at restriction sites. Both the pET-14b digest product and the SiCASEDOM digest product were purified using a Zymo Research DNA Gel Recovery kit. A Quick Ligation technique was used to stitch the two digest products together. The tube was incubated at room temperature for 5 minutes and was stored in the -20 °C freezer for further processing.

![Figure 1. Electrophoresis Gel of SiCASEDOM PCR products. The bands appear at the predicted molecular weight (approximately 870 bp)](image_url)

Lane 2: 100 bp ladder
Lanes 3 & 4: SiCASEDOM FL + RS PCR products
Lanes 6 & 7: SiCASEDOM FS + RL PCR products

Title of Project: Investigating the Role of lin-42 in the Germline Development of *C. elegans*

Project Summary:

*C. elegans* is a simple model organism whose sequenced genome and short life cycle of three to four days make it ideal for experimental research. *C. elegans* development includes a brief period of embryogenesis, four larval stages separated by a molt, and finally an adult stage. These organisms exist most commonly as hermaphrodites, whose gonad arms include oocytes and sperm, allowing for self-fertilization. Male *C. elegans* exist at a lower frequency and can be bred in the lab for crosses. During *C. elegans* development, germ cells maintain proliferation via mitosis at a stem cell niche known as the Distal Tip Cell (DTC) and enter meiosis only after migrating away from the DTC in a process known as the mitosis/meiosis switch.

*Lin-42* is a regulatory gene implicated in the germline development of *C. elegans*. As a member of the heterochronic pathway, *lin-42* expression oscillates between the four larval stages of development and regulates molting. *Lin-42* regulates development by transcriptionally repressing various miRNAs and is expressed in the DTC as well as in sex myoblasts and vulval precursor cells. Its expression pattern in the DTC is indicative of its role in regulating germline development. Previous work done in the Van Wynsberghe lab indicated that the number of cells undergoing mitosis was significantly reduced in organisms with a deletion at the N terminus of *lin-42*. After the connection between *lin-42* and proper germline development was established, our lab began the process of determining the mechanism by which this occurs.

The already established *glp-1* signaling pathway (figure 1) regulates germline development by regulating the meiosis/mitosis switch. Consequently, our lab hypothesized that *lin-42* affects development of the germline by interacting with this pathway. To investigate the relationship, we began examining a possible phenotypic rescue of a *glp-1* tumorous gain of function mutation seen in *glp-1;lin-42* double mutants. In other words, while a *glp-1* gain of function mutation leads to tumors in the germline, *glp-1;lin-42* double mutants may have fewer tumors and appear more similar to wild type. A confirmation of the phenotypic rescue would indicate that *lin-42* acts to somehow negate the effects of the *glp-1* signaling pathway. Currently, analysis of these results is underway. We also utilized quantitative real time polymerase chain reactions (qRT-PCR) to examine mRNA levels of various genes in the *glp-1* signaling pathway in *lin-42(n1089)* worms compared to wild type. Current results have been inconclusive and further experimentation will be necessary to provide insight into the nature of the relationship between *lin-42* and the *glp-1* signaling pathway.

The role of *atx-2* in regulating germline development was another main focus in the Van Wynsberghe lab this summer. *Atx-2* is the homolog of the *Drosophila* protein *ataxin-2* which serves to regulate the PER protein. *Atx-2* mediates the switch from spermatogenesis to oogenesis and is necessary for proper mitotic zone and gonad size. Due to the homologous relationships of the proteins as well as its implications in proper germline development, we hypothesized that *atx-2* regulates *lin-42* in *C. elegans*, much like *ataxin-2* regulates *per* in fruit flies. We began our investigation by attempting to utilize an immunofluorescence protocol with an antibody to *lin-42* in an effort to examine the localized expression of the gene in the DTC in worms with an *atx-2* loss of function mutation compared to wild type worms. Unfortunately, various immunofluorescence protocols were ineffective in their antibody staining of *lin-42*. As an alternative method, we used Western Blot with a primary antibody to LIN-42 to examine protein levels in *atx-2* mutants and wild type worms. Western Blot results were inconclusive and also somewhat less informative, due to the nature of the assay. Western Blots demonstrate differences in proteins at the whole-worm level, rather than localized expression of *lin-42* to the area of interest, the DTC, as an immunofluorescence assay would allow. Future directions would include developing an effective immunofluorescence assay that would allow an analysis of the effects of an *atx-2* mutation on *lin-42* levels localized to the DTC.
Research Fellow: Zachary “Zack” Weaver (2017)  
Concentration: Astronomy/Physics

