Cover photo: Romario Lobban, Colgate class of 2018, explains his research on Nonlinear Dynamics in Superconducting Networks at the summer research poster session. See page 100 to read more about Romario’s summer research project. Photo by Mark DiOrio.
Colgate University
Summer Undergraduate Research Directory

Volume 24
2017

Courtesy of the Office of Undergraduate Research
Center for Learning, Teaching, and Research
Colgate University
13 Oak Drive
Hamilton, NY 13346
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Participants</td>
<td>1</td>
</tr>
<tr>
<td><strong>Division of the Arts and Humanities</strong></td>
<td></td>
</tr>
<tr>
<td>Art and Art History</td>
<td>2</td>
</tr>
<tr>
<td>East Asian Languages and Literatures</td>
<td>2</td>
</tr>
<tr>
<td>English</td>
<td>2</td>
</tr>
<tr>
<td>Religion</td>
<td>2</td>
</tr>
<tr>
<td><strong>Division of Natural Sciences and Mathematics</strong></td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Computer Science</td>
<td>6</td>
</tr>
<tr>
<td>Geology</td>
<td>7</td>
</tr>
<tr>
<td>Mathematics</td>
<td>8</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>9</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>9</td>
</tr>
<tr>
<td>Psychology</td>
<td>12</td>
</tr>
<tr>
<td><strong>Division of Social Sciences</strong></td>
<td></td>
</tr>
<tr>
<td>Anthropology</td>
<td>13</td>
</tr>
<tr>
<td>Economics</td>
<td>13</td>
</tr>
<tr>
<td>Educational Studies</td>
<td>13</td>
</tr>
<tr>
<td>Geography</td>
<td>14</td>
</tr>
<tr>
<td>History</td>
<td>14</td>
</tr>
<tr>
<td>Political Science</td>
<td>15</td>
</tr>
<tr>
<td>Sociology</td>
<td>15</td>
</tr>
<tr>
<td><strong>Division of University Studies</strong></td>
<td></td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>16</td>
</tr>
<tr>
<td>Film and Media Studies</td>
<td>16</td>
</tr>
<tr>
<td>Native American Studies</td>
<td>16</td>
</tr>
<tr>
<td>Peace and Conflict Studies</td>
<td>16</td>
</tr>
<tr>
<td>Writing and Rhetoric</td>
<td>17</td>
</tr>
<tr>
<td><strong>Center for Freedom and Western Civilization</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Lampert Institute for Civic and Global Affairs</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>New York Six Liberal Arts Consortium</strong></td>
<td>18</td>
</tr>
<tr>
<td><strong>Research Council</strong></td>
<td>19</td>
</tr>
<tr>
<td><strong>Upstate Institute</strong></td>
<td>19</td>
</tr>
<tr>
<td><strong>Research Summaries</strong></td>
<td>23</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>159</td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td></td>
</tr>
<tr>
<td>Student Participants</td>
<td>166</td>
</tr>
<tr>
<td>Faculty Participants</td>
<td>168</td>
</tr>
</tbody>
</table>
List of Participants
DIVISION OF THE ARTS AND HUMANITIES (AHUM)

Department of Art and Art History

Name: Emily Crichlow 2018 (Geography)
Mentor: Robert “Bob” McVaugh (Art and Art History)
Title: Web Catalog of Colgate Campus Structures and Campus Plans
Funding: AHUM Division

Name: Brandon Doby 2018 (Art and Art History)
Mentor: Penny Lane (Art and Art History)
Title: Gemini Film Post Production Research
Funding: J. Curtiss Taylor ’54 Endowed Student Research Fund

Department of East Asian Languages and Literatures

Name: Carmen Kong 2019 (Art and Art History)
Mentor: John Crespi (East Asian Languages and Literatures)
Title: Sensation and Satire: Scanlation Part III
Funding: AHUM Division

Name: Phuong “Alicia” Nguyen 2020 (International Relations)
Mentor: Jing Wang (East Asian Languages and Literatures)
Title: A Study of Nationalism in the French Indochina: An Ethno-Symbolist Approach
Funding: J. Curtiss Taylor ’54 Endowed Student Research Fund

Department of English

Name: Emerson “Emmy” Watkins 2019 (English; Environmental Studies)
Mentor: Jennifer Brice (English)
Title: Living Writers
Funding: AHUM Division

Department of Religion

Name: James Hurst 2018 (Philosophy)
Mentor: Ben Stahlberg (Religion)
Title: Spinoza and the Problem of Desire
Funding: AHUM Division

DIVISION OF NATURAL SCIENCES AND MATHEMATICS (NASC)

Department of Biology

Name: Benjamin “Ben” Apple 2018 (Molecular Biology)
Mentor: Geoffrey “Geoff” Holm (Biology)
Title: Mechanism and Functional Consequences of Innate Immune Responses to Reovirus Infection
Funding: National Institutes of Health (NIH) Area Grant

Name: Skyler Berardi 2019 (Biology)
Mentor: Priscilla Van Wysberghe (Biology)
Title: Investigating the Role of Lin-42 in Germline Development
Funding: Michael J. Wolk ’60 Heart Foundation
Name: Erin Biggar 2018 (Biology)  
Mentor: Ana Jimenez (Biology)  
Title: *Lack of Refractory Period in Red Eyed Vireo Song Causes a Decrease in Ovenbird Song Productivity*  
Funding: NASC Division

Name: Karl Brown 2018 (Biology)  
Mentor: Ana Jimenez (Biology)  
Title: *Year-round Bird Resident Resistance to Oxidative Stress Due to Temperature Increases*  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Peyton Cole 2019 (Chinese; Biology)  
Mentor: Barbara Hoopes (Biology)  
Title: *The Molecular Genetics of Size and Color Variation in Dogs*  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Sonya Dexter 2018 (Biology)  
Mentor: Catherine Cardelús (Biology; Environmental Studies)  
Title: *Health Status of Ethiopian Sacred Forests*  
Funding: NASC Division

Name: Tanner Gill 2018 (Molecular Biology)  
Mentor: Geoffrey “Geoff” Holm (Biology)  
Title: *Mechanism and Functional Consequences of Innate Immune Responses to Reovirus Infection*  
Funding: National Institutes of Health (NIH) Area Grant

Name: Lumbardh “Lumi” Halitjaha 2019 (Mathematics; Computer Science)  
Mentor: Ahmet Ay (Biology; Mathematics)  
Title: *Model Strengthens Molecular Link between Circadian Polymorphisms and Major Mood Disorders*  
Funding: NASC Division

Name: Christine Horn 2019 (Biology)  
Mentor: Frank Frey (Biology; Environmental Studies)  
Title: *Volatile Organic Compound Expression in Response to Herbivory in Tomatoes*  
Funding: Beckman Scholar Program

Name: Nadia Houerbi 2020 (Undeclared)  
Mentor: Catherine Cardelús (Biology; Environmental Studies)  
Title: *Health Status of Ethiopian Sacred Forests*  
Funding: NASC Division

Name: Max Israelit 2018 (Biology; Geography)  
Mentor: James “Eddie” Watkins (Biology)  
Title: *Reproductive Allocation and the Ecology and Physiology of Cycads*  
Funding: NASC Division

Name: Jourdan Kidd 2019 (Molecular Biology)  
Mentor: Jason Meyers (Biology; Neuroscience)  
Title: *Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate*  
Funding: Oberheim Memorial Fund

Name: Molly Klare 2018 (Neuroscience)  
Mentor: Jason Meyers (Biology; Neuroscience)  
Title: *Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate*  
Funding: Michael J. Wolk ’60 Heart Foundation
Name: Amanda Liberman 2017 (Molecular Biology; Russian and Eurasian Studies)  
Mentor: Ahmet Ay (Biology; Mathematics)  
Title: Model Strengthens Molecular Link between Circadian Polymorphisms and Major Mood Disorders  
Funding: Beckman Scholar Program

Name: Yimei Lin 2020 (Music; Biology)  
Mentor: Barbara Hoopes (Biology)  
Title: The Molecular Genetics of Size Variation in Dogs  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: MaryKathryn McCann 2018 (Biology)  
Mentor: Ana Jimenez (Biology)  
Title: Lack of Refractory Period in Red Eyed Vireo Song Causes a Decrease in Ovenbird Song Productivity  
Funding: NASC Division

Name: Nezar Mehanna 2018 (Molecular Biology)  
Mentor: Bineyam Taye (Biology)  
Title: Environmental and Demographic Risk Factors of Allergic Disorders Among School Children in Rural Ethiopia  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Nader Mohamed 2019 (Molecular Biology)  
Mentor: Bineyam Taye (Biology)  
Title: The Effects of School-Based Mass Deworming on the Risk of Cestode and Protozoan Infections in Rural Ethiopia  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Allegra Padula 2019 (Molecular Biology)  
Mentor: Priscilla Van Wynsberghe (Biology)  
Title: Exploring the Role of kin-20 in Regulating Developmental Phenotypes and MicroRNA Levels in C. elegans  
Funding: NASC Division

Name: Michael Reed 2020 (Undeclared)  
Mentor: James “Eddie” Watkins (Biology)  
Title: Reproductive Allocation and the Ecology and Physiology of Cycads  
Funding: NASC Division

Name: Kyle Rhodehouse 2019 (Molecular Biology)  
Mentor: Priscilla Van Wynsberghe (Biology)  
Title: kin-20 and the Heterochronic Pathway of C. elegans  
Funding: NASC Division

Name: Nikhil Tewari 2019 (Molecular Biology)  
Mentor: Barbara Hoopes (Biology)  
Title: SNPs Upstream of IGF1R Do Not Influence its Expression  
Funding: Michael J. Wolk ’60 Heart Foundation

Name: Kailey Tobin 2019 (Biology)  
Mentor: Ana Jimenez (Biology)  
Title: Chronic Temperature Acclimation Effects on Anaerobic Tolerance in the Sheepshead Minnow  
Funding: Oberheim Memorial Fund
Name: Michael “Mike” Vassolas 2018 (Biology)  
Mentor: James “Eddie” Watkins (Biology)  
Title: Developmental Study on Gametophytes of Three Local Ferns: Osmundastrum cinomomea, Osmunda claytoniana, and Osmunda regalis  
Funding: NASC Division

Name: Elizabeth Vitaro 2019 (Biology)  
Mentor: Barbara Hoopes (Biology)  
Title: Investigating Copy Number Variation at the K Locus and Unusual Color Patterns in Dogs  
Funding: NASC Division

Name: Emma Wellington 2019 (Asian Studies)  
Mentor: Frank Frey (Biology; Environmental Studies)  
Title: Fluctuating Asymmetry As a Result of Drought Stress in Glycine Max  
Funding: NASC Division

Name: Joshua “Josh” Winward 2018 (Environmental Biology)  
Mentor: Ana Jimenez (Biology)  
Title: Cellular Oxidative Stress as a Determinant of Longevity between Small and Large Breed  
Funding: NASC Division

Department of Chemistry

Name: Matthew Bousquet 2020 (Undeclared)  
Mentor: Jason Keith (Chemistry)  
Title: Insertion of Molecular Oxygen into Rhodium III Hydride Complexes: A Computational Analysis  
Funding: Miller-Cochran Fund

Name: Harrison Chen 2019 (Chemistry)  
Mentor: Jason Keith (Chemistry)  
Title: Insertion of Molecular Oxygen into Rhodium III Hydride Complexes: A Computational Analysis  
Funding: Miller-Cochran Fund

Name: Oliver Harris 2019 (Chemistry)  
Mentor: Jason Keith (Chemistry)  
Title: Insertion of Molecular Oxygen into Rhodium III Hydride Complexes: A Computational Analysis  
Funding: Warren Anderson Fund

Name: Tianyi “Mike” He 2019 (Philosophy; Chemistry)  
Mentor: Anthony Chianese (Chemistry)  
Title: Ruthenium-catalyzed Ester Hydrogenation  
Funding: Warren Anderson Fund

Name: Jiachen “Ed” Liu 2018 (Chemistry; Physics)  
Mentor: Anthony Chianese (Chemistry)  
Title: Ruthenium Pincer Catalysts for Ester Hydrogenation  
Funding: Warren Anderson Fund

Name: Markus Miranda 2019 (Chemistry)  
Mentor: Jason Keith (Chemistry)  
Title: I. Activation of Molecular Oxygen by Transition Metal Species Insertion of O2 into Rhodium III Complexes; II. Pre K-Edge Features of Aluminum Coordination Complexes  
Funding: American Chemical Society Petroleum Research Fund; Miller-Cochran Fund
Department of Computer Science

Name: Leonardo “Leo” Ascenzi 2020 (Computer Science; Physics)
Mentor: Madeline E. Smith (Computer Science)
Title: Design of a Video Co-Watching Web App
Funding: NASC Division

Name: Rohan Chaudhari 2019 (Computer Science)
Mentor: Darren Strash (Computer Science)
Title: Speeding Up Maximum Clique Computation with Graph Partitioning
Funding: NASC Division

Name: Rosalie “Rosie” Coyle 2020 (Undeclared)
Mentor: Elodie Fourquet (Computer Science)
Title: Perspective Tiled Floors in Paintings for a 3D Blueprint in Processing
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Lindsey Derbyshire 2018 (Computer Science)
Mentor: Aaron Gember-Jacobson (Computer Science)
Title: Improving Auto-generated Repairs for Computer Networks
Funding: National Science Foundation Grant

Name: Asad Jamil 2019 (Mathematics)
Mentor: Michael Hay (Computer Science)
Title: DPComp: Realistic Data Mining Under Differential Privacy
Funding: National Science Foundation Grant

Name: Christopher “Chris” King 2018 (Computer Science)
Mentor: Elodie Fourquet (Computer Science)
Title: Handy Dandy Tracking: A Simple Hand Gesture Recognition System
Funding: NASC Division

Name: Jack Lin 2018 (Computer Science; Neuroscience)
Mentor: Vijay Ramachandran (Computer Science)
Title: Controlling a Robotic Hand via Machine Learning Classification of EEG Movement Planning Signals
Funding: Holden Endowment Fund

Name: Ahsan Mahmood 2018 (Computer Science; Applied Math)
Mentor: Aaron Gember-Jacobson (Computer Science)
Title: Improving Auto-generated Repairs for Computer Networks
Funding: NASC Division

Name: Rebecca “Bec” Mitchell 2020 (Undeclared)
Mentor: Elodie Fourquet (Computer Science)
Title: Perspective Tiled Floors in Paintings for a 3D Blueprint in Processing
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Can “Alexandra” Nie 2020 (Computer Science)
Mentor: Joel Sommers (Computer Science)
Title: Measuring Aspects of the Multilingual Web
Funding: National Science Foundation Grant; NASC Division
<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryan Rios 2020 (Computer Science)</td>
<td>Joel Sommers (Computer Science)</td>
<td>Measuring Aspects of the Multilingual Web</td>
<td>National Science Foundation Grant; NASC Division</td>
</tr>
<tr>
<td>Ruchit Shrestha 2020 (Mathematics)</td>
<td>Aaron Gember-Jacobson (Computer Science)</td>
<td>Improving Auto-generated Repairs for Computer Networks</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Franklin van Nes 2018 (Computer Science)</td>
<td>Aaron Gember-Jacobson (Computer Science)</td>
<td>Repairing Network Configurations</td>
<td>Research Council</td>
</tr>
<tr>
<td>Ryan Wetsman 2019 (Computer Science; Economics)</td>
<td>Madeline E. Smith (Computer Science)</td>
<td>Design of a Video Co-Watching Web App</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Ryan Yu 2018 (Neuroscience; Computer Science)</td>
<td>Vijay Ramachandran (Computer Science)</td>
<td>Controlling a Robotic Hand via Machine Learning Classification of EEG Movement Planning Signals</td>
<td>Holden Endowment Fund</td>
</tr>
<tr>
<td>Tinotenda “Tino” Zinyama 2018 (Computer Science; Art and Art History)</td>
<td>Elodie Fourquet (Computer Science)</td>
<td>Handy Dandy Tracking: A Simple Hand Gesture Recognition System</td>
<td>Science and Math Initiative-SMI (NASC Division)</td>
</tr>
</tbody>
</table>