Faculty Mentor: Thomas Balonek  
Department: Physics and Astronomy

Title of Project: The Dramatic June 2016 Flare of the Blazar 3C 454.3

Project Summary:

Blazars are a type of active galactic nuclei in which charged particles are accelerated through a magnetic field and emit energy in the form of photons, which are relativistically beamed into jets that are in line with our line of sight to these objects. As such, small physical changes in the material or emission processes become propagated along the jet and reach detectors in the form of variability in the light curve of these objects over time.

The blazar 3C 454.3 is one of the most optically violent variable blazars. Major outbursts of this blazar in the last twenty years show the blazar can rapidly increase in energy by a factor of a hundred (and correspondingly decrease in energy output) over timescales of weeks to months. Various models exist for what physical processes are causing the outbursts. But models currently cannot reproduce similar activity, so more work is needed to fully understand the nature of the observed variations.

This summer I was part of a group working at the Colgate University Foggy Bottom Observatory monitoring the energy output of several blazars over time. During June 2016, the blazar 3C 454.3 underwent a dramatic outburst (see the Figure). Over one week the object increased in energy output by a factor of ten. The corresponding decay of the outburst occurred over a period of a few days, a timescale unprecedented for this blazar. Within three hours in a single night, the energy output of the blazar fell by a factor of two. Correlation of this outburst in optical data with data in other energy regimes is needed to determine the cause of this outburst.

☑ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Research Fellow: Alexander “Alex” Weig (2017)  
Concentration: Chemistry

Faculty Mentor: G. Richard “Rick” Geier  
Department: Chemistry

Title of Project: Synthesis of Phlorins with Different Spiro Substituents

Project Summary:

We have been investigating phlorins, a member of the calixphyrin family. Calixphyrins have structures that are intermediate to porphyrin (all sp²-hybridized meso-carbon atoms) and porphyrinogen (all sp³-hybridized meso-carbon atoms). Phlorins have one sp³–hybridized meso-carbon atom and three sp²-hybridized meso-carbon atoms. The single sp³-hybridized meso-position disrupts the conjugation of the macrocycle. Phlorins absorb long wavelength light, can be oxidized by up to three electrons, and bind to anions.

Previously, a step-wise synthesis has been employed to produce phlorins. Recently, our group developed a two-step, one-flask synthesis of a meso-substituted phlorin, potentially streamlining the preparation of phlorins. We sought to apply the new two-step, one-flask methodology to a series of cyclic ketones to make a family of spiro phlorins. Using this family of phlorins, we will investigate the effect of the size of the spiro ring at the sp³-hybridized meso-position on structure, spectroscopic properties, and stability. By changing the ketone we will also be able to evaluate the generality of the reaction conditions used for the two-step, one-flask synthesis which was initially refined for acetone.

\[
\begin{align*}
\text{HNNH} & \\
\text{HNN} & \\
\text{C}_6\text{F}_5 & \\
\text{C}_6\text{F}_5 & \\
\text{C}_6\text{F}_5 & \\
\text{1)} TFA & \\
\text{2)} \text{DDQ} & \\
\end{align*}
\]

This past year, our group was able to successfully produce cyclohexyl- and cyclopentylphlorin (Michael O’Brien ’16). Continuing that work, we successfully reproduced the synthesis of the cyclohexylphlorin and have synthesized cycloheptyl- and cyclooctylphlorin this summer. Both cyclohexyl- and cycloheptylphlorin were produced on a preparative-scale affording greater than 100 mg each. The attempted synthesis of cyclooctylphlorin provided a low yield. We are now performing analytical-scale reactions to refine the reaction conditions used to synthesize this phlorin. We attempted to synthesize cyclobutylphlorin, but its preparation has been challenging. Though analytical-scale reactions were promising, a preparative-scale reaction did not afford the cyclobutylphlorin. More analytical-scale reactions will be performed to further refine reaction conditions for this phlorin as well.

Source of Support:  
☐ AHUM Div.  ☒ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
Title of Project: Impacts of KIN-20 and LIN-42 on C. elegans Development

Project Summary:

Changes in environmental cues such as light can impact the physiology and behavior of many organisms. These regular fluctuations in gene expression are regulated by a biological clock called the circadian clock which is found in the majority of organisms. In humans, the period of this cycle is about 24 hours. In C. elegans developmental timing is regulated via the heterochronic pathway and cycles are based off of the larval molts rather than a 24 hour period. There are four larval stages separated by molts (L1-L4) before adulthood. C. elegans is a useful model organism for studying the circadian clock because many of the genes involved are the same in both C. elegans and humans.

One such homologous gene, LIN-42 (a Period protein homolog) is an important regulator of the heterochronic pathway. It temporally regulates gene expression by acting as a repressor for many microRNAs (miRNAs) such as let-7. MicroRNAs are small RNAs that post-transcriptionally regulate gene expression by cleaving or repressing the translation of their target. The let-7 sequence and temporal expression are well conserved across higher order organisms and its misregulation has been implicated in a variety of cancers. LIN-42 expression is known to oscillate with larval molts. Identifying when peak levels of this gene occur is extremely important in order to control for oscillating levels of protein when manipulating this pathway. Western blot analysis of wild-type worms shows that LIN-42 expression is highest at 18hrs (L2-L3 molt), 24-26hrs (mid-L3), and 30-32hrs (L3-L4 molt) post-hatching.

The Period protein (a homolog to LIN-42) is known to be phosphorylated and then degraded by Doubletime in flies. The C. elegans homolog of Doubletime is KIN-20. Prior experiments have shown that KIN-20 is a member of the heterochronic pathway and is a positive regulator of miRNAs such as let-7 whereas LIN-42 is a negative regulator of let-7. Whether or not KIN-20 regulation of let-7 is dependent or independent of LIN-42 could indicate a lot about the relationship between KIN-20 and LIN-42. qPCR can be used to determine relative levels of let-7 in wild type worms fed on control RNAi and kin-20 RNAi (to induce knockdown of RNAi) and LIN-42(n1089) knockouts fed on control and kin-20 RNAi. If levels of let-7 increase in the double knockdown, that would imply that KIN-20 is dependent on LIN-42. If levels of let-7 decrease, then KIN-20 regulates miRNAs independently of LIN-42. Three replicates showed a statistically significant decrease in let-7 levels in the double knockdown condition which implies that KIN-20 regulates miRNA function independently of LIN-42.

Future experiments will further investigate the relationship between LIN-42 and KIN-20 by measuring LIN-42 levels in wild type and KIN-20 mutant worms via Western blotting.
Beginning in 1914, the faculty and administration of Colgate University began to discuss revising the college curriculum. The faculty suggested that the University implement groups of academic study, in which students would be required to take a certain number of courses to satisfy each group. They hoped this revision to the required curriculum would provide students with a more well-rounded and thorough education, since they would be required to take courses in a variety of areas rather than only in their specialty area. Thus began the series of curricular changes, most of which were implemented following WWI, which shaped the requirements into a what is now considered to be a liberal arts curriculum, one that was an early precursor to the University’s Common Core curriculum and Areas of Inquiry of today.

In April of 1923 the faculty first proposed an overhaul in the freshman curriculum. They suggested that the University provide initiatory/orientation courses for first-year students. According to the 1923 Report on the Committee of Standards, the Initiatory Course for freshmen was to focus on English, the critical thinking, rhetoric and public speaking, and lecture courses on various topics including the American citizenship, reflecting the nationalist sentiment and global awareness in the United States following WWI. They also proposed that the freshmen’s second semester Initiatory Course would be more focused on the natural and social sciences. The Initiatory Courses were meant to provide new students with a common base of knowledge, which would allow them to begin college on a more even playing field. In June of 1923 the faculty approved the freshmen Initiatory courses, an early form of the current Common Core classes at Colgate.