**Department of Geology**

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia Barcello 2018 (Religion; Geology)</td>
<td>William Peck (Geology)</td>
<td>Contact Metamorphism and Ore Formation during Intrusion of Adirondack Anorthosite</td>
<td>Doug Rankin ’53 Endowment-Appalachian Research; Doug Rankin ’53 Endowment-Geology Research</td>
</tr>
<tr>
<td>Monica Dimas 2019 (Geology)</td>
<td>Aubreya Adams (Geology)</td>
<td>Crust and Upper Mantle Structure of the Adirondack Mountains</td>
<td>Doug Rankin ’53 Endowment-Geology Research</td>
</tr>
<tr>
<td>Isabel Dove 2019 (Geology)</td>
<td>Amy Leventer (Geology)</td>
<td>Diatoms as Paleoeceanographic Tools in Southern Ocean Sediments</td>
<td>Norma Vergo Prize</td>
</tr>
</tbody>
</table>
Name: Meghan Duffy 2018 (Geology)
Mentor: Amy Leventer (Geology)
Title: *Paleoclimate Record of Glacial-Interglacial Cycling from the Sabrina Coast, East Antarctic Margin*
Funding: Norma Vergo Prize

Name: Yinuo “Tayshaun” Jin 2020 (Undeclared)
Mentor: Aubreya Adams (Geology)
Title: *Crust and Upper Mantle Structure of the Adirondack Mountains*
Funding: Doug Rankin ’53 Endowment-Appalachian Research; Hackett-Rathmell 1968 Memorial Fund

Name: Natalie Kozlowski 2019 (Environmental Studies)
Mentor: Amy Leventer (Geology)
Title: *Diatoms as Paleoceanographic Tools in Southern Ocean Sediments*
Funding: Hackett-Rathmell 1968 Memorial Fund

Name: Mark LaPan 2019 (Geology)
Mentor: Amy Leventer (Geology)
Title: *Paleoenvironmental Reconstruction of Warm Periods of Earth’s History: Diatom Records in Marine Sediments from the Drake Passage*
Funding: Doug Rankin ’53 Endowment-Geology Research

Name: Dhara Patel 2019 (Geology)
Mentor: William Peck (Geology)
Title: *Chemistry of Garnet in the Lewis Wollastonite Deposit*
Funding: Norma Vergo Prize; Bob Linsley/James McLelland Fund

Name: Caio Rodrigues Faria Brighenti 2020 (Peace and Conflict Studies)
Mentor: Karen Harpp (Geology)
Title: *Virtual Galapagos Project*
Funding: Hackett-Rathmell 1968 Memorial Fund

Name: Juan Saenz 2020 (Music)
Mentor: Karen Harpp (Geology)
Title: *Virtual Galapagos Project*
Funding: NASC Division; Norma Vergo Prize

Name: Emily Weaver 2020 (Undeclared)
Mentor: Karen Harpp (Geology)
Title: *Virtual Galapagos Project*
Funding: Bob Linsley/James McLelland Fund

**Department of Mathematics**

Name: George Armstrong 2018 (Mathematics)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: *Gene Selection in Classification of Cancer Patients*
Funding: NASC Division

Name: Jake Bensky 2019 (Applied Math)
Mentor: William Cipolli (Mathematics)
Title: *PTmutest: Bayesian Nonparametric Multiple Testing Software*
Funding: NASC Division
Name: Xiaohan Li 2019 (Computer Science/Mathematics)
Mentor: William Cipolli (Mathematics)
Title: PTmtest: Bayesian Nonparametric Multiple Testing Software
Funding: NASC Division

Name: Ha Vu 2017 (Computer Science; Mathematics)
Mentor: Ahmet Ay (Biology; Mathematics)
Title: Computational Modeling of the Vertebrate Segmentation
Funding: Picker Interdisciplinary Science Institute

Name: Sandesh Chapagain 2020 (Undeclared)
Mentor: Bruce C. Hansen (Neuroscience; Psychology)
Title: Harnessing Electroencephalography, Machine Learning, and Neuromodulation to Uncover the Neural Dynamics and Mechanisms of Scene Categorization
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Ravendra Dhanraj 2019 (Neuroscience)
Mentor: Jason Meyers (Biology; Neuroscience)
Title: Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Erin Moroney 2018 (Biology)
Mentor: Jason Meyers (Biology; Neuroscience)
Title: Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate
Funding: NASC Division

Name: Cassady Olson 2018 (Neuroscience; Mathematics)
Mentor: Bruce C. Hansen (Neuroscience; Psychology)
Title: Harnessing Electroencephalography, Machine Learning, and Neuromodulation to Uncover the Neural Dynamics and Mechanisms of Scene Categorization
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Danielle Paynter 2018 (Neuroscience)
Mentor: Bruce C. Hansen (Neuroscience; Psychology)
Title: Behavioral Measure of the Role of Feature Spaces in Scene Categorization
Funding: NASC Division

Name: Tessa Ruff 2018 (Neuroscience)
Mentor: Jun Yoshino (Neuroscience; Psychology)
Title: Effects of Antidepressants on Nitric Oxide Production by Microglia and Astrocytes
Funding: NASC Division

Name: Michelle Taylor 2018 (Neuroscience)
Mentor: Jun Yoshino (Neuroscience; Psychology)
Title: Effects of Antidepressants on Nitric Oxide Production by Microglia and Astrocytes
Funding: NASC Division

Name: Aayam Bista 2020 (Undeclared)
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)
Title: Optical Tweezers
Funding: National Science Foundation Grant
Name: Noah Campbell 2018 (Mathematics; Environmental Studies)  
Mentor: Linda Tseng (Environmental Studies; Physics)  
Title: Characterization of Local Municipal Wastewater  
Funding: NASC Division

Name: Logan “Cooper” Conran 2018 (Physics)  
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)  
Title: Ghost Imaging and Possible Medical Applications  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Sean Corrigan 2018 (Astrogeophysics)  
Mentor: Jonathan Levine (Physics and Astronomy)  
Title: Supporting the Development of a Spaceflight Dating Spectrometer  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Ryan de Silva 2020 (Physics)  
Mentor: Beth Parks (Physics and Astronomy)  
Title: Developing an Inexpensive Solar Tracker for Photovoltaics in the Developing World  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Ishir Dutta 2017 (Physics; Mathematics)  
Mentor: Linda Tseng (Environmental Studies; Physics)  
Title: Biogenic Nanoparticles in Municipal Wastewater Treatment  
Funding: NASC Division

Name: Kaitlyn Eckart 2019 (Physics)  
Mentor: Thomas Balonek (Physics and Astronomy)  
Title: Optical Variability of the Blazar OJ 287 at the Colgate Observatory  
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Megan Emch 2018 (Astrogeophysics)  
Mentor: Jeffrey “Jeff” Bary (Physics and Astronomy)  
Title: Spectral Analysis of Accretion Activity and Cool Spots on DQ Tau  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund; NASA / New York Space Grant

Name: Suyash Handa 2020 (Physics)  
Mentor: Jonathan Levine (Physics and Astronomy)  
Title: Developing a Spaceflight Mass Spectrometer for Extraterrestrial In Situ Geochronology  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: John “Jack” Herrick 2019 (Molecular Biology)  
Mentor: Rebecca Metzler (Physics and Astronomy)  
Title: Exploring Barnacle Exoskeleton Formation  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Brianna Holmes 2019 (Physics)  
Mentor: Rebecca Metzler (Physics and Astronomy)  
Title: Exploring the Correlation between Structure, Composition, and Strength in Biominerals  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

Name: Jin Won “Jin” Huh 2019 (Physics)  
Mentor: Beth Parks (Physics and Astronomy)  
Title: Improving THz Spectroscopy to Enable Studies of Carbon Nanotubes  
Funding: Science and Math Initiative-SMI (NASC Division)
<table>
<thead>
<tr>
<th>Name</th>
<th>Field</th>
<th>Year</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Romario Lobban 2018</td>
<td>Physics</td>
<td></td>
<td>Kenneth “Ken” Segall (Physics and Astronomy)</td>
<td>Nonlinear Dynamics in Superconducting Networks</td>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
</tr>
<tr>
<td>Patrick Matulka 2019</td>
<td>Astronomy/Physics</td>
<td></td>
<td>Beth Parks (Physics and Astronomy)</td>
<td>Measuring Home Insulation</td>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
</tr>
<tr>
<td>Stephen Paolini 2018</td>
<td>Physics</td>
<td></td>
<td>Kenneth “Ken” Segall (Physics and Astronomy)</td>
<td>Nonlinear Dynamics in Superconducting Networks</td>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
</tr>
<tr>
<td>Jacob Pilawa 2020</td>
<td>Astronomy/Physics</td>
<td></td>
<td>Thomas Balonek (Physics and Astronomy)</td>
<td>The Multi-Decade Optical Light Curve of Blazar OJ 287</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Alina Sabyr 2019</td>
<td>Astronomy/Physics</td>
<td></td>
<td>Jeffrey “Jeff” Bary (Physics and Astronomy)</td>
<td>High-resolution Spectroscopic Monitoring of the DQ Tau Binary System: Pulsed Accretion and Starspots</td>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
</tr>
<tr>
<td>Derek Sherry 2018</td>
<td>Physics</td>
<td></td>
<td>Kenneth “Ken” Segall (Physics and Astronomy)</td>
<td>Simulations of Superconducting Neuromorphic Circuits</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Ryan Stahlin 2018</td>
<td>Astronomy/Physics</td>
<td></td>
<td>Thomas Balonek (Physics and Astronomy)</td>
<td>Optical Variability of Quasars and Stars at the Colgate Observatory</td>
<td>NASC Division</td>
</tr>
<tr>
<td>Veronica Switzer-Poplar 2019</td>
<td>Biochemistry</td>
<td></td>
<td>Rebecca Metzler (Physics and Astronomy)</td>
<td>Exploring the Correlation between Structure, Composition, and Strength in Biominerals</td>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
</tr>
<tr>
<td>Araven Tiroumalechetty 2019</td>
<td>Physics</td>
<td></td>
<td>Beth Parks (Physics and Astronomy)</td>
<td>Investigating the Diffusion Demonstration Experiment</td>
<td>Science and Math Initiative-SMI (NASC Division)</td>
</tr>
<tr>
<td>Faith Williams 2019</td>
<td>Physics</td>
<td></td>
<td>Enrique “Kiko” Galvez (Physics and Astronomy)</td>
<td>Biomedical Diagnosis with Quantum Entanglement</td>
<td>Picker Interdisciplinary Science Institute</td>
</tr>
</tbody>
</table>
Name: Chenglu Wu 2019 (Astronomy/Physics)  
Mentor: Jeffrey “Jeff” Bary (Physics and Astronomy)  
Title: *Spectrum Analysis of DQ TAU Binary*  
Funding: NASC Division

Name: Saiyang “Sylvan” Zhang 2019 (Astronomy/Physics)  
Mentor: Enrique “Kiko” Galvez (Physics and Astronomy)  
Title: *Polarization Singularities*  
Funding: Justus ’43 and Jayne Schlichting Student Research Fund

**Department of Psychology**

Name: Kaine Brown 2019 (Psychology)  
Mentor(s): Erin Cooley and Rebecca Dyer (Psychology)  
Title: *The Physical Experience of Warmth Promotes Interpersonal Warmth and Greater Cooperation*  
Funding: Science and Math Initiative-SMI (NASC Division)

Name: Tiffany Castillo 2018 (Neuroscience)  
Mentor: Scott Kraly (Neuroscience; Psychology)  
Title: *A Study on the Different Factors That Are Affecting the Efficacy of Schizophrenia Treatment at the National Institute of Mental Health, Sri Lanka*  
Funding: Lampert Institute for Civic and Global Affairs

Name: MaKenna Cealie 2019 (Neuroscience)  
Mentor: Wan-chun Liu (Psychology)  
Title: *The Influence of Early Auditory Experience on the Development of Vocal Learning and Neural Circuits*  
Funding: NASC Division

Name: Kathleen “Katie” Murray 2019 (Neuroscience)  
Mentor: Wan-chun Liu (Psychology)  
Title: *Analysis of Approach Behavior in Male Juvenile Zebra Finches (Taeniopygia guttata) During the Sensitive Period for Song Learning*  
Funding: NASC Division

Name: Margaret Nelsen 2018 (Neuroscience)  
Mentor: Neil Albert (Neuroscience; Psychology)  
Title: *Studying the Effects of Forced Desynchrony in Circadian Rhythms on Cognitive and Athletic Performance of Student-Athletes*  
Funding: NASC Division

Name: Ho Jun “Paul” Sim 2018 (Neuroscience; Music)  
Mentor: Wan-chun Liu (Psychology)  
Title: *Development of Optogenetic Transgenic Songbirds*  
Funding: NASC Division

Name: Bernadette Tankle 2018 (Neuroscience)  
Mentor: Jenessa Seymour (Psychology)  
Title: *The Effects of Video Game Playing and Athletic Training on Peripheral Visual Performance*  
Funding: NASC Division
## Division of Social Sciences (SOSC)

### Department of Anthropology

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
</table>

### Department of Economics

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob Chaas 2019 (Mathematical Economics)</td>
<td>Benjamin Anderson (Economics)</td>
<td>Competitive Balance in Panel Data</td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Baiyu “Bonnie” Zhou 2018 (Mathematics; Economics)</td>
<td>Takao Kato (Economics)</td>
<td>Labor Turnover and Ability: Four Case Studies of Manufacturing Factories in China and the U.S.</td>
<td>SOSC Division</td>
</tr>
</tbody>
</table>

### Department of Educational Studies

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holly Geranen 2018 (Educational Studies; Women’s Studies)</td>
<td>Ashley Taylor (Educational Studies)</td>
<td>An Examination of the Language Used to Talk About Immigrants in ELD Classes and the Languages Used to Talk About Students Labeled with Disabilities in Special Education Classrooms</td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Woohee Kim 2018 (Educational Studies)</td>
<td>Anne “Anna” Rios-Rojas (Educational Studies)</td>
<td>Korean Youth Activism and Education: Negotiating Knowledge and Power to Create New Sites of Learning</td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Cynthia Melendez 2019 (Educational Studies; Africana and Latin American Studies)</td>
<td>Mark Stern (Educational Studies)</td>
<td>Grit and Bear It: Experiencing KIPP Charter Schools</td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Anh “Julie” Nguyen 2018 (Educational Studies; Mathematics)</td>
<td>Ashley Taylor (Educational Studies)</td>
<td>What Kinds of Citizen are Students Learning to Become: A Content Analysis of Social Studies Standards in D.C.</td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Renee Roundy 2019 (Educational Studies)</td>
<td>John Palmer (Educational Studies)</td>
<td>Black Women in Introductory Chemistry: Course Environment’s Involvement in Decreasing Interest in STEM Fields</td>
<td>Walter Broughton ’63 Research Fund</td>
</tr>
</tbody>
</table>
### Department of Geography

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sabrina Farmer 2018</td>
<td>Michael Loranty (Geography)</td>
<td><em>Comparison of Shrub Traits in Siberian Boreal Forests</em></td>
<td>National Science Foundation Grant; Research Council</td>
</tr>
<tr>
<td>Angelica Greco 2018</td>
<td>Daisaku “Dai” Yamamoto (Geography; Asian Studies)</td>
<td><em>Who’s Calling the Shots on Nuclear Decommissioning: A Case Study of Scriba, NY and Vernon, VT</em></td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Emma Newmann 2018</td>
<td>Peter Scull (Geography)</td>
<td><em>Landcover Change Dynamics Outside Church Forests in the Northern Ethiopian Highlands</em></td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Jacob Wasserman 2018</td>
<td>Peter Scull (Geography)</td>
<td><em>Landcover Change Dynamics Outside Church Forests in the Northern Ethiopian Highlands</em></td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Samto Wongso 2019</td>
<td>William Meyer (Geography)</td>
<td><em>Resource Consumption of Residential Areas in the Suburb of a Medium-Sized Indonesian City, Palu: An Exploratory Study</em></td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Seung-Ah Yang 2019</td>
<td>William Meyer (Geography)</td>
<td><em>How Does the Urban-Rural Difference Affect the Unequal Distribution of Subjective Well-being in South Korea</em></td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Gabrielle “Gabby” Yates 2019</td>
<td>Ellen Kraly (Geography)</td>
<td><em>Legacies of the Stolen Generation: An Analysis of Film Resources from Carrolup Native Settlements</em></td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
</tbody>
</table>

### Department of History

<table>
<thead>
<tr>
<th>Name</th>
<th>Mentor</th>
<th>Title</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matthew Kato 2019</td>
<td>Robert Nemes (History)</td>
<td><em>Tourism’s Mixed Bag: An Emic Investigation into the Impacts of the Tourist Industry in Andalusia, Spain</em></td>
<td>Lampert Institute for Civic and Global Affairs</td>
</tr>
<tr>
<td>Peishan “Lillian” Li 2020</td>
<td>David Robinson (History)</td>
<td><em>Early Modern China and Its Foreign Relations</em></td>
<td>SOSC Division</td>
</tr>
<tr>
<td>Aleksandra “Sasha” Mikus 2020</td>
<td>Kira Stevens (History; Russian and Eurasian Studies)</td>
<td><em>Everyday Law, Russia: 1693-1730</em></td>
<td>SOSC Division</td>
</tr>
</tbody>
</table>
Name: Yekaterina “Katya” Yepifanova 2020 (Undeclared)
Mentor: Kira Stevens (History; Russian and Eurasian Studies)
Title: *Everyday Law, Russia: 1693-1730*
Funding: SOSC Division

Department of Political Science

Name: Matthew “Matt” De Leo 2018 (Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: *Benevolence in Human Nature: Solving the Adam Smith Problem*
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Andrew “Drew” Derrenbacker 2018 (Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: *American Origins: An Examination of Competing Theories of the American Founding*
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Kyle Dillon 2019 (Philosophy and Religion)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: *Wrestling with God: Three Approaches to the Role of Religion in the University*
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Annina “Anna” Pluff 2020 (History)
Mentor: Barry Shain (Political Science)
Title: *Researching Revolutionary-era American Pamphlet Literature in Context: A Documentary History*
Funding: SOSC Division

Name: Sotirios “Soto” Raphtis 2018 (English; Political Science)
Mentor: Valerie Morkevicius (Political Science)
Title: *ISIS The Perfect Proxy*
Funding: SOSC Division

Name: Benjamin “Ben” Ringel 2018 (International Relations; Spanish)
Mentor: Danielle Lupton (Political Science)
Title: *Apartheid South Africa Manipulates its Nuclear Program for Political Gain*
Funding: Lampert Institute for Civic and Global Affairs

Name: Ryan Zoellner 2020 (Philosophy and Religion; Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: *Leo Strauss and the Revival of Classical Political Philosophy*
Funding: Center for Freedom and Western Civilization/Stone Summer Research Fund

Department of Sociology

Name: Timothy Englehart 2018 (Sociology)
Mentor: Janel Benson (Sociology)
Title: *Examining the Role of Selective Colleges in Producing Graduates Committed to Altruistic Good*
Funding: SOSC Division

Name: Hunter Filer 2018 (Psychology; Sociology)
Mentor: Janel Benson (Sociology)
Title: *The Integration of Non-Western Immigrant and Refugee Adolescents within the Danish Efterskole*
Funding: Lampert Institute for Civic and Global Affairs
DIVISION OF UNIVERSITY STUDIES (UNST)

Department of Environmental Studies

Name: Julian Danetiu 2019 (Environmental Biology)
Mentor: Timothy “Tim” McCay (Biology; Environmental Studies)
Title: Understanding Invasion by “Crazy Worms”
Funding: Picker Interdisciplinary Science Institute

Name: Zachary Gallate 2019 (Biology)
Mentor: Timothy “Tim” McCay (Biology; Environmental Studies)
Title: Understanding Invasion by “Crazy Worms”
Funding: Picker Interdisciplinary Science Institute

Name: Abigail “Abbey” Langenderfer 2019 (Environmental Studies)
Mentor: Linda Tseng (Environmental Studies; Physics)
Title: Characterization of Local Municipal Wastewater
Funding: UNST Division

Name: Paige Smalley 2019 (Environmental Economics)
Mentor: Linda Tseng (Environmental Studies; Physics)
Title: Characterization of Local Municipal Wastewater
Funding: UNST Division

Department of Film and Media Studies

Name: Alden DeBouter 2019 (Anthropology)
Mentor: Mary Simonson (Film and Media Studies; Women’s Studies)
Title: Staging Cinema: Performance, Liveness, and the Transition to Sound
Funding: UNST Division

Name: Catharine Strong 2018 (English)
Mentor: Mary Simonson (Film and Media Studies; Women’s Studies)
Title: Staging Cinema: Performance, Liveness, and the Transition to Sound
Funding: UNST Division

Department of Native American Studies

Name: Sierra Sunshine 2018 (Anthropology; Native American Studies)
Mentor: Carol Ann Lorenz (Native American Studies)
Title: Lifetime Career of Peter B. Jones, Onondaga Ceramist
Funding: UNST Division

Department of Peace and Conflict Studies

Name: Zakaria Imessaoudene 2018 (Peace and Conflict Studies; International Relations)
Mentor: Jacob Mundy (Peace and Conflict Studies)
Title: Rise of Insurgencies in the Sahel and The United States’ Counterterrorism Efforts in Northwest Africa from 2003 to 2016
Funding: UNST Division
Name: Benjamin “Ben” Kelsey 2018 (French; Japanese)
Mentor: Karen Harpp (Geology; Peace and Conflict Studies)
Title: Cross-linguistic Analysis of the Wave Distribution Model of Dialects: Synthesizing Italian and Japanese Literature
Funding: UNST Division

**Department of Writing and Rhetoric**

Name: Priyadarshinee “Priya” Dhawka 2019 (Computer Science)
Mentor: Suzanne Spring (Writing and Rhetoric)
Title: The Multilingual Experiences of International Students on NY6 Campuses
Funding: New York Six Liberal Arts Consortium

Name: Zhanling “Annie” Wang 2019 (History)
Mentor: Suzanne Spring (Writing and Rhetoric)
Title: The Multilingual Experiences of International Students on NY6 Campuses
Funding: New York Six Liberal Arts Consortium

**CENTER FOR FREEDOM AND WESTERN CIVILIZATION**

Name: Matthew “Matt” De Leo 2018 (Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: Benevolence in Human Nature: Solving the Adam Smith Problem
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Andrew “Drew” Derrenbacker 2018 (Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: American Origins: An Examination of Competing Theories of the American Founding
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Kyle Dillon 2019 (Philosophy and Religion)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: Wrestling with God: Three Approaches to the Role of Religion in the University
Funding: Center for Freedom and Western Civilization/James Madison Summer Research Fund

Name: Ryan Zoellner 2020 (Philosophy and Religion; Political Science)
Mentor: Robert Kraynak (Political Science; Director, Center for Freedom and Western Civilization)
Title: Leo Strauss and the Revival of Classical Political Philosophy
Funding: Center for Freedom and Western Civilization/Stone Summer Research Fund

**LAMPERT INSTITUTE FOR CIVIC AND GLOBAL AFFAIRS**

Name: Tiffany Castillo 2018 (Neuroscience)
Mentor: Scott Kraly (Neuroscience; Psychology)
Title: A Study on the Different Factors That Are Affecting the Efficacy of Schizophrenia Treatment at the National Institute of Mental Health, Sri Lanka
Funding: Lampert Institute for Civic and Global Affairs

Name: Hunter Filer 2018 (Psychology; Sociology)
Mentor: Janel Benson (Sociology)
Title: The Integration of Non-Western Immigrant and Refugee Adolescents within the Danish Efterskole
Funding: Lampert Institute for Civic and Global Affairs
Name: Holly Geranen 2018 (Educational Studies; Women’s Studies)  
Mentor: Ashley Taylor (Educational Studies)  
Title: An Examination of the Language Used to Talk About Immigrants in ELD Classes and the Languages Used to Talk About Students Labeled with Disabilities in Special Education Classrooms  
Funding: Lampert Institute for Civic and Global Affairs

Name: Angelica Greco 2018 (Geography)  
Mentor: Daisaku “Dai” Yamamoto (Geography; Asian Studies)  
Title: Who’s Calling the Shots on Nuclear Decommissioning: A Case Study of Scriba, NY and Vernon, VT  
Funding: Lampert Institute for Civic and Global Affairs

Name: Matthew Kato 2019 (History)  
Mentor: Robert Nemes (History)  
Title: Tourism's Mixed Bag: An Emic Investigation into the Impacts of the Tourist Industry in Andalusia, Spain  
Funding: Lampert Institute for Civic and Global Affairs

Name: Woohee Kim 2018 (Educational Studies)  
Mentor: Anne “Anna” Ríos-Rojas (Educational Studies)  
Title: Korean Youth Activism and Education: Negotiating Knowledge and Power to Create New Sites of Learning  
Funding: Lampert Institute for Civic and Global Affairs

Name: Benjamin “Ben” Ringel 2018 (International Relations; Spanish)  
Mentor: Danielle Lupton (Political Science)  
Title: Apartheid South Africa Manipulates its Nuclear Program for Political Gain  
Funding: Lampert Institute for Civic and Global Affairs

Name: Samto Wongso 2019 (Geography)  
Mentor: William Meyer (Geography)  
Title: Resource Consumption of Residential Areas in the Suburb of a Medium-Sized Indonesian City, Palu: An Exploratory Study  
Funding: Lampert Institute for Civic and Global Affairs

Name: Seung-Ah Yang 2019 (Geography)  
Mentor: William Meyer (Geography)  
Title: How Does the Urban-Rural Difference Affect the Unequal Distribution of Subjective Well-being in South Korea  
Funding: Lampert Institute for Civic and Global Affairs

Name: Gabrielle “Gabby” Yates 2019 (Geography)  
Mentor: Ellen Kraly (Geography)  
Title: Legacies of the Stolen Generation: An Analysis of Film Resources from Carrolup Native Settlements  
Funding: Lampert Institute for Civic and Global Affairs

NEW YORK SIX LIBERAL ARTS CONSORTIUM

Name: Priyadarshinee “Priya” Dhawka 2019 (Computer Science)  
Mentor: Suzanne Spring (Writing and Rhetoric)  
Title: The Multilingual Experiences of International Students on NY6 Campuses  
Funding: New York Six Liberal Arts Consortium

Name: Zhanling “Annie” Wang 2019 (History)  
Mentor: Suzanne Spring (Writing and Rhetoric)  
Title: The Multilingual Experiences of International Students on NY6 Campuses  
Funding: New York Six Liberal Arts Consortium
RESEARCH COUNCIL

Name: Sabrina Farmer 2018 (Biology; Women’s Studies)
Mentor: Michael Loranty (Geography)
Title: Comparison of Shrub Traits in Siberian Boreal Forests
Funding: National Science Foundation Grant; Research Council

Name: Franklin van Nes 2018 (Computer Science)
Mentor: Aaron Gember-Jacobson (Computer Science)
Title: Repairing Network Configurations
Funding: Research Council

UPSTATE INSTITUTE

Name: Kaitlin Abrams 2018 (Neuroscience; Women’s Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: For the Good, Inc.: Building Community as we Grow Good Food
Funding: Upstate Institute

Name: Ethan Ackerman 2020 (Economics)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellowship with the Village and Town of Hamilton
Funding: Upstate Institute

Name: Jacob Adams 2018 (Economics)
Mentor: Julie Dudrick (Upstate Institute)
Title: Economic Impact of Madison County Agriculture
Funding: Upstate Institute

Name: Hayley Arlin 2018 (Peace and Conflict Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellow
Funding: Upstate Institute

Name: Dzenela Becic 2018 (Russian and Eurasian Studies; International Relations)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellow
Funding: Upstate Institute

Name: Gabriella “Gaby” Bianchi 2019 (Economics; Classical Studies)
Mentor: Julie Dudrick (Upstate Institute)
Title: Combating Systematic Oppression through Film and Summer Camp
Funding: Upstate Institute

Name: Erin Burke 2018 (History)
Mentor: Julie Dudrick (Upstate Institute)
Title: Sex and Stigma: The Oneida Community Mansion House and the Struggle of Children’s Programming
Funding: Upstate Institute

Name: Megan Carney 2018 (Geography)
Mentor: Julie Dudrick (Upstate Institute)
Title: Complete Streets: Mapping Central NY to Create Safer and Healthier Communities
Funding: Upstate Institute
Name: Olivia “Liv” Castro 2019 (Sociology)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the Chenango County’s Hospice & Palliative Care*  
Funding: Upstate Institute

Name: Zakaria Chakrani 2019 (Molecular Biology)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the Abraham House*  
Funding: Upstate Institute

Name: Maggie Cusick 2018 (Psychology)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellow*  
Funding: Upstate Institute

Name: Colleen Donlan 2018 (Political Science)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Local Farms, but Limited Access to Local Food: What Barriers do Farmers Face when Selling to Low-income Consumers?*  
Funding: Upstate Institute

Name: Taylor Dumas 2020 (Peace and Conflict Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Integrating Refugee and Immigrant Communities through Microenterprise in Utica, NY*  
Funding: Upstate Institute

Name: Jessica “Jess” Eldridge 2019 (Educational Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with Pathfinder Village*  
Funding: Upstate Institute

Name: Robert “Bobbie” Howie 2018 (Environmental Studies; Philosophy)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the National Abolition Hall of Fame and Museum*  
Funding: Upstate Institute

Name: Lindsey Johnson 2020 (Peace and Conflict Studies)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the Young Scholars Liberty Partnership Program and the Utica Children’s Museum*  
Funding: Upstate Institute

Name: Jeffrey Marr 2018 (Economics)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the Legal Aid Society of Mid New York (LASMNY)*  
Funding: Upstate Institute

Name: Dylann McLaughlin 2018 (English)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Field School Fellowship with the Young Scholars Liberty Partnership Program and the Utica Children’s Museum*  
Funding: Upstate Institute

Name: Revée Needham 2018 (Environmental Studies; Geography)  
Mentor: Julie Dudrick (Upstate Institute)  
Title: *Wastewater Treatment Survey and Radon Mapping*  
Funding: Upstate Institute
Name: Shannon Ormel 2019 (Economics)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellowship with the Horned Dorset Colony
Funding: Upstate Institute

Name: Ashlea Raemer 2018 (Environmental Studies; Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Combating Hunger and Food Insecurity in a College Population
Funding: Upstate Institute

Name: Victoria Rykaczewski 2019 (Political Science)
Mentor: Julie Dudrick (Upstate Institute)
Title: Population Health Management Testing Hepatitis C in Rural Communities
Funding: Upstate Institute

Name: Jonathan Santiago 2018 (Geography)
Mentor: Julie Dudrick (Upstate Institute)
Title: Opioid Research at Bassett Research Institute
Funding: Upstate Institute

Name: Tiong Hua Sia 2017 (Geology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Invasion of the Water Body Snatchers: Invasive Species of Lake Moraine
Funding: Upstate Institute

Name: Alicia Violette 2019 (Biology)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellowship with BRiDGES of Madison County
Funding: Upstate Institute

Name: Susan Waltz 2018 (English)
Mentor: Julie Dudrick (Upstate Institute)
Title: Field School Fellowship for the Chenango United Way
Funding: Upstate Institute

Name: Emily Wong 2018 (History)
Mentor: Julie Dudrick (Upstate Institute)
Title: Breaking Glass: Breaking Down the Barrier between the Arts and Social Responsibility
Funding: Upstate Institute
Research Summaries
For the Good is a community organization based in the heart of Utica, NY. In 2002, C.E.O Cassandra Harris-Lockwood started the nonprofit with the intention of restoring Utica’s Community Action Agency. Since then the organization has grown to accommodate two community gardens opening in 2008, an independent newspaper, and various youth programming such as the Study Buddy Club.