Throughout the late 1920s through the early 30s, the administration and faculty of Colgate were also working on setting up an orientation program for freshmen, as many other colleges were also doing. The orientation’s purpose was to help incoming students adjust to the college environment and scholastic standards. Freshmen orientation would include lectures by heads of various departments on academic subjects, but this part of orientation would be replaced by survey courses once they became completely developed. Many other colleges, such as Dartmouth, University of Chicago, University of Wisconsin, and most notably, Columbia University were offering survey courses and undergoing curricular changes. However, while other colleges tended to only have one survey course for freshmen, Colgate faculty believed students would benefit more from a series of courses. The University proposed survey courses in the physical sciences, biological sciences, social sciences, fine arts, and adaption (philosophy and religion). These courses would be taken during students’ freshman year and first semester of sophomore year. This curricular change was the forerunner of the current Areas of Inquiry the University. Thus, many of the roots of Colgate’s current curricular requirements are evident in the curricular changes that occurred following WWI.

Source of Support: 
☐ AHUM Div.  ☐ NASC Div.  ☒ SOSC Div.  ☐ UNST Div.
☐ Other (specify):
Utica, NY has a large refugee population, and many were resettled by the Mohawk Valley Resource Center for Refugees, an agency I was fortunate to work with this summer through the Upstate Institute Summer Field School. MVRCR not only resettles refugees, but also offers a variety of services for refugees and immigrants once they arrive, including English language classes, immigration counseling, case management, traffic safety promotion, job assistance, and more. I worked as a health access intern to improve the agency’s capacity for trauma-informed care training.

Many, but not all, refugees have experienced potentially traumatic events, and rates of PTSD and depression are especially high among refugees. For example, in a study of Bosnian refugees in Croatia, researchers from the Harvard Program for Refugee Trauma found that respondents experienced a mean 6.5 traumatic events, while 39.2% and 26.3% displayed symptoms of depression and PTSD, respectively. (Mollica RF, McInnes K, Sarajlic N, Lavelle J, Sarajlic I, Massagli MP 1999). Similarly, in a 2012 CDC survey of Iraqi refugees resettled in the US 50% of participants reported anxiety, 49% depression, 31% a need for further assessment for PTSD (CDC 2012). Because many of Utica’s refugees come from these regions, it is likely that there is a high prevalence of trauma and trauma-related disorders among refugees in Utica.

Staff at MVRCR have noticed a need for a better trauma care for refugees in Utica, and this need became evident throughout the summer. Throughout my casework, I noticed that the trauma histories of refugees affects their lives even in Utica by inhibiting their ability to seek and receive healthcare and social services. There seems to be a gap of knowledge and understanding between some healthcare providers and refugee patients that arises due to a lack of awareness of refugee trauma experiences and culturally competent information among healthcare providers. In response to these observations, MVRCR tasked me with researching trauma-informed care.

The National Center for Trauma Informed Care (NCTIC) defines trauma informed care as: “an approach to engaging people with histories of trauma that recognizes the presence of trauma symptoms and acknowledges the role that trauma has played in their lives.” This method of care can manifest in open and clear communication, in which the provider clearly explains the purpose and nature of all actions, asks for permission and obtains consent before initiating new procedures, assesses the client’s understanding of the problem and future plans, and uses an interpreter if necessary. It involves respect of the client’s agency, comfort, and priorities by allowing them to do whatever makes them feel safe. This policy of respect also requires an awareness and attentiveness to a client’s history, trauma story, cultural norms and expectations, and conflict background. By being attentive and aware, providers can avoid potentially re-traumatizing clients and failing to adequately address the true problem. Lastly, and most importantly, trauma-informed care requires a provider to practice empathy and understanding, rather than sympathy and pity. At the end of the summer, I summarized these above findings, along with more complex research, in a series of tools, including a handout and PowerPoint presentation, for MVRCR to use in cultural competency trainings with healthcare and service providers. These training tools will hopefully help providers serve refugees more compassionately and effectively and increase the accessibility of healthcare for Utica’s refugee populations.

Research Fellow: Yecheng “Carlton” Yang (2017)  Concentration(s): Mathematics; COSC
Faculty Mentor: Ahmet Ay  Department(s): Biology; Mathematics

Title of Project: Computational Modeling of the Vertebrate Segmentation

Project Summary:

Goals: The goal of this project is to reconstruct the gene regulatory network controlling traveling-waves of the vertebrate segmentation clock using computational modeling.

Narrative: Spatial pattern formation is critical for the survival of living organisms. On the other hand, precision of timing is essential during embryonic development. Somitogenesis is a unique case of pattern formation as it combines both spatial and temporal control: the precursors of spatially repetitive vertebrae segments are periodically generated by a rhythmic gene expression oscillator called the vertebrate segmentation clock. The segmentation clock genes, in an unknown manner, establish regulatory interactions with critical transcription factors that are dynamically expressed in the unsegmented tissue. This yet-to-be discovered gene regulatory network drives the establishment of anterior-posterior segment polarity.