For the Good’s main project, the community gardens are multi-faceted. One goal of the garden is to increase access to healthy, affordable produce for the food insecure and those at-risk for hunger. According to the Food Access Research Atlas created by the USDA, many areas of Utica qualify as food deserts. This indicates that these spaces lack access to affordable or good-quality fresh food within reasonable traveling distance. In response to this issue, For the Good allows community members the opportunity to volunteer in the garden in exchange for produce. The hope is that working directly with the earth and the food as it grows will make kids more comfortable eating fresh produce they may not be used to due to the typically high cost. Youth are also empowered through learning valuable green skills and self-sufficiency. Overall, garden work promotes a healthy and active lifestyle in a community lacking outdoor activity.

This summer I worked with For the Good’s community garden program. While each day was a little different, my typical day involved working with young kids in our garden planting vegetables, weeding, mulching, and maintaining crops. For the Good also partners with organizations such as the Oneida County Summer Youth Employment Program which employs young teenagers for 15 hours a week for pay. I worked with this group of kids for three hours a day, teaching them how to transform a plot of land from mere weeds to fruitful earth. The work was sweaty and exhausting, but at the end of the day the group looked accomplished and I sensed pride in the transformation they saw from their hard work.

My contribution to this organization at the end of the summer was to create a summary of informal interviews with the volunteers and employees that came through the garden. Over the years, For the Good has seen many faces, some who return to garden, and some who stay only for their assigned hours. It is important that they begin to understand what it is that draws people to the garden in the first place, and what keeps them coming back. What is it about working with the earth that is attractive to Utica residents, and what makes people hesitate to get their hands dirty? By working directly with these garden helpers, I tried to gain a better understanding of their views of the organization, and to compile this information for better future practice.

As a behavioral neuroscience and women’s studies double major, it may be difficult to see how this work aligns with my studies. But neuroscience and women’s studies both require an understanding of lived experience. I can intellectualize the impact of mental illness and addiction, theorize about gender scripts, and the impacts of poverty on food access all I want in the classroom, but working directly within communities shows the lived impact of these systems on the ground.

Additionally, this work has shown me what non-profit work looks like day-to-day. It has shown me the sometimes difficult funding crises, the stress of organizing and working with a city, and the daily grind of a small organization. But over that, my time here has shown me the power of being connected to the earth and the empowerment that can come from working with your hands and with a community to build something together. My potential future in law will benefit from direct work within the communities I want to aid legally. There are many green thumbs who are struggling with legal issues and court-relegated community service hours who have expressed their difficulties with me while we garden. Lawyers need to remain humble and remember the humanness of everyone who comes through a court of law.

Project Summary:

This summer, I aided the Village of Hamilton with multiple projects. My primary project was assisting with the formation of a database of land uses within the Village that are not conforming to the Village’s revised zoning law. My secondary project was compiling an electronic database and physical registry of all site plans, construction documents, and similar architectural plans that the Village has in its possession.

On June 29, the Village Board approved a new zoning law, which was the first major change in zoning in over a decade. The text of the law requires the Village to compile a registry of all non-conforming land uses. To complete this project, I worked under the guidance of various Village officials, including Mayors Bob McVaugh and RuthAnn Loveless, Planning Board Chair Morgan Larson, and Codes Enforcement Officer Don Forth. Under their guidance, I conceived various possible mechanisms to collect the needed data on land usage. After much collaboration and running through various ideas, we eventually proceeded with a method that would allow us to collect the needed data with minimal intrusion into the private affairs of the Village residents. The final deliverables for this project include a full list of non-conforming land uses and their corresponding street address, as well as a labeled map of the Village, with non-conforming land uses color-coded based on type of use.

Over the past few years, the Village’s inventory of architectural plans has become very large and disorganized. These plans contain information on a variety of properties within the Village, and it is vital that the Codes Enforcement Officer is able to locate each specific plan as needed. Over the course of this summer, I went through the mountain of plans and, one by one, inputted the basic information of each one in an online database. At the time of writing, this is an ongoing project, but it should reach completion in the coming months. There are still some plans that need to be inputted in the digital database and physically organized.

Title of Project: Economic Impact of Madison County Agriculture

Project Summary:

This summer I was granted the opportunity to complete a Fellowship for the Madison County branch of the Cornell Cooperative Extension for the Agricultural Economic Development program. Cooperative Extension’s role in the community is wide reaching, as there are several facets to the responsibilities of the different Madison County programs. The mission statement reads, “The Cornell Cooperative Extension educational system enables people to improve their lives and communities through partnerships that put experience and research knowledge to work.” Programs run include 4H, agribusiness outreach, and Open Farm Day. The Agricultural Economic Development office of the extension is vital to the agriculture market of Madison County by creating market opportunities for farmers and encouraging value-added enterprises. The secondary objective of the office is to maintain a sizeable arable land base in the county to encourage future economic growth in the agricultural sector.

Agriculture is one of the country’s oldest foundational markets, but in today’s economy it only makes up 1 percent of GDP. On the other hand, agriculture and related industries employ around 11 percent of the American workforce, per the USDA. The Agricultural Economic Development office takes the role of encouraging economic growth in a sector that is often forgotten, yet incredibly important to the world’s expanding population.

My role as the office’s Upstate Institute Fellow was to analyze the greater economic impact of Madison County’s agricultural sector. The goal was to produce two final products. The first was a calculator that would utilize economic multipliers to show the approximate greater economic impact of agricultural output, employment, and value added in Madison county. The calculator was broken down into sectors such that the individual impact of certain outputs, such as dairy, could be analyzed. The second product of my work was a report detailing the economic impact and importance of Madison county agriculture, which was distributed to the county Agricultural Advisory Committee. The final report was designed to simplify the technical economic language such that it could be distributed to farmers across the county. The main point of emphasis was that the bulk of economic activity resulting from farms is through value added enterprise and food processing.

My secondary project this summer was for the Madison County Department of Social Services. Since the recurrence of child abuse reports in Madison County is above both the New York State standard and average, the DSS saw it necessary to review the data to find any particular factors to view with a higher level of priority/risk. The task at hand consisted of using econometric methods in order to find which of the 54 variables recorded in a child maltreatment/abuse case affects the probability of recurrence in a statistically significant way. The results showed that the number of prior abuse reports, repeated sexual abuse, and domestic violence as the three most statistically significant factors in a recurring case. This was the case in linear probability, probit, and logit models.

The research yielded some interesting results that the DSS found helpful, but the project is still ongoing, as we are waiting for another year’s worth of data to hopefully strengthen the argument for the current results as well as perhaps revealing other factors that the DSS should take into account.

Title of Project: Mechanism and Functional Consequences of Innate Immune Responses to Reovirus Infection

Project Summary:

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 project has been 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 lack of qPCR amplification may be due to a lack of primer specificity and/or sensitivity for the IRF3-DNA binding sequences being studied. In order to ensure that the pulled down DNA fragments are amplified specifically for our DNA sequences-of-interest, we recently designed TaqMan probe and primer sets for the Noxa promoter (experimental), the IFN-beta promoter (positive control), the ISG15 promoter (positive control), and beta-Actin (negative control). Hopefully, these new TaqMan probes/primers will provide more precise qPCR results of our ChIP DNA fragments. Despite not perfecting the ChIP procedure, my work with Professor Holm has been an invaluable experience for learning the skills, thought processes, and adversities of biological research.

Research Fellow: George Armstrong (2018)  
Concentration: Mathematics

Faculty Mentor: Ahmet Ay  
Department(s): Biology; Mathematics

Title of Project: Gene Selection in Classification of Cancer Patients

Project Summary:
Cancer is an incredibly prevalent disease and approximately 40% of all people in the United States will be diagnosed with cancer at some point in their life. Furthermore, colorectal cancer accounts for a 10% of all diagnosed cancers. Cancers arise when genes that regulate cell growth and division, amongst other factors, mutate in a way that causes uncontrolled growth detrimental to the individual’s health. Due to the large size of the human genome and the spontaneous nature of mutation, there is a large amount of variation in cancers between individuals. Prognostic outcomes can vary dramatically from patient to patient and treatments that are effective at treating some tumors will have little effect on others. As a result, there is great interest in developing algorithms that can quickly and accurately classify molecular subtypes of cancer.

I worked on improving a currently existing network-based classification algorithm (NBC) developed by Professor Ay and his collaborators to classify genomic samples of colon cancers into their molecular subtypes. This algorithm, as opposed to other state-of-the-art machine-learning algorithm, takes into account the underlying biology to make predictions about a sample’s molecular subtype. Our new version of the algorithm (pNBC) utilizes probabilistic networks to represent gene-gene interactions, opposed to the deterministic ones utilized by NBC. We found that the performance of pNBC exceeded that of the original NBC algorithm, achieving classification accuracies of up to 79% on a colon cancer dataset.

In order to accomplish this, we had to decide how to implement the probabilistic algorithm. Previously, the algorithm performed linear regressions on networks constructed between genes with high Pearson correlation coefficients. We adapted the algorithm to use a slightly more robust network construction algorithm, called ARACNE, which is designed to remove redundant interactions from gene interaction networks. The networks are intended to represent the gene interactions that are most helpful for distinguishing between subtypes of colorectal cancer. After the deterministic networks had been constructed, we assigned each edge a probability based on the likelihood of the genes interacting. We then used these probabilistic networks to generate a new, larger set of deterministic networks to be used to predict a sample’s colorectal cancer subtype. Upon completion of this project, I had implemented R code (with embedded Python and C++) to perform the necessary tasks to analyze a genomic dataset with pNBC in an efficient and reproducible manner.

Source of Support:
☐ AHUM Div.  ☑ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.
☐ Other (specify):
Title of Project: Design of a Video Co-Watching Web App

Project Summary:

The primary object of our research was to create an application to improve people’s ability to remain connected to one another across distances while still engaging in a meaningful and fun activity. To that end, we began work on an application in which people would be able to watch videos “together” while they are not in the same place. We designed our application for people who may be unable to see each other regularly, e.g., people in long-distance relationships, military families, students studying abroad, etc.

We started with background research to better understand the benefits of watching movies in groups and to find out if any similar applications already existed. We then conducted interviews with students, faculty members, and people living in the area to learn more about people’s solo and group video watching habits. We created an affinity diagram (see Figure 1) to analyze interview data and identify the most salient points. We defined user requirements, brainstormed potential features, and prioritized the essential features to implement in the application this summer.

We designed multiple prototypes, sought feedback from potential users, combined the prototypes, and refined the design to meet the user requirements (see Figure 2). The primary features of the application are: streaming a YouTube video at the same time as a group of users while video and text chatting those users. More specifically, the YouTube video can be maximized, video chat feeds can be enlarged, the text chat can be hidden, specific users can be hidden and muted, and new users can be added to the call.

Once the prototype was finalized, we began coding the front-end of the web application in HTML, CSS, JavaScript, and jQuery. By the end of the summer we had completed the front-end of the application and began to work on the back-end, using PHP.

☑ Other (specify): Science and Math Initiative-SMI (NASC Division)
Project Summary:

This research project is focused on the chemistry of garnets in wollastonite ore deposits. Specifically, core samples collected from the Lewis wollastonite mine in the northeastern region of the Adirondack Mountains. These core samples were drilled by the company that owns the mine and reach depths of 250 feet with alternating layers of wollastonite, garnet, and anorthosite with some pyroxene and quartz layers. At the mine, in order to collect my samples, I surveyed the core and labeled 39 areas where there was at least an inch-wide layer rich in garnet. These labeled sections were then analyzed using a hand-held x-ray spectrometer to gather a base elemental data that was recorded along with their depths in the core. Samples were then cut out of the full core using a rock saw to be taken back to Colgate University and analyzed further.

Back at Colgate University my job was to prepare the core samples into a couple different sets of samples for in depth analysis. First, I had to use the rock saw to cut each sample into mirror-image halves. One half was archived and the other was crushed using a chipmunk rock crusher to turn the piece of core into a mix of pea-sized pieces and individual smaller crystals. I then examined these small fragments under a microscope and used tweezers to hand-pick five to ten micrograms worth of pure garnet from each sample. A few of the samples that came from an anorthosite layer were separated into pure plagioclase and pure garnet and put in plastic vials. Professor Peck analyzed the samples for oxygen isotope ratios at the University of Wisconsin.

The larger pieces from the rock crusher were used to make epoxy mounts for examination using Colgate’s scanning electron microscope. To make these epoxy mounts, I had to find pieces with a relatively flat side that contained garnet to lay at the bottom of the mold. I then combined the resin and a hardener to make the epoxy mixture that I poured over the rock fragments and let harden overnight. After the mixture hardened, I then had to smooth all the sharp edges with a rock grinder. At this time I also made sure the flat side of the rock fragments were at the surface of the mount by grinding away any extra epoxy. While doing this I had to make sure that the surface was level. A polish was achieved by grinding using progressively smaller grits.

I will be continuing this summer research project this semester as I continue to gather data and analyze it for my senior thesis. I will be using the scanning electron microscope to collect data on the chemical composition of the epoxy mount samples, for comparison with the oxygen isotope ratios of the mineral separates.

☒ Other (specify): Doug Rankin ’53 Endowment-Appalachian Research; Doug Rankin ’53 Endowment-Geology Research
Title of Project: PTmtest: Bayesian Nonparametric Multiple Testing Software

Project Summary:

Our project over the summer was to develop an application that allows users to perform Bayesian nonparametric multiple testing. The traditional normal model, while easy to implement, is less effective when that assumption is faulty. Meanwhile, more advanced models that are robust to assumptions like this, often require expensive software or coding expertise to implement and use. We worked in RShiny, a language that allows for visual representations of data, and RJava, an add-on to R that allows us to quickly run the multiple testing procedures in Java to create a user interface that makes such complex analysis freely available and easily accessible. Our aim is that this applet will make this cutting-edge statistical methodology easily accessible and usable in real-world applications for scientists from all disciplines.

A Polya tree, seen in Figure 2, contains a prespecified number of levels. At each level, we partition the real line into equally probable “bins” which we approximate by the mid-quantile. This approximation is reasonable because, as more levels are added, these “bins” become smaller except in the tails. In each Markov chain Monte Carlo (MCMC) iteration, the observations are placed into bins based on their magnitude and this process results in a discrete estimation of the Polya Tree and allows us to make posterior inference on key variables in the model.

It is of interest whether or not our observations are drawn from a distribution of mean zero. If the observation is deemed to have mean zero, it goes into the bin at point zero often enough during MCMC and we fail to reject it. Otherwise, if the observation falls into any other bin enough during MCMC, we reject the observation where enough is defined by a prespecified threshold. We use the count of observations placed in each bin, containing the rejected values, to flexibly model the distribution of the non-zero means. We center the Polya tree at the usual normal model and use the information about the rejected observations to add non-normal details to the density estimate, noting that the resulting estimate may become highly skewed or even bimodal at the end of the process, as the Polya tree allows us to flexibly modeling the data.

The resulting RShiny application allows any researcher to use this complex methodology without an expert knowledge of programming. The RShiny applet prompts the user for input parameters and then runs the Polya tree approximation and displays the results. The main benefit of this applet is that anyone with a dataset and a desire to run such an analysis can do so without struggling through the steep learning curve of coding.