In this project, I investigated systems-level emergent properties of the regulatory networks that govern the rhythmic pattern formation during zebrafish embryonic development. To that end, I utilized an interdisciplinary approach to combine experimentation (performed by Dr. Ozbudak and his students at Albert Einstein College of Medicine) with mathematical modeling and computer programming to determine how the segmentation clock genes interact with other dynamically expressed genes in the tissue that results in anterior-posterior segment polarity and spatial pattern formation.

Methodology: Protein and mRNA levels in the posterior part oscillate with a period of 30 minutes because of negative feedback loop. And as we move toward anterior of PSM, the period increases. When the PSM grows, posterior is growing and the period in that end is the same over time and period in anterior part gets longer and longer until anterior becomes formed somites and oscillation stops. In current model, we simulate the interactions between Her proteins in the zebrafish segmentation network. We also included communication between cells occurs through Notch signal transduction pathway, which enhances her1 and her7 transcription and cause harmony among the cells. This summer, I tried to fit two more genes into the model, mespa and mespb. I extended the model and satisfied the conditions provided by professor Ay’s collaborator. After that, I investigated the network structure with mespa and mespb included. This incorporation can hopefully explain the process of transformation from anterior PSM to formed somite, which is currently unknown.

□ Other (specify):
Project Summary:

The first Massive Open Online Course (MOOC) designed by undergraduates for primary school students was the result of implementing a project-based learning (PBL) model in the liberal arts classroom. At Colgate University, a group of student developers led by Professor of Geology and Peace & Conflict Studies, Karen Harpp, produced a first-year seminar focused on online educational technology and MOOC practices. This seminar, the only one to involve students in online course design at Colgate University, created an atmosphere in which students could develop a fuller understanding of what they could contribute to the field of online education.

The first-year seminar offered in the fall of 2015, Emerging Global Challenges, was designed by Professor Harpp and five undergraduates from the class of 2017. We incorporated assignments and readings to further the first-years’ knowledge of online education, however, the central focus of the course was for the seminar students to create their own MOOC for middle-school students. After analyzing seminar student work and gathering feedback from the course designers, we found the class was successful in many aspects, but we have several recommendations for future iterations.

The goals of the first-year seminar were for students to a) learn MOOC design practices and apply them to their own course; b) participate in a major, team-based project where students are able to learn from one another; c) create an interdisciplinary MOOC that combines aspects of their topic with global and societal implications. We designed these goals as a means of attaining the requirements of Scientific Perspectives on the World courses and First-Year Seminars.

The seminar students designed a MOOC entitled BreadX. The central theme of the course was bread, which served as a lens for participants to learn about a variety of globally important issues including agricultural versus industrial farming practices, fossil fuel resources, food waste, global warming, and food distribution questions. A primary focus of the MOOC was to use bread as a focal point, allowing participants to explore how global-scale issues have important, local implications. The seminar students intended to inspire the MOOC participants to think globally and act locally, thereby creating a community of civically engaged individuals.

Making a MOOC is an onerous process. Designing a class where students learn how to create their own MOOC is a feat. No matter how difficult or challenging the course is, this type of project is an important addition to the field of online education. This seminar was the first of its kind to introduce liberal arts students to online education through a PBL model. Moreover, the students were the first to produce a MOOC for elementary school aged children, designed by young adults. Educational technology is an emerging tool that can be used to supplement, or perhaps eventually replace an in-classroom experience. With this kind of work, it is imperative to expose students to these tools so they may begin to shape the fields’ evolution.