Figure 1 shows an example of how this application can be applied in the real world. Looking at a dataset of 7,866 public schools, we examined the difference in the proportion of success rates on pass-fail math exams between socioeconomically advantaged and disadvantaged students. The resulting non-null distribution, shown in Figure 1, is bimodal. In one group, the gap between advantaged and disadvantaged students is narrower, while in the other the difference is much wider. In this real-world scenario, the researcher might use this result by studying what the “better” schools are doing to better serve their disadvantaged students, and how to change the schools that are in most need of improvement. This bimodal shape isn't captured by the model that assumes normality.

In addition to this project, we were able to collaborate with the Economics department by providing some computational and statistical consulting. We completed a consultation for Professor Blume-Kohout where we used historical data from a social security database and other sources to predict the gender of NSF Graduate Research Fellowship Program grants awardees. This will allow Professor Blume-Kohout to research how this grant affects graduation rates by gender.

☐ Other (specify):
Title of Project: Investigating the Role of Lin-42 in Germline Development

Project Summary:

I conducted research on Caenorhabditis elegans in Professor Van Wynsberghe’s lab this summer. C. elegans is a primarily hermaphroditic nematode with a short generation time and many observable phenotypes. The life cycle of C. elegans is comprised of four larval stages before adulthood is reached. Germline development throughout these stages is regulated by signaling in the distal tip cell (DTC) region of the gonad. Cells close to the DTC are in the mitotic zone of the gonad, where they undergo mitosis. When cells reach the transition zone, signaling promotes meiosis to occur. The mitosis to meiosis transition is regulated by GLP-1/Notch signaling in the DTC region.

My studies focused on a gene called Lin-42, the C. elegans period protein homolog. Its expression oscillates with the larval stages, and it functions in timing the development of the gonad, vulva, sex myoblasts, and hypodermis. Preliminary research suggests that lin-42 is a transcription factor that regulates genes in the GLP-1/Notch signaling pathway to influence the mitosis to meiosis transition. Lin-42 likely maintains normal mitotic zone size by promoting the expression of lag-2, a ligand in the pathway, by acting as either a transcription factor or by influencing miRNA levels. The relationship between lin-42 and other genes in the GLP-1/Notch signaling pathway, including apx-1, lag-1, arg-1, lst-1, and sygl-1, is unknown.

I employed immunofluorescence to visualize the mitotic region of the DTC in wild type (N2) and lin-42 mutant C. elegans, and I found that the mitotic zone size is decreased in lin-42 mutant worms. This indicates that functioning lin-42 is needed for proper mitotic zone function. Future studies should incorporate phalloidin staining into the immunofluorescence protocol to better visualize the mitotic zone rachis.

I studied the interactions of lin-42 with genes in the GLP-1/Notch signaling pathway to regulate C. elegans germline development using qPCR, and I found that lin-42 and arg-1 interact at the L4 stage of C. elegans development.

Previous research indicated that lin-42 regulated lag-2, but it was unclear whether lin-42 was doing this by acting as a transcription factor or by regulating miRNA. To help determine if lin-42 was a transcription factor for lag-2, I measured GFP expression in L3, L3/L4 molt, and L4 worms grown on vector and lin-42 RNAi. I found that the worms grown on vector at each stage expressed GFP, but the worms grown on lin-42 did not show any GFP expression. The loss of GFP expression in lag-2::GFP worms grown on lin-42 RNAi suggests that lin-42 regulates lag-2 as a transcription factor.

I also wanted to study the interaction between atx-2 and lin-42. Atx-2 regulates the transition from spermatogenesis to oogenesis in C. elegans, and it is necessary for proper mitotic zone and gonad development. I examined alae formation in N2 and ap201 strains to determine if atx-2 regulates lin-42, but there was not sufficient data produced to suggest a relationship. The atx-2 alae assay will be repeated on young adult worms and worms at earlier time points to more clearly determine how atx-2 and lin-42 are interacting. Overall, the data gathered through these experiments has improved our understanding of the important role that lin-42 plays in C. elegans germline development.
Project Summary:

This summer, I joined the Fiver Children’s Foundation as a Fellow though the Upstate Institute Summer Field School. Fiver exists as a youth development non-profit organization in Poolville, New York. Striving to motivate children from disenfranchised New York City and Upstate New York communities, Fiver combats the cyclic nature of poverty and marginalization by teaching children how to engage positively with their Fiver community as well as their community back home. Children attend summer camp free of charge as they engage in a ten-year commitment. Children ages 8-16 arrive for a two-week long character building camp experience. When the campers reach ages 17 and 18, they return to camp for a four-week paid internship where they serve as mentors for other campers while also providing services for the camp, such as working in the kitchen or in the office. During the school year, Fiver keeps in close contact with the children involved in the program. Fiver encourages participants to attend community building activities as well as career focused trainings in a New York City location.

Beyond timeless summer camp activities such as canoeing, arts and crafts, and soccer, Fiver offers campers the opportunity to study public speaking, attend college trips, create newsletters, attend wilderness camping trips, and participate in debates. Throughout all of these activities, counselors and staff reinforce the 12 core values of Fiver: compassion, trustworthiness, self-confidence, responsibility, creativity, respect, courage, learning, making peace with others, becoming a team player, building the community, and embracing the environment. At the end of every session, counselors award their campers with a dog tag that represents one attribute that the camper showcased or worked towards and will continue to strengthen over time. The dog tags concretely express growth in character and give the campers a physical reminder of the positive environment existing at Fiver. In addition to receiving dog tags, the campers attend “Whole Self”, a class that encourages campers to analyze and reflect on how the 12 attributes interconnect. Through this program, campers learn the importance of supporting their community and themselves.

My research this summer involved working on a video project that visually brings the impact of the Fiver experience to potential donors and new parents. While at Fiver, I interviewed campers and alumni ages 8-22 about their time spent at camp. I also attended classes and evening activities where I filmed the children in action. I then compiled footage of my interviews into 12 short packages that correspond with the 12 Fiver attributes using the editing software Final Cut Pro. These videos will eventually make it on to the Fiver website, Fiver.org and the YouTube Channel, FiverVision.

Most of the questions I posed revolved around character development and day to day successes and challenges. In asking campers questions, the campers defined values learned at Fiver and related them to their own experiences at camp and in their home communities. Through individual stories and powerful visuals, donors and parents can more accurately understand the personalized impact this program has had.

A quote from a graduating member of Fiver, Patrice, displays the impact of the Fiver experience. “Before I leave I just want to ask you guys a question: Why does poverty exist? My answer to that question is because kids like us are not given the resources nor opportunities needed to succeed. They are in a better sense of words, set up to fail. Now, what is Fiver’s goal? To ensure that every child is given a chance to obtain these resources and opportunities needed to succeed, so that their children and the children long after that will never fall susceptible to the evils, traps, and stereotypes of our world. So that one day, we won’t need places like Fiver. So me, you, and the person beside you can live their dream. So we can all live our dream.”
Title of Project: Lack of Refractory Period in Red Eyed Vireo Song Causes a Decrease in Ovenbird Song Productivity

Project Summary:

Soundscapes recordings allow analysis of bird song to understand the mating behavior and interactions between bird species in an ecosystem. This bioacoustical study aims to provide a deeper understand of Colgate’s forested lands and the bird species present in this area. The recordings captured at the Colgate Snowhill were analyzed to understand how bird song changes across the breeding season and across seasons annually. This longitudinal study will continue after this summer to provide information on how the bird population on the Colgate hill is affected by climate change and increased anthropogenic noise due to changes on Colgate’s campus.

As Colgate University expands up the hill with new dorm buildings and more students and faculty arrive, there will be changes in bird richness and abundance due to alterations in habitat and food resources. The soundscape recordings will allow us to track those changes. The richness and abundance of various species speaks to the health of a forest. These aspects can be measured and seen through recordings of soundscapes and individual birds. Various species rely on different aspects of the forest and if changes due to human activity or climate change affect the bird population, there will be a noticeable change in the soundscape and individual birds recorded.

Individual recordings capture the song of one bird in a particular area to be used to understand the bird through song analysis. These are two-minute recordings that capture the entire song of one specific bird with minimal background noise. Each week nine individual recording sessions were conducted containing a variety of diverse bird recordings. Three recordings are taken each day on Monday through Friday for about two hours each. One begins at 5:20 am, one begins at 12:00pm and one begins at 6:00 pm. The dusk and dawn recordings are characterized by high bird song output. These recordings are standardized with little exception; however, recordings cannot take place during heavy rainfall due to possible equipment damage and sharp decrease in bird song activity.

Research shows Ovenbirds sing during the refractory period of another individual’s song to avoid song interference (Ficken et al., 1985). Ovenbirds have been found to have fairly even spacing between songs during the morning chorus. The research is only looking over the period of 2 days and supports the idea that over the course of one day or one recording the spacing of songs should not change much (Hann 1937). In order to explore this claim more it would be beneficial to look how this spacing between songs changes due to the time of year and the species of birds occupying the area at the same time. Birds like the common yellowthroat have sporadic songs and sing within the same frequency band as the Ovenbirds. Both bird species will space out their song in order to avoid song overlaps. The recordings obtained from the wooded areas in Colgate’s forested lands shows a repetitive pattern containing an Ovenbird song directly following the completion of a Common Yellowthroat’s song when both individuals are present in the same area. As the breeding season continues an increase in the amount of Red-Eyed Vireos occurs and the song of the Vireos is continuous and offers less refractory periods for the Ovenbirds to come in and sing with little or no interference within the sound frequency band (Borror 1981 and Lemon 1981). An analysis of the rate of song Ovenbirds produce shows a decrease in song productivity when Red Eyed Vireos are present and producing song. The production of a continuous song with a lack of a refractory period disrupts the rate of song production of Ovenbirds in Colgate’s forested lands. Further research can show the impact of Red Eyed Vireos can have on species diversity in relation to global climate change since the Red Eyed Vireos migration is during warmer periods of the summer.

Citations


Research Fellow: Aayam Bista (2020)  
Concentration: Undeclared

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

Title of Project: Optical Tweezers

Project Summary:

**Concept**  
The basic idea behind this is the change in momentum of photons when it comes in contact with any object in space. If the total momentum change of the photons after transmission through an object is equal in two opposite directions, the resultant momentum change in the sphere is zero, hence causing the object to be trapped.

**The setup**  
The setup can be divided into two parts; the first part, consisting of a microscope objective and a camera, is used to view the objects while the second part uses laser beam to manipulate the objects.

![Image of optical tweezers setup](image)

The red arrows show the path of the illuminating light for imaging while the green arrows show the path of the trapping laser beam.

**Trapping 6 micrometer spheres**  
We used the optical tweezer to successfully trap solid spheres with diameters of 6 micrometer.

![Images of trapped spheres](image)

The images show a trapped sphere (bottom-right in the first image) staying in a fixed position while all other spheres move around it.

**Effects on other samples**  
We tested the effects of the optical tweezer on a sample taken from the aragonite tablets of sea-shells. The light beam caused the particles to twist and twirl in an erratic motion.

**Using circularly polarized light**  
We made the sample from sea-shells interact with circularly polarized light. This caused the samples to rotate with the direction of rotation dependent on the orientation of the polarization of the light (right-hand circular or left-hand circular), showing the transfer of angular momentum from the photons to the sample.

**Future Work**  
We will proceed to use the optical tweezer to try to detect the helical-gradient force on chiral molecules. This would help to differentiate right-hand and left-hand enantiomers and could be highly useful in pharmaceuticals.

**Source of Support:**  
- [ ] AHUM Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [X] Other (specify): National Science Foundation Grant
Title of Project: **Insertion of Molecular Oxygen into Rhodium III Hydride Complexes: A Computational Analysis**

**Project Summary:**

The purpose of the research was to use the computer program Gaussian 09 to determine which reaction path is the most favorable for the reaction of inserting molecular Oxygen into a Rhodium (III) complex. The Rhodium complex was analyzed with different ligands attached to determine how that would affect the relative energy of each pathway. This reaction is important in the field of aerobic oxidation chemistry and in the creation and application of artificial fuels. There are several possible reaction pathways that were considered and evaluated. The pathways that were considered were a Hydrogen Atom Extraction pathway (HAA), a Reductive Elimination (RE), and a Migratory Insertion pathway (MI). Each intermediate energy was determined using the Gaussian program and the data was used to determine the relative energy of each step of the reaction.

For each of the Intermediates and transition states the energy was calculated using B3LYP-d3 Flavor of dispersion corrected hybrid density functional theory, 6-31G(d,p) basis set on H, C, N, O Cl and occasionally F when applicable, and LANL08(f) effective core potential (pseudopotential) and basis set on Rh. Stability calculations were performed on the structures to ensure that the most stable structure of each was used in further calculations. After the stability calculations frequency calculations were performed to obtain data on each structures Zero-point energy, and thermal corrections to the internal energy, enthalpy and entropy. Each transition state was verified to have the correct number of imaginary frequencies. All solvent calculations were done using Dichloromethane as the solvent.

In the future more work is to be done on the Migratory Insertion pathway and any other pathways. Once the energy for all of the intermediates and transition states are calculated we will create an energy surface for each reaction and determine how each ligand affects the energy levels of the reaction. It is possible that in the future other pathways may be considered. Once more data on the intermediates and transition states we will be able to hypothesis which ligand group provides the lowest energy pathway.

**Source of Support:**

- [ ] AHUM Div.
- [ ] NASC Div.
- [ ] SOSC Div.
- [ ] UNST Div.
- [x] Other (specify): Miller-Cochran Fund; Warren Anderson Fund
Title of Project: The Physical Experience of Warmth Promotes Interpersonal Warmth and Greater Cooperation

Project Summary:

Most individuals, when given the ultimatum between aiding themselves and aiding another person, consider many factors before making a decision. To examine these factors experimentally, researchers often use decision-making dilemmas such as the prisoner’s dilemma game (PDG). In a PDG people decide between two options: to cooperate (X) or to compete (Y). As can be seen in Figure 1 below, the interpersonal outcomes of these decisions depend on the combination of one’s own decision (on left) and the decision of one’s partner (on top). The best outcome for the self occurs if you compete (Y) and the other cooperates (X), in which case you get 125 points and they only get 25. The worst outcome for the self occurs if you cooperate (X) and your partner competes (Y), in which case they get 125 points and you get 25.

![Figure 1. PDG game with numbers representing points obtained by combinations of one's own decision (options on left) and one's partner's decision (options on top).](image)

One factor that influences how people behave in a PDG is expectations about how one's partner will behave. For example, research indicates that groups who engage in a PDG with other groups tend to compete more than individuals who engage in a PDG with other individuals (Insko et al., 2004). The reason for greater competition among groups is that groups expect other groups to be untrustworthy and aggressive. As a result, groups behave more competitively as a preemptive defense against the competition they expect to receive. Together, these existing findings suggest that perception of an interaction partner’s interpersonal warmth (e.g., will they cooperate or compete?) is one key factor determining decisions in a PDG.

In 1958, Harry Harlow conducted research on macaque monkeys, which suggested that macaque monkeys wanted to stick close to a mother who provided warmer physical contact over a mother that provided needs for survival (Harlow, 1958). Because of these early bonding experiences with its caregiver, Harlow suggested that there's a natural association between the physical warmth and psychological warmth (e.g., care, nurturance) in most animals. Building from this work, experimental work on temperature priming suggests that physical contact with a warm or cold surface can, indeed, influence feelings of interpersonal warmth (Williams & Bargh, 2008). In particular, physical warmth promotes social bonding. As a result, physical temperature can affect one's attitude and behavior towards others. In the present research, we reasoned that if the interpersonal warmth of an individual can be influenced using subtle temperature cues, that such shifts in temperature may affect decisions to cooperate or compete with others.