For the students with whom we worked, we wanted to ensure they knew their capacities to have a global impact. What may be more important than this, the first-years were exposed to the fact that they have the ability to engage with and teach young students in meaningful ways. For higher education institutions, this experiment should help to prove that undergraduates can produce knowledge, they can be innovators, and they can leave a lasting impact on future generations of learners, if only given the right tools.
Research Fellow: Fanyi Zhang (2019)  
Concentration: Undeclared

Faculty Mentor: John Crespi  
Department(s): Asian Studies; Chinese; EALL

Title of Project: Scanlation of the Wartime Chinese Arts Magazine Resistance Sketch (Kangzhan manhua, 1938)

Project Summary:
Chinese cartoonists used their brushes as weapons during the Resistance War against Japan (1937-1945). To promote China’s cause, they founded the National Salvation Cartoon Association and formed the National Salvation Cartoon Propaganda Corps. In January 1938 the Association launched Resistance Sketch, a twice-monthly arts magazine aimed at educating the population about the wartime crises and continuing the development of Chinese graphic arts.

Scanlation is the process of scanning, translating, and editing comics or cartoons. This summer we scanlated the 3rd issue of Resistance Sketch using Photoshop. Our goal is to give the English-language reader the full experience of a Chinese wartime arts pictorial.

The challenges we faced during the translation process include translating handwriting, choosing proper typefaces, rearranging layout, and fitting texts into the limited space. For typefaces, we decided to use period typefaces to give the magazine a suitably historical look. We used a Bamboo capture-pen and touch tablet to reproduce the look of handwritten characters. As for the layout, traditional Chinese texts read vertically from top to down, right to left, while English texts read horizontally, which created challenges for our scanlated layout. Also, because Chinese characters are more concise than English words, we often had to drastically shorten the English to fit the limited space.

We completed the magazine translation and posted it online using the ISSUU publishing platform. Resistance Sketch no. 3, is now publicly available to anyone who wishes to see it.

According to Professor David Robinson, most historians would not doubt that Chinese history is highly politicized. However according to John H. Arnold, author of “History A Very Short Introduction,” one of the primary purposes of studying history is to use history as “something with which to think” and “to think differently about oneself”. If the past the historians reconstructed are politicized versions of historical truths in the first place. It is likely to make history degenerate into a mere extension of contemporary politics (or even realpolitik). History will probably merely perpetuate political beliefs. Two primary benefits become nonexistent if we write history this way. This also strongly resembles the political game of winner take all, including the right to represent the past. Contemporary Chinese history and to a lesser extent ancient Chinese history are two primary victims of the politicization of history and historiography. Interestingly, the history of the same event can be wildly different depending on if the historians respect China and its history or not.

According to Professor Dan Bouk at Colgate University, history is a discipline that straddles the border between the social sciences and the humanities. However, this does not necessarily mean that history is subjective. Politicized history is a form of subjective history, for example fitting existing event into a grand political narrative.

Arnold argued that “truth” only exists in “context” and is dependent on “acceptance.” In other words, objective truth(history) does not exist. In the discipline of statistics, according to Professor Victoria Stodden at Columbia University, the true mean always exists somewhere out there, but we just do not know it (yet), by sampling and calculating the mean from a sample space, we are obtaining an estimate of the only one true mean. Similarly, for historical event, the true reason of a list of reasons in order of importance and scale of why an event occur are out there, but we just do not know them (yet), historians, by using existing documents and other sources, can piece together a version of reasoning and causation which is an estimate of the true reason or a list of reasons. For example, if a doctor misjudged a case of stomach cancer and diagnosed it instead as a simple case of indigestion. The patient is convinced that is a simple case of indigestion and the staff at the hospital and the patient's family members are convinced as well because the doctor said so. In this case, the belief of all those people mentioned is simply wrong and the true reason for the stomach pain is stomach cancer.

Just like our inability to know the true mean and have to estimate and the doctor's inability to find the true cause of stomach pain, we just have difficulty knowing the objective truth. However, we can still use existing evidence and methods to help us to get a good estimate of what really is the case.
Title of Project: Optical Variability of Blazar OJ 287

Project Summary:

This summer I have been doing astronomical observations at the Colgate Foggy Bottom Observatory and working in the Astronomy Research and Teaching Lab. I began my research prior to this summer, participating in some of the observations recorded in the figure below. During the summer, I stayed up all night at least twice a week to take images and do preliminary reduction of the images. During the daytime, I read some books on Active Galactic Nuclei and Quasars, learning their structures and theories. Also, I used programs written by Colgate students called Superphot and Superflux to stack and calculate the brightness of objects in each image.