To test these ideas, we created an experiment with a 2 (Temperature Prime: Physical Warmth vs. Physical Cold) x 2 (Player Choice in PDG: Cooperate vs. Compete) design. In the first part of the study, participants were led to believe they were completing a consumer judgment task. Some participants evaluated a temperature pack that had been chilled and others evaluated a temperature pack that had been warmed. This was our manipulation of physical temperature. Next, participants learned they would interact with an anonymous partner (who was actually the computer) in an online PDG. Before completing the PDG, they further reported their expectations about this partner (e.g., would he/she be cooperative and trustworthy?). We predicted that people who were primed with physical warmth would expect their partner to be more interpersonally warm, and thus more cooperative. As a result, we expected physical warmth would elicit greater levels of cooperation from the participant than physical coldness. As exploratory analyses, we are also testing whether participants’ personalities (Big - 5 questionnaire; Goldberg, 1992) and sense of altruism (Rushton, Chrisjohn, & Fekken, 1981) interact with physical temperature to predict PDG decisions. This study is ongoing, and we aim to collect data from 50 - 75 individuals between the next two semesters.

A soundscape is an acoustic fingerprint, it tells the story of an environment in whole. It is made up of three types of sound: biophony (natural sound from living organisms), geophony (natural sound not coming from living organisms), and anthrophony (sound generated by humans). Colgate University expands up the hill with new dorm buildings and more students and faculty; soundscapes can tell us how these changes impact the levels of biodiversity and abundance in the forested land surrounding the campus. The richness and abundance of various species speaks to the health of a forest, thus by recording and analyzing the soundscapes of the land surrounding Colgate, we can measure the health of our land and track changes that occur over time. With an increase in human activity and development on campus and the looming threat of climate change, keeping track of the health of Colgate's land is of the utmost importance.

Soundscape recordings were gathered atop the Colgate Snowhill approximately four times each week. Each recording session lasted two hours and consisted of four separate recordings, each being 30 minutes long. Each session began at a specific time of day, either being at 5:20am, 12:00pm, or 6:00pm. The dusk and dawn sessions are characterized by high bird song output. These recordings are standardized with little exception; however, recordings cannot take place during heavy rainfall due to possible equipment damage and sharp decrease in biological activity. For each recording, we placed a microphone on a stand at a specific location and let it record for the full 30 minutes before ending the recording and moving the microphone to a new location where we would then start another recording. There were eight specific locations that we used to capture soundscape recordings, each of which was representative of a different type of habitat based on vegetation and geographic features. We wanted to get data that represented all of the diverse wildlife on the Snowhill and since different organisms have specific preferences of habitat, we chose locations that represented all of these habitats.

The analysis of the soundscape recordings was done using the statistical software R. Using the package “soundecology” we were able to produce a number of indices from each recording that contained useful information about the Snowhill ecosystem. Two key indices that we utilized were the Acoustic Diversity Index, which provided information on the level of biodiversity present, and the Bioacoustic Index, which provided information on the amount and amplitude of biological noise. Initial statistical tests showed that there was no significant correlation between temperature and ADI (p = 0.255) but a negatively significant correlation between temperature and bioacoustic activity (p = 0.00172). Our data from this summer is significant in that it shows how climate change and increasing temperatures could impact the forest ecosystems around Colgate. But, ultimately this is a longitudinal study and data gathered in subsequent years can be compared to the data that we have gathered to examine how Colgate’s forests are changing over time in terms of biodiversity and human influence.
Title of Project: Sex and Stigma: The Oneida Community Mansion House and the Struggle of Children's Programming

Project Summary:

This summer I interned with the Education Department at the Oneida Community Mansion House. The Oneida Community Mansion House (OCMH) is a non-profit historic house museum that shares the history of the Oneida Community. The Oneida Community was a socialist Utopian group that was active from 1848-1881. They are known for their social practices, which differed from their contemporaries: the Community believed in sharing all property in common, that men and women were of comparable standing, that all men and women in the Community were heterosexual spouses to one another, and that men were responsible for preventing conception. OCMH also strives to use the story of the Oneida Community as a platform to discuss pressing social issues that still face audiences today.

OCMH is working to expand their children’s programming and attract younger visitors to the museum. This is key for a few reasons – not only do children bring vitality and excitement to the museum space, but when children don’t come to the museum, neither do their parents. This means that the absence of children in the museum actually affects two different potential audiences for OCMH. Currently, only a few children attend the museum’s guided tours and most of the special events offered are for adult audiences. OCMH is in the process of conducting research to discern why children and their families do not attend OCMH, but early trends in non-user data suggest a few possibilities. Firstly, the rural setting of OCMH limits the amount of drive-by exposure and makes marketing in central, family-friendly locations a challenging task. Secondly, the reputation of the Oneida Community’s sexual relations may keep families away. Although OCMH’s children’s programming focuses on the Community’s love of sharing, communication, and education, some parents may not know that these age-appropriate children’s programs exist. To address these difficulties, OCMH’s education department is working to develop more child-friendly programs and marketing materials to inform families of these options.

My internship this summer focused on evaluating the existing children’s programming at OCMH as well as brainstorming and developing new children’s programming for the museum. OCMH already offers a few different children’s programs, such as a children’s tour for elementary school programs, family tours, and summer and winter day camp. I evaluated these programs with a few different methods: docent observation surveys, visitor experience surveys, visitor interviews, and parent surveys. Along with my evaluations, I also conducted research into the current best practices of children’s museum programming. I ultimately concluded that the current children’s programming needed to be altered to include more interactive, hands-on activities that allowed parents and children to learn together. Furthermore, the elementary school program needed to be updated so that it would align more closely with current New York State educational standards. The most exciting part of my job was the opportunity to develop new children’s programming for the museum. I developed a “History Mystery” scavenger hunt for OCMH’s summer camp that the museum now uses for younger visitors.

Research Fellow: Noah Campbell (2018)  Concentration(s): Mathematics; Environmental Studies
Faculty Mentor: Linda Tseng  Department(s): Physics; Environmental Studies

Title of Project: Characterization of Local Municipal Wastewater

Project Summary:

Water is perhaps the most important resource needed for a functional society. Even a small town such as Hamilton, NY can use millions of gallons of water per year. The sewage treatment process is an important and complex procedure which involves many variables, such as volume of water, weather, and rainfall. My Environmental Studies research with Professor Tseng studied wastewater from different stages of the treatment process at the Hamilton Wastewater Treatment Plant. In addition, both upstream and downstream of the plant, we took water and sediment samples from Payne Brook, which receives the plant’s effluent water. We sought to characterize the water, as well as attempt to discern any trends in chemical content and total organic material. Although we found some interesting results, this project will continue long-term before we have more significant findings.

We took water samples from five stages of the wastewater treatment process, and water and sediment samples from four stream locations - two upstream of the plant, and two downstream. For each water sample, we used a few different methods of determining the amount of organic material. Chemical Oxygen Demand, or COD, is the amount of a specific oxidant that reacts with a sample under controlled conditions. It is a way to measure dissolved organic material that will react with a given oxidant. Total Suspended Solids, TSS, is the amount of suspended material present, found by comparing the mass of a sample before and after heating it in a 103-105°C oven. Similarly, Volatile Suspended Solids, or VSS, is defined as the amount of combustible organic material present, which is the mass of material lost after heating the sample in a 550°C oven. The sediment samples collected from Payne Brook were analyzed for materials which tend to collect in the mud and sand, known as Contaminants of Emerging Concern.

Our findings were largely consistent with what was to be expected. The highest rates of organic material were found in the stages of the wastewater treatment process which included the most unprocessed sewage and/or bacteria. The levels in the Chlorinated Effluent samples, which were taken from the final stage of treatment, were generally not higher than the levels upstream or downstream of the Hamilton Wastewater Treatment Plant.

Perhaps surprisingly, the variable which affected the most types of samples (five) was the cloud coverage of the sky before and during sampling. At this stage in our research, we are unsure of the relevance of sky coverage for the wastewater treatment process. We wonder if it may be due to the broad relationship between cloud cover and other factors, such as temperature, humidity, and precipitation. We also postulate that the rate of photosynthesis may be altered by the cloud cover, changing the amount of organic material in the water.

At this point in the research process, precipitation levels have not been found to have any correlation to COD levels, which is somewhat surprising. We would expect sewage and storm water combined overflow to have an effect on the COD, because this overflow will often end up in the treatment plant. There may be a reason that precipitation levels affect suspended solid levels, while not having an effect on the levels of dissolved organic material. This is something we will look into over the course of this project.

Overall, we are still in the beginning stages of our exploration of the relationship between Payne Brook, the wastewater treatment plant, and outside factors. It appears that the weather has an effect on the TSS, VSS and COD found upstream, downstream and within the plant. However, we need more samples to find a more consistent relationship. Additionally, there are variables which we wish to be able to take into account, such as the population increase when Colgate students arrive for the fall, that we cannot test for in the summer months. We have uncovered some interesting results, but there is still much more to look into in this study on organic material in wastewater.

□ Other (specify):
Research Fellow: Megan Carney (2018)  
Concentration: Geography  
Faculty Mentor: Julie Dudrick  
Department: Upstate Institute  
Title of Project: Complete Streets: Mapping Central NY to Create Safer and Healthier Communities  

Project Summary:

My role at Bassett Healthcare this summer, through the Upstate Institute Summer Field School fellowship program, was to work on their “Complete Streets” project by mapping current sidewalk infrastructure and street design in rural Central NY towns. The term “Complete Streets” refers to a national initiative to plan, design, and maintain transportation networks that are safe and accessible for people of all ages and abilities, as well as to help support local economies and cultures. Examples of “Complete Streets” actions include creating more sidewalks and bike lanes, narrower roads, safer crosswalks, and more accessible public transportation stops. The project a part of the Mohawk Valley Population Health Improvement Program (MVPHIP), a unit of Bassett Healthcare’s research institute located in Cooperstown, NY. The program works to lower health disparities by working with regional communities and stakeholders, and one of their specific focus areas is to reduce regional obesity rates. As studies have shown that moderate physical activity has many health benefits, including lowering the risk for CVD, diabetes, osteoporosis, obesity, dementia, and clinical depression, working to create and maintain safe streets presents opportunities for people to be more physically active in their day-to-day lives.

The towns I mapped for the “Complete Streets” project includes Schoharie, Richfield Springs, Canajoharie, Gloversville, and Little Falls. I utilized Geographic Information Systems (GIS), specifically using the program ArcMap, to map and analyze current street design. I georeferenced World Aerial Imagery, available through the ArcGIS software, to display current sidewalk infrastructure in each town, as well as streets where sidewalks could potentially be expanded or restructured. I also mapped out areas where bike lanes and nature walking trails could be established. In order to gather this information, I visited each town to scout the street design. I referenced Google satellite imagery as well. Each map also included the location of important economic and cultural spaces, such as hospitals, grocery stores, schools, and shopping areas. I downloaded the address points from GIS.NYS.GOV (https://gis.ny.gov/). These locations were included to exactly pinpoint how pedestrian traffic can be improved upon to increase economic flow to these areas.

The maps I have created this summer will be incorporated into a three-day workshop hosted by Bassett Healthcare in October 2017 to highlight the importance of adapting “Complete Streets” resolutions to communities. The overall goal is to convince municipalities to invest in creating safer streets and, in turn, increasing downtown business activity and advocating for healthier livelihoods.

![Figure 1 and Figure 2. Examples of maps of Canajoharie, NY (left) and Richfield Springs, NY (right).](image-url)

☑ Other (specify): Upstate Institute
Title of Project: A Study on the Different Factors That Are Affecting the Efficacy of Schizophrenia Treatment at the National Institute of Mental Health, Sri Lanka

Project Summary:

The focus of this study was to investigate how socialization factors, stigma, cultural practices, treatment practice, national policy, protocol and other unidentified factors, have a connection and potential influence on the treatment outcomes of patients suffering from schizophrenia at the National Institute of Mental Health (NIMH), Sri Lanka; the only public institution that provides long-term psychiatric care in a country with a population of over 20 million people. It aimed to provide important information that could be used in the future to further promote the wellbeing of this particular community.

This qualitative study was conducted over a two-month period, and consisted of both observation and guided interviews. The population of interest was health professionals working at the National Institute of Mental Health, and professionals working for Sri Lanka’s Ministry of Health. Due to the hospital’s limited professional population and the qualitative nature of this study, both criterion-based, and theoretical sampling methods were used. In order to observe health professional interactions, using a naturalistic observational method, five wards that included the treatment of patients suffering from schizophrenia were included in this study.

The desire to conduct research regarding this community arose after completing an observational report at NIMH, regarding stigma around psychiatric illness in Sri Lanka. The study was primarily conducted to provide insight on different psychiatric services at NIMH, bring light to policies that still need improvement in order to eliminate the stigma around psychiatric illnesses, and promote the wellbeing of its patients. During this investigative period, it was found that patients suffering from schizophrenia at NIMH experience very high relapse, readmission rates, and respond very poorly to treatment. With only a handful of psychiatrists overseeing a hospital with over 1000 patients, having limited resources, and a low budget, psychiatrists have not had the opportunity to research and examine the many factors that could play a potential role in treatment outcomes of patients suffering from schizophrenia.

Through the Upstate Institute Summer Field School this summer, I have had the privilege of working as a Fellow at Chenango County’s Hospice & Palliative Care in the Norwich region. Hospice of Chenango County is a relatively small non-profit healthcare organization that specializes in end of life care. Their mission is to provide the highest quality end of life care by partnering with patients, families, and the community. In doing so, Hospice strives to provide pain and symptom control, and give emotional and social support to all their patients and loved ones. Hospice of Chenango County provides three service lines to their residents in the Chenango County: hospice care, to those living in their homes or a contracted skilled nursing facility; palliative care through collaboration with At Home Care; and Complimentary Grief Services to residents of Chenango County.

Especially in lieu of the new administration, the future of healthcare is uncertain and ever-changing. With changes in regulations, treatments, laws, and the rapid acceleration of technology, something new is always around the corner. During my time at Hospice of Chenango County, I have been exposed to the non-profit side of a healthcare organization that is eager for growth and determined to provide their services to all residents in need. By working together under new leadership, the new changes in action are positive and headed in the right direction to make the organization an even better resource for Chenango County residents. The ideas and conversations sparked from the ever-changing facets of healthcare have proven to be useful and necessary to improve access to care and experience of care, all while doing this with a non-profit mindset. With this mindset, donations and fundraisers are most valuable (such as the annual plant sale).

During my time spent at Hospice of Chenango County I lent a hand investigating different avenues for fundraising and community outreach. My first project was to plot out where patients live, where the referral for Hospice care came from, and where their primary care doctor location is by researching trends in patient referral sources over the past few years I was able to gain a better understanding of what areas in the county would benefit most from certain outreach aspects. This was done to determine where outreach should be focused, along with marketing and education efforts. For example, if a majority of the town of Earlville referrals from 2015-2017 were by word of mouth, it would be in the best interest to continue with a word of mouth marketing system in the Earlville area.

On top of researching trends, I took a look at the fundraising aspect of Hospice. Hospice of Chenango County hosts five larger fundraisers each year. Fundraisers are crucial to the organization, with the plant sale accruing the most revenue. I looked at spreadsheets of orders from the last few years regarding the plant sale, investigating which areas sold the most plants and which plants sold the most. This was done to target certain areas that had low sales in hopes to increase the number of participants in the coming year.

Lastly, a common misconception attributed to Hospice is ‘giving up’. On the contrary, Hospice is a service that comes to the patient; 67% of patients receive Hospice in their own home. It is proven that patients in Hospice care, on average, live 29 days longer than those who are not in Hospice. With these numbers in mind, I created a survey to highlight the areas where knowledge of Hospice is prominent, and areas where it is lacking. A short 10 question survey was distributed to the Hospice & Palliative Care of Chenango County Facebook page, which has a strong following.

Research Fellow:  MaKenna Cealie (2019)  
Concentration:  Neuroscience

Faculty Mentor:  Wan-chun Liu  
Department:  Psychology

Title of Project:  The Influence of Early Auditory Experience on the Development of Vocal Learning and Neural Circuits

Project Summary:

My research is focused on how environmental factors can influence development of vocal learning and its brain circuits. Zebra finches are a good model for neuroscience because of the many parallels in vocal learning and brain structures between songbirds and humans. Studies have shown that there is environmental influence on the development of human speech/language learning and the brain. In my research, I have been looking at how prenatal and early postnatal environmental changes can impact development of neural circuits and vocal learning. The project I have been working on is playback experiments with eggs and newborn birds.