My prime object of interest is OJ 287, which is a super-massive binary black hole system located billions of light-years away from the earth. Therefore, our images capture the early stage of the universe and shed some light on the formation of galaxies. From those images our group calculated the magnitude (brightness or energy) of OJ 287. We made plots of the object’s variations over different time ranges. The chart below shows the variation of the quasar from November 15th 2015 to June 16th 2016, with each data point representing the value of one single image. Because the object was low in altitude for the rest of the summer, we could not observe OJ 287; thus, the graph only consists of the data for these few months of the year.

OJ 287 exhibits yearly, monthly and hourly variations, so it is an object of great interest. This blazar was particularly active (and we were able to obtain images on many nights) between late February and early March, 2016. Since then, its brightness gradually dropped. Our last few data points shows that its magnitude may be going up again, but we did not do observations to further confirm that.

□ Other (specify):
Tracing back to over two thousand years ago, ancient Chinese philosophers came up with different approaches to form the harmonious society, one of the most noble proposition among those is “Tian Ren He Yi”, standing for a harmonious relationship between “the sky”, resembling the nature, and people. However, industrial revolution took place in 18th century offered supreme power to Western society, brought up new ideology in pursuit of high production and the self-balance of market, which ended up to take over other ways that can potentially contribute to the well-being of the human society, including the traditional Chinese value which focuses on the maintenance of a balance between the nature and human. Since WWI, some scholars, both from China and other foreign countries, have realized that shortcomings of the Western values do exist, and some ideas that may contribute to the improvement of the Western value may come from traditional Chinese thoughts.

The research took two parallel paths, one focused on the ideas came from modern scholars who either think highly of traditional Chinese thoughts and believe in its usage in modern society or come up with ideas that are analogous to traditional Chinese values, which are in pursuit of a balanced and harmonious society rather than a rapid growing commercial society for people’s well-being. Some scholars, like (insert name here), attributing the reason that Western value turned out to be the universal value to the widespread usage of English, for some ideas from a certain culture may only be accurately explained in its own language, and the translation of which can potentially cause some misunderstanding due to a lack of explanation for certain ideas and scenarios in English. For instance, traditional Chinese medicine can only be treated as a folk culture since it cannot be proven through methodologies of modern science, which is because science is defined in such a way that excludes any knowledge without any theoretical analysis and any proof of effectiveness. For better understanding on values from other culture backgrounds in evaluating their potential contribution to human society, a better “system of language”, allowing the idea to be fully explained without any confusion, can be crucial in making the idea accessible by people who may find these thoughts beneficial.

The other part focused on the thoughts from Chinese philosophers, especially from the period of the Colonization period before the establishment of People’s republic of China, (mid-19th century to mid-20th century) during which time the colonization from Western society opened up the long enclosed minds of Chinese people, many of whom started to think of those pros of Western values, which gave rise to the overwhelming power of Western society in against China, as well as questioning the value of traditional Chinese thoughts that made China fall behind. However, by the time when the majority had lost confidence to traditional Chinese thoughts, some voice called for the maintenance of Chinese values, and some others appealed to “select the essence yet abandon the dross”, seeking for a fusion between Western values and those from China. Philosophers like Liang Shumin, Feng Youlan, Zhang Taiyan, and Liang Qichao, each of whom held a different opinion on the cause of differences between Western ideologies and oriental values plus the pros and cons of each value, agreed on the fact that total westernization was disadvantageous to the Chinese society due to the inherited features of Chinese society from ancient time.
Research Fellow: Yingqi Zhang (2018)  
Concentration(s): Biology; Geography

Faculty Mentor: Randall “Randy” Fuller  
Department(s): Biology; Environmental Studies

Title of Project: Macroinvertebrate response to acid-stressed and lime amended Adirondack Mountain streams

Project Summary:

Our study examined the impact of in-stream and whole drainage basin liming as a mitigation strategy for counteracting acidification in streams and restoring ecosystem-level health. The experiment was carried out in 5 chronically or episodically acidic tributary streams that drain into Honnedaga Lake in the Adirondack Mountains, among which T6, T8D, and T16 were limed. The pH values of all experimental streams increased after lime amendments and some even approached neutral. According to past findings, microbial respiration rates and leaf decomposition rates were higher in streams with high pH than in acid-stressed streams. This summer we sorted, identified, and quantified the macroinvertebrates from decomposing leaf packs from stream samples that were collected in 2015. We also prepared leaf samples from leaf packs collected from 2012 to 2015 for leaf chemistry analysis. While the leaf chemistry will be completed this academic year, we did see differences in macroinvertebrate communities. First, macroinvertebrate communities in the neutral streams are more diverse than those in the acidic streams. In addition, leaf shredders, such as caddisfly (Trichoptera) and stonefly (Plecoptera), were more abundant in neutral streams than acidic streams. Leaves are decomposed at a faster rate in streams with higher pH, so the more abundant leaf shredders increased the rate of leaf decomposition. Second, we hope to see lower carbon to nitrogen ratios in leaves that were placed into the neutral streams because microbial activity increases nitrogen content of the leaves and microbial activity is negatively impacted when streams become acidified. We hope to better understand how quickly different lime application methods (instream versus whole drainage basin) can mitigate the effects of acidification in Adirondack Mountain streams and how long the beneficial effects might persist.

Source of Support:  
☐ AHUM Div.  ☒ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
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: 199

Distribution of Students by Concentration (students with double majors are included twice)

<table>
<thead>
<tr>
<th>Concentration</th>
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</thead>
<tbody>
<tr>
<td>Africana and Latin American Studies</td>
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</tr>
<tr>
<td>Anthropology</td>
<td>5</td>
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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

### Internal 140
- Career Services 1
- Center for Freedom and Western Civilization 2
- Division of the Arts and Humanities 6
- Division of Natural Sciences and Mathematics 64
- Division of Social Sciences 18
- Division of University Studies 6
- Geology Department 1
- Ho Tung Visualization Laboratory & Planetarium 2
- Information Technology Services (ITS) 1
- Lampert Institute for Civic and Global Affairs 12
- New York Six Liberal Arts Consortium 2
- Research Council 3
- Upstate Institute 22

### Endowed 41
- Bob Linsley/James McLelland Fund 1
- Doug Rankin ’53 Endowment-Appalachian Research 2
- Doug Rankin ’53 Endowment-Geology Research 3
- Hackett-Rathmell 1968 Memorial Fund 1
- Harvey Picker ’36 Institute for Interdisciplinary Study in the Sciences and Mathematics 1
- Holdeen Endowment Fund 2
- J. Curtiss Taylor ’54 Endowed Student Research Fund 2
- Justus ’43 and Jayne Schlichting Student Research Fund 16
- Michael J. Wolk ’60 Heart Foundation 4
- Miller-Cochran Fund 1
- Norma Vergo Prize 3
- Oberheim Memorial Fund 1
- Theodore Herman Fund 1
- Warren Anderson Fund 3

### External 23
- American Chemical Society Petroleum Research Fund 2
- Beckman Scholar Program 1
- Keck Northeast Astronomy Consortium (KNAC) 3
- NASA / New York Space Grant 4
- National Institutes of Health (NIH) 2
- National Science Foundation 11
Total Number of Participating Faculty: 75

Distribution of Faculty by Division and Department:

### Arts and Humanities
- **Arts and Humanities** 8
  - Art and Art History 1
  - Classics 1
  - East Asian Languages and Literatures 3
  - English 1
  - Philosophy 1
  - Religion 1

### Natural Sciences and Mathematics
- **Natural Sciences and Mathematics** 44
  - Biology 12
  - Chemistry 7
  - Computer Science 3
  - Geology 6
  - Mathematics 2
  - Neuroscience 4
  - Physics and Astronomy 5
  - Physics and Astronomy; Pre-Engineering 2
  - Psychology 3

### Social Sciences
- **Social Sciences** 18
  - Anthropology 2
  - Economics 2
  - Educational Studies 1
  - Geography 1
  - History 5
  - Political Science 4
  - Sociology 3

### University Studies
- **University Studies** 9
  - Africana and Latin American Studies 1
  - Asian Studies 2
  - Environmental Studies 2
  - LGBTQ Studies 1
  - Peace and Conflict Studies 2
  - Women’s Studies 1

### Other
- **Other** 19
  - Center for Freedom and Western Civilization 1
  - Ho Tung Visualization Laboratory & Planetarium 1
  - Lampert Institute for Civic and Global Affairs 11
  - New York Six Liberal Arts Consortium 2
  - Research Council 3
  - Upstate Institute 1
**Distribution of Faculty by Funding Source**
(Faculty with more than one funding source are counted multiple times)

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