In humans, it is known that the onset of auditory learning starts as early as the prenatal stage. Human fetuses can hear and respond to their mothers’ voices. In animals, there has also been evidence of prenatal auditory learning in Australian cuckoo birds. After chicks have hatched they can imitate their mother’s “incubation” calls produced only during the late embryonic stage while the chicks are in the eggs, which suggests that auditory learning is happening in the prenatal stage. There is still much unknown about early auditory listening in songbirds, such as: Is there prenatal auditory learning in zebra finches? What are the neural mechanisms for auditory listening? What brain regions are involved? I thus hypothesize that there will be prenatal auditory learning in the auditory region of zebra finches.

To test this hypothesis, I looked at gene expression of a songbird species, the zebra finch, after playing zebra finch songs to embryonic and newborn birds. A silent condition where no song was played back toward the eggs to act as a control. After song playback, the birds were sacrificed and in situ hybridization was used to look at ZENK expression in the birds’ brains. ZENK is an immediate early gene that is expressed in response to neural activity. The preliminary results show that there appeared to be more ZENK expression in the playback condition compared to the silent condition, which could suggest that the auditory region of the brain is activated in response to birdsong playback. This could mean that zebra finches might have prenatal auditory learning.

My future plan is to increase my sample size and continue to analyze data to confirm that there is more gene expression in the auditory region after song playback. I will also do in situ for adult zebra finch brains so I can further compare auditory expression at different stages of the zebra finch life. If there are positive results, I could continue with this research by playing conspecific and heterospecific songs to the birds, then analyzing gene expression to see if young zebra finches can differentiate between species’ songs.
Project Summary:

The goal of this research was to find a comprehensive model for visual evoked potentials (VEPs) measured via electroencephalography (EEG). VEPs are elicited by visual stimuli and constitute a measure of activation from multiple populations of neurons in the visual cortex. The magnitude of VEPs is influenced by a wide variety of visual features, thereby making it difficult to model. Instead of trying to capture every single visual feature that could modulate VEPs, we took a different approach and attempted to model the geometry of the VEP response space. Through this research, we learned about the basic properties of visual system and image state space in addition to gaining valuable skills including knowledge of Matlab programming, EEG net application, and data analysis.

In the first half of the summer, we replicated research that gave a geometric model of the response space defined by individual neurons. In order to do so, we utilized “sparsenet” which is a software routine written in Matlab by Bruno Olshausen (Olshausen & Field, 1997). When given image patches as inputs, sparsenet breaks the images down into their basic components in the most efficient way possible. These basic components are called basis vectors, and they look similar to the receptive fields in the visual cortex (see figure 1). Using these basis vectors as neurons and considering the angle between the basis vectors, the geometry of neuronal response can be modeled. This was done by using sparsenet to collect responses to basis vectors and then projecting the response into the two dimensional plane created by two basis vectors.

During the second part of the summer, we applied the logic from the sparsenet analysis to investigate the geometry of VEP response space. We considered the angles between 512x512 images and then observed where in space the image vectors were located (see figure 2). To explore how VEPs interacted in this image state space, nine batches of images were selected from the collection. Images with similar angles relative to all other images clustered closer together and were in similar batches. Human participants viewed these images during an EEG recording session. Once the data had been collected and analyzed, we saw that the different batches of images had distinct VEPs (see figure 3). We finished the summer working on building a geometric representation of the VEP response space.

Figure 1: Basis vectors generated from sparsenet that were used to model neurons.

Figure 2: Image State Space. Each point represents an image plotted relative to its distance from three other images.

Figure 3: VEP data. Each colored line represents a different image batch. Note that each image batch has a specific response profile.
Project Summary:

In a social network, a clique is a group of mutual friends. A clique is maximum if it has the largest cardinality among all cliques in the graph (as shown in Fig 1). There is no known efficient algorithm to compute a maximum clique; even the best ones evaluate an exponential number of cliques in the worst case. However, there are many real-world applications, such as community detection in social networks and molecular docking in computational biology. Our research focuses on speeding up maximum clique finding.

We show that applying graph partitioning with techniques to reduce graph size significantly speeds up clique finding. Our process is two-fold. We first use an existing technique, due to San Segundo, Lopez & Pardalos [1], to pre-process by initially finding a high quality clique very quickly and then peeling away parts of the graph that cannot contain a larger clique. Then, we use graph partitioning to break up the resulting graph into smaller disjoint subgraphs with few crossing edges between them using KaHIP, a high quality graph partitioner [2. Sanders & Schulz]. Each subgraph contains only those edges between vertices of that subgraph. Edges between vertices in different blocks (crossing edges) induce a separate inter-block subgraph (illustrated by the center subgraph in Fig 2). A maximum clique will be found in at least one of these subgraphs due to the nature of our partitioning. We observe that clique finding is fast on block subgraphs, however the inter-block subgraph is prohibitively expensive due to its size; we therefore introduce a new reduction for the inter-block subgraph.

A clique that is unique to the inter-block subgraph must contain a crossing edge; all other cliques are evaluated in the single block subgraphs. As shown in Fig 3, we can peel away those edges of the inter-block subgraph that are guaranteed to not be in a large clique. We can remove crossing edge whose end vertices have a common neighborhood smaller than the best known clique size minus one. Applying this process iteratively removes a significant number of edges from the inter-block subgraph.

Partitioning the original graph and then processing the inter-block subgraph before running the search algorithm shows promising results. On 32 partitions, we achieve a maximum speed-up of 69x and an average speed-up of 9.5x over all instances. We currently only measure search times, since more work is needed to modify our algorithm to perform preprocessing more efficiently.

Future work also includes scaling up our reduction algorithm using a $k$-plex reduction technique and efficiently processing networks that do not fit in memory.

Works Cited
As a result of selective breeding by humans, the domesticated dog exhibits a large amount of visible variation between breeds. Physical traits that demonstrate this variation range from pointy or floppy ears, too long or short tails. These types of phenotypic differences establish dogs as excellent candidates for studying complex genetics. For my own project, I focused on coat color, specifically shades of yellow. The current list of genes known to contribute to coat color can determine whether a dog’s coat will contain pheomelanin, the pigment responsible for red and yellow coat color, but cannot explain the difference in intensity that creates white, cream, apricot (light red), and red coats.

In order to identify genes that were associated with this coat color variation, we compared white dogs to black, brown, blue, and silver dogs using a Genome-Wide Association Study. The resulting Manhattan Plot (Figure 1) showed several genetic variants (SNPs) that demonstrated genome-wide significance (-log(p)>6), with the highest association found on chromosomes 5 (which contains the gene known to be essential for yellow color) and 4. From previous work in Professor Hoopes's lab, Chromosome 4 SNP 2 was found to show a significant difference between red and white dogs. We continued to genotype all dogs that demonstrated a phenotype of white, cream, apricot, or red coat color at this SNP. Additionally, we genotyped all of these dogs at the variant linked to dilution of black color (silver), which breeders believed may also be linked to shades of yellow.

Using PLINK software, we found that both Chromosome 4 SNP2 (p=0.0001619) and the silver SNP (p=0.00104) are associated with red or white phenotype when comparing white and cream dogs to red and apricot dogs. There was a significant difference when comparing which nucleotide, A or G, was present at each SNP (Figure 2). When these two SNPs are combined and considered quantitatively, there is a significant difference between the two groups as well in regard to how many of each alleles they possess. However, it remains unknown as to how or if these SNPs interact with each other or other SNPs that we did not genotype. Moving forward, establishing more phenotypic groups such as light apricot, dark apricot, light red, and dark red instead of simply red and white will create a more quantitative and specific approach to looking at this range of coat colors. Additional genotyping at other SNPs that demonstrated significance would be ideal in determining if they also play a role in intensity of yellow, and will allow for further studies on interactions of all of the SNPs linked to differences between red and white.

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

My summer research was on Ghost Imaging, which is a quantum optics experiment that utilizes spatial and temporal correlations between entangled photons produced in spontaneous parametric down-conversion (SPDC). What this means is that when we fire a laser beam through a crystal, it splits the beam into two new, weaker beams. These new beams are made up of photons that are correlated in both time and space. When we send one of these new beams to an object and the other to a camera, we are able to produce an image of the object.

Most of my summer was spent learning how to use an advanced Electron Multiplying Charged Coupled Device (EMCCD) camera and imaging software. In addition to learning how to use the equipment for the experiment, I had to test the limits of our camera in order to determine if it was suitable for ghost imaging.

My first large task was testing the camera’s sensitivity to low light levels and short exposure times. This was done by imaging the photon rings created in Type-I and Type-II SPDC. The images of the two types of rings can be seen below. Figure 1 shows the single ring created from a Type-I crystal while figure 2 is an image of the two rings created by a Type-II crystal. Where the two rings intersect is where the pairs of entangled photons are created.

My next major task was to determine the electronic delay in our camera, which would then determine the length of the arms in our experiment. The basic layout for ghost imaging contains two arms and can be seen in Figure 3. The setup consists of a pump beam, SPDC crystals, our object, bucket detector, and EMCCD camera. Because light moves so quickly, we need to make sure the electronic delay of our camera is not too slow. This is because once a photon passes our object and is detected by the bucket detector, we send a pulse to the camera to take a picture of the partner photon. If the pulse does not arrive at the same time as the partner we will miss it, and will be unable to image the object. Ghost imaging works by having a camera take a picture of all the partner photons that make it past the object and to the bucket detector. This creates an image of the shadow of the object.

I tested the delay of our camera by using a finely tuned electronic pulse generator and pulse laser. I would fire the laser and start the camera at fixed intervals with the pulse generator and see if I am able to get a picture of the laser. By changing the time between the firing of the laser and when the camera exposes, I am able to determine the delay on the camera. As a result, we found that the delay on our camera is around 150 microseconds, which means our delay line to the camera needs to be about 400 meters long.

I will be continuing this research as my thesis for senior year. Seeing as 400 meters is an unreasonably long distance for our experiment, we will try and change out our camera for a scanning single-pixel detector setup, which has a much shorter delay time.

Project Summary:

I spent this summer writing tutorials for future students to use when working in a program called Processing. Processing is a computer software program that is based in a programming language called Java. This particular software is designed with artists in mind because it is easy to create many different shapes, such as ellipses, rectangles, and triangles, in any color that appear in a graphics window—a small window on the screen on for the images to be displayed. When using Processing, it’s simple to create works of art on a computer. It’s also simple to recreate works of art, which is the basis of the assignment that originated this research project. Our faculty advisor had, in the past, assigned students to recreate famous paintings using the Processing software. There were many difficulties that arose with this, as recreating 3-dimensional perspective using a 2-dimensional platform can be very tricky. To help future students struggle less when completing this assignment my colleague and I recognized ways that we struggled when recreating paintings and wrote tutorials of how to best tackle these complicated situations, along with some general advice on completing the assignment. In addition to writing tutorials, I also spent some of my summer research time learning the Java programming language.

I wrote seven tutorials this summer. The first of which was on coding cylinders so they appeared to be in perspective. To do this, the students need to think of the cylinder as a stack of ellipses that change size and positions slightly as they are stacked. By thinking about the cylinder like this, the student can write a for loop or a while loop that draws a new cylinder each time and changes the width, height, and the x and y of the center position. In following these directions, the end result should look something like Fig. 1. The second tutorial was on coding cones in perspective. This used a similar method to coding cylinders, but as the cylinders are stacked, the width and height change in such a way that either the first or last ellipse drawn has a width and height of 0. By doing this, it’s like a cylinder that comes to a point. The result of following these directions will result in an image like Fig. 2. The third tutorial I wrote was about creating shaded cylinders, that is, cylinders that are colored to appear as though there is shadow on them. To do this, the student follows the cylinder tutorial, but also codes arcs in different colors to make up the shaded outer wall of the cylinder. The fourth tutorial involved using Adobe Illustrator and described a method of outlining faces using its pen tool. This is a useful resource in conjunction with a tutorial my colleague wrote describing how to turn Illustrator creations into Processing files by saving them as SVG files. It can be difficult to translate the curves of face shapes into the simple shapes that are available in Processing, but using these two tutorials, it can become much simpler. My fifth tutorial explained how to use a Cylinder class that I had made that allows the user to create Cylinder objects and draw them with and without shading. My sixth and seventh tutorials explained how to constrain randomly generated shapes to an elliptical boundary. One demonstrated how to achieve this using Point and Dimension objects and the other explained how to achieve this without using them. The result of this process can be seen in Fig. 4.

<table>
<thead>
<tr>
<th>Fig. 1</th>
<th>Fig. 2</th>
<th>Fig. 3</th>
<th>Fig. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is the result of following my cylinder tutorial.</td>
<td>This is the result of following my cone tutorial.</td>
<td>This is the result of following my shading cylinders tutorial.</td>
<td>This is the result of following my elliptical boundary tutorial.</td>
</tr>
</tbody>
</table>

Project Summary:

The majority of my time for this research project was spent in the Colgate University Archives and Facilities Archives. I went through all of the documentation on Andrews Hall, Lawrence Hall, Whitnall Field, and Huntington Gymnasium. The goal was to compile a complete history of each building from information on the architect, down to the materials that were used for each building. All of these building projects were completed within a ten-year span and that proved beneficial in my knowledge of the President, Board of Trustees, and other important figures of Colgate during this time period. Another important part of my research was discovering themes and successful traits in web archives of other colleges and universities. Professor McVaugh hopes to launch a web archive for the architectural history of Colgate in the near future and I helped to conceive what the layout or context could be. Below I provided a very quick and broad summary of information gathered on the buildings I researched.

In June of 1920 after students were returning from war the need for a new dormitory became extremely dire. The last dormitory built on campus was Eaton Hall in 1886 and outside of the seminary it was East Hall in 1834. Construction for Andrews Hall began in May 1922 and students were able to occupy the building in the fall of 1923. The building was built to provide more living space for 84 men on the campus and designed by the firm Gouge and Ames. This four-story stone structure was centered 200 feet south of East and West Halls. The massing of Andrews Hall is different from East and West Halls because the building projects out on both sides and the central core of the building is recessed. A simple steep-pitched roof is used and dormers are incorporated on the façade. In January 1925, Colonel Austen Colgate generously donated $400.00 for the erection of a new building. Austen Colgate was a member of the Board of Trustees at the University for several years and was committed to bettering the Colgate community throughout his life. He let the Board of Trustees decide between either creating a new recitation hall or dormitory and selected Walter Chambers as the architect. The building would be named “Lawrence Hall” as a dedication to Reverend William M. Lawrence D.D. Lawrence Hall has three clear vertical divisions where a dominant central core projects from the outer “arms” on either side. Such a massing was common in academic buildings across the United States in order to align with the Beaux-Arts mentality. This classical form allowed for hierarchy and strict proportionality on the façade. The old gymnasium and Whitnall Field on the lower campus were the extent of Colgate’s athletic facilities in 1914, with exception to the Academy field that was closed down with the Academy. Huntington Gymnasium was made possible by the fundraising efforts of the student body and alumni and would mark a tremendous leap for Colgate athletics. I found numerous undiscovered documents in the facilities archives that help show the different locations and renderings for Huntington Gymnasium. These documents were critical in patching my research together and giving insight into the design process for each building project.

Huntington Gymnasium, Preliminary Study Front Elevation, Franklin Ware, Undated

☐ Other (specify):
Earthworms play a critical role in shaping their local habitats, which they do by aiding in decomposition of decaying organic matter and mixing key nutritional components through different soil depths. Earthworms, however, are not native to the northeastern United States. After a period of cold temperatures known as Pleistocene glaciation, all earthworms North of Pennsylvania either died off or were driven south to warmer temperatures. Most earthworms found in the northeastern United States today are European invaders, including the well-known night crawler.

Throughout the course of this summer, our research focused on the presence and abundance of earthworms in the areas surrounding Colgate University. Plots of land were fenced off in order to ascertain the effects of local deer population on plants. We worked in tandem with the students analyzing the influence of deer on plant diversity, and studied the effects earthworm presence had on the local biodiversity and on the forest floor. To isolate effects caused by deer and those caused by earthworms, we conducted field work both inside the fenced-off areas devoid of deer and outside the fenced off areas where deer were present. To analyze the effect earthworms had on the state of the forest floor, we took samples of the leaf litter layer and all the organisms living within it. Soil samples were taken to analyze soil pH. Afterwards, we cleared roughly meter square quadrats of the forest floor and applied a mustard water solution to drive all earthworms in the soil to the surface for collection. The worms were identified, and kept in the lab. All the bugs living in the leaf litter layer extracted from the field sites were removed from the leaf litter by implementation of Berlese funnels and stored for identification. The leaf litter was then processed in order to determine percent organic matter by weight.

Generally, we found presence of earthworms was directly correlated with a lower percent organic matter in the leaf litter layer. This trend was not always followed, however, and in some instances earthworm presence was paired with thicker leaf litter and a higher percent organic matter by mass. Soil pH was also analyzed, though correlations between earthworm presence and soil pH have not yet been analyzed. The identification of both worms and bugs collected in the field is still ongoing.
Title of Project: Staging Cinema: Performance, Liveness, and the Transition to Sound

Project Summary:

When patrons walk into movie theaters today, they enter with certain expectations of their movie-going experience. They expect to see a box office in the lobby and a concession stand. Inside the theater, they expect to find a dark room with rows of comfortable seats facing a large projection screen.

However, audiences entering prominent movie theaters in major U.S. cities in the early 1920s would have entirely different expectations. They would expect to see a grand hall, complete with elaborate decorations, velvet chairs, ornate architecture, and a full stage beneath a proscenium arch. Moreover, they would expect to see and hear a live orchestra, an organist, and a fleet of other actors, actresses, solo musicians, and dancers.

Long before the American film industry’s shift to “sound” in the late-1920s, filmmakers, innovators, and particularly exhibitors were exploring ways to make film “sound.” Using archival materials, particularly the trade journals *Motion Picture News* and *Moving Picture World*, we examined a wide range of silent era audiovisual experiments: live stage prologues in which music, dance, and dialogue were used to introduce and create an ambience for feature films; live radio broadcasts of narrated motion picture programs, among others.

Taken together, these experiments expand our understanding of film’s so-called silent era, adding a new dimension to contemporary debates about technology, perception, and sensation. Ultimately, these ventures show the way in which film’s transition to sound was not a rapid technological shift, but an ongoing investigation of liveness, mediation, and the concept of the audiovisual enacted by a diverse group of exhibitors, performers, filmmakers, and the American public.
Research Fellow: Matthew “Matt” De Leo (2018)  
Concentration: Political Science

Faculty Mentor: Robert Kraynak  
Department(s): POSC; Center for Freedom and Western Civilization

Title of Project: Benevolence in Human Nature: Solving the Adam Smith Problem

Project Summary:

The two primary works of Adam Smith, The Wealth of Nations and The Theory of Moral Sentiments seem to paint two different views of human nature – the former emphasizes man as a selfish materialist motivated by economic interest, while the latter emphasizes man as a social animal motivated by sympathy or benevolence. Scholars have debated extensively the question of whether Smith is inconsistent for presenting divergent views of human nature in these two works. In my research, I look at the work of several scholars and attempt to show where they are wrong, while arguing that benevolence is actually the guiding factor in Smith’s view of human nature.

The paper sets out to prove that Adam Smith intended to use The Theory of Moral Sentiments as a way of explaining the system of social interactions among human beings as well as the importance of virtue. I then argue that The Wealth of Nations is in many ways a rejection of mercantilist, zero-sum economic policy. Smith rejected this notion due to the selfish behavior it creates. The system of perfect and ordered “natural liberty” is the ideal, if unrealistic, economic system for Adam Smith; it is one where people are allowed to have personal choice because it has the most positive effect on the society. The paper shows that the role of society and government are to foster an environment in which virtuous and benevolent people are able to thrive while also punishing those who seek to do harm to fellow-citizens. This work builds on the work of Donald Winch and Dogan Gocmen, while rejecting Gocmen’s conclusions about the problems of a commercial society and the Marxist utopia that he believes Smith envisioned.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Center for Freedom and Western Civilization  
(James Madison Summer Research Fund)
Title of Project: Improving Auto-generated Repairs for Computer Networks

Project Summary:

Computer networks are often complex, which makes it very difficult for network operators to manage them. Networks are composed of physical devices, called routers, that pass messages through the network and exchange control information to learn the best path through the network. Each router is configured to use specific algorithms and settings to identify the best path. Network verification tools, such as ARC [1], have been developed to confirm that a network is upholding important policies, even if part of the network fails. However, operators must still manually fix the configuration problems these tools uncover. We would like to automatically repair network configuration errors, quickly and efficiently, so we can fix problems and restore network security and availability. Existing methods for network repair [2,3] do not scale to large, complex networks. Our goal is to use genetic programming techniques that have been used to automatically repair bugs in computer programs [4] to repair network configuration errors.

We use genetic algorithms to mutate router configurations until a correct repair is generated. Our genetic programming code takes the set of erroneous router configurations as input. Using the output from ARC, we can localize a failure to a line or set of lines within the configuration files. Once the fault has been found, a random mutation occurs. A line is inserted, removed, or replaced by another existing line within the configuration files in the network. These mutations create a new generation of configuration files. The chance of an individual configuration moving on to the next generation to be further mutated is dependent on its ability to satisfy network policies. If an individual can uphold many of the network’s policies, then it has a high fitness level and is more likely to be chosen for the next generation. As generations are created, the goal is that configurations will be edited in a way that fixes the detected policy violations.

To ensure efficient performance, we need to limit the space of possible mutations available to our repair algorithm. We implement a fault localization heuristic that narrows the search space to the lines of configuration that are most likely responsible for the violated policies. We use the network verification results from ARC, which list violated policies along with paths through the network that demonstrate these violations. We take the routers involved in a given path and identify sections of the network configurations which we think contributed to the violation. Additionally, we wrote a configuration simplifier, which removes lines of configuration that are unrelated to network policy. Simplifying router configurations beforehand will make the localization process more efficient, as it reduces the search space for fault localization and patch generation.

The graph shows the time required to fix certain policy violations in a simple network. For example, ACLs are used to block certain hosts from entering or leaving a network for security purposes. Missing ACLs are easily localizable and can be fixed with a single insertion. Sometimes violations can occur if some component of a router is accidentally disabled. Fixing such violations can be fast because localization can detect the exact faulty statement and the mutation operator required is a single deletion. Other scenarios can be more ambiguous and hard to localize. If two parts of the network are suddenly unable to communicate with each other, it is harder to determine where the fault exists, so more router configurations have to be mutated to find a solution.

_genre: Other (specify): National Science Foundation Grant


Faculty Mentor: Robert Kraynak  Department(s): POSC; Center for Freedom and Western Civilization

Title of Project: American Origins: An Examination of Competing Theories of the American Founding

Project Summary:

This summer I interned here at Colgate for the Center for Freedom and Western Civilization. My research project studied the various influences and origins of the American Founding, examining several different arguments and perspectives. I presented four different primary theses written by well-respected academic scholars. These included Russell Kirk and his “Five Cities” thesis, Barry Shain and his Protestant Communalism/Localism Thesis, the English Common Law and Tradition Thesis, and finally Michael Zuckert and Thomas West’s Natural Law and Natural Rights Thesis. My research paper gave a comprehensive overview of each argument, hitting their main points and presenting a wide range of evidence each argument utilizes. I ultimately came to a conclusion about which thesis/author(s) gave the strongest argument for the roots and origins of the American Founding. After extensive reading, research, and evaluating of the different theses, I concluded that Michael Zuckert and Thomas West, who present the Natural Law and Natural Rights thesis, provided the strongest arguments and the best documented evidence. While I overall did conclude that the American Founding was a clear conglomeration of different sources and traditions, my paper asserts that there is a clear case made for the centrality of Natural Law and Natural Rights at the American Founding providing ample and detailed evidence to back up my claim. This was a fantastic summer experience for me and provided me with an opportunity to study an academic subject that I have a great passion for and to produce a high quality research paper I can be proud of for some time.

Source of Support: □ AHUM Div.  □ NASC Div.  □ SOSC Div.  □ UNST Div.  ☒ Other (specify): Center for Freedom and Western Civilization (James Madison Summer Research Fund)
Title of Project: Health Status of Ethiopian Sacred Forests

Project Summary:

The Amhara region of Northern Ethiopia, like many regions in Africa, has suffered from centuries of deforestation driven by the new industrialization of the country. Due to their religious and cultural importance, the sacred forests of Northern Ethiopia, which surround Ethiopian Orthodox Tewahido Churches, have survived to modern day. Despite efforts of both local and international parties to protect these forests, they are still threatened by their small size and isolation. They also suffer high levels of disturbance through activities such as cattle grazing, edge effects, and human disturbance (e.g. firewood gathering and human burial).

Although it is important to preserve these forests for cultural reasons, they are critical ecologically because they serve as biodiversity refugia: they hold the majority of the biodiversity of the region. The main concern for the conservation of these forests is the lack of forest regeneration due to the low rate of seedling survival: as adult trees die, there will be no new generation of young trees to replace them. In order to protect these forests, the conservation approach must be multi-faceted, taking into consideration both the ecological and social importance of these forests and including the local population in their conservation. In fact, part of our research focuses on gathering social science data on the effect and interactions between the local population and these forests. We believe understanding the role of these forests is critical to understanding not only why, but also how they should be protected.

While in Ethiopia, we collaborated with a team of Ethiopian graduate students in partnership with Bahir Dar University and worked on assessing ecological status of the sacred church forests of Northern Ethiopia. Across multiple sites, we measured and identified trees and saplings and collected foliar, litter, and soil samples. We processed soil and plant material in our lab at Bahir Dar University and continued this work at Colgate. We have analyzed all samples for total carbon, nitrogen, and phosphorus, and soils for available plant nutrients (phosphorus, nitrogen, calcium). With the combined efforts of the natural science team and the social science team, we aim to better understand the ecological status and social/cultural value of these forests.

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

Title of Project: Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate

Project Summary:

Over the summer, I conducted research on the lateral line of the zebrafish in Professor Meyers’ lab. Some vertebrates, such as the zebrafish, are capable of repairing sensory organs like the retina or sensory hair cells. However, mammals do not possess this ability, and it has been theorized that this due to the risk of cancer that is associated with the division of cells to repair damage. Therefore, studying the mechanisms of regeneration in the zebrafish is important for giving us insights on how to treat conditions such as blindness and hearing loss in humans. My research focused on the regeneration of the neuromast of the zebrafish. The neuromast is a sensory organ which contains sensory hair cells that allow the zebra to detect motions/direction of water flow. The neuromast is developed from a primordium containing approximately 140 cells. The primordium develops approximately 22 hours after fertilization and it migrates caudally towards the tail end of the zebrafish. Along the way the primordium drops off clusters of cells which eventually develop into neuromasts. A fish at a particular time may contain 5-7 neuromasts. The neuromasts consists of three cell types: mantle cells, support cells, and sensory hair cells [as shown in Figure 1]. In my research, I used different types of drugs to manipulate the signaling pathways of the neuromast in order to look at how it affects its regeneration.

I primarily worked with two different drugs: AZ and PD166. AZ is a Wnt activator and PD166 is an FGF inhibitor. Both of these signaling pathways interact with each other in the primordium and during the formation of the neuromast. In a 2 day old fish, with neuromasts already formed, AZ and PD166 together causes the neuromast to reenter their migrating fate. My first question was focused on how Wnt and FGF signaling affect the reformation of neuromasts after spreading. We had already known that if both drugs were washed off the spreading neuromast will reform into a cluster similar to figure 1. So basically, I wanted to look at what would happen if only one of the drugs was washed off. Will that impact neuromast reformation? In order to see the effect of the drugs, genetically modified zebrafish were used to allow us to see the cells of the neuromast. Drugs were applied to two-day old fish for two days after which, one drug was removed and the fish were left to incubate for another two days. For the two controls, both drugs were washed off in one and no drugs were washed off in the other. It seemed, although not substantiated, that the neuromast did not reform when Wnt activator (AZ) was not washed off. From figure 2, it seems that the neuromast reforms in all the trials except for the one where AZ remained, labeled “PD wash”. In this trial, it is clear that the neuromast did not reform, but instead seem to spread erratically, suggesting that FGF is needed for in order to reform. More experiment would need to be done to corroborate the findings, which would then need to be quantify.

In a follow up experiment, I wanted to look at the sensory hair cells. I wanted to investigate what happens to the sensory hair cells after the drug induced spreading; would hair cells remain in the same place, would they migrate with the other cells and return after the drugs were washed off, or would they be completely random about the neuromast? To conduct this experiment, I used a line of genetically modified fish known as Brn – this modification would allow me to identify the sensory hair cells within the neuromast. The two-day-old fish were treated with the AZ and PD166 and incubate for two days, then the drugs were removed and the fish was placed in BrdU for another two days. BrdU is a drug that labels dividing cells. In figure 3, the dividing cells are labeled in green and the sensory hair cells of the neuromast are labeled in red – hair cells that contain green are new (they were formed after the drug was washed off and the fish were placed in BrdU) and older hair cells are only red. To my surprise, it seems that sensory hair cells are replaced by dividing support cells. It seems that all, or most of, the hair cells were destroyed when the neuromast begins to spread, causing new hair cells to form after the fish was removed from the drugs. This experiment would also need to be repeated and quantify for better understanding of what is going on.

Title of Project: The Multilingual Experiences of International Students on NY6 Campuses

Project Summary:

Our research project, “The Multilingual Experiences of International Students on NY6 Campuses,” began with our desire to see “us” -- international students who speak English as a non-native language in US liberal arts institutions. We were interested in the relationship between English as a non-native language and matters of race, gender, class, sexuality, and cultural orientations, which were important themes that we observed in our own experiences. We interviewed 14 students (13 from Colgate University, 1 from Skidmore College). We positioned ourselves and our interviewees as equal, including ourselves in the research sample and listening to our interviewees with empathy and a respect for originality and diversity.

Two themes were central to our research project: border-crossing and agency. For international students, the crossing of national borders brings in the crossings of the borders of race, gender, class, sexuality, language, “culture,” etc. These crossings pose difficulties but also provide opportunities for agency. We were interested in the question: Under unfavorable circumstances, how can international students survive and thrive?

Our first finding reaffirms that international students are different. Research participants under similar circumstances in terms of country of origin, linguistic experiences, and academic experience at their US institutions, often have completely different interpretations of their lives and their institutions. This, we believe, is largely due to their personalities, how they navigate their campuses, and their experiences back home, along with how all of these contribute to who they are. We strove to unpack these complexities.

A second finding is the relationship between intersectionality and the English language. Interviewees who identified as white generally felt more comfortable speaking and using English. For research participants of color, those who are extroverted and who choose to unsee or think less about discrimination and oppression felt more comfortable. The more they tended to assimilate, the smoother their experience seemed to be.

We also found a correlation between levels of consciousness and levels of vulnerability and strength. Having consciousness of racial, political issues could be a vulnerability. International students, often belonging to disadvantageous or under-represented identity categories, would have to endure more pain if they constantly reminded themselves of their oppressions and their dilemmas. If they overlooked these oppressions, they could allocate their energy to more practical matters such as passing exams and working their jobs. However, all actions have prices. Students who paid the price to delve into political issues seemed to gain the potential of seeing past the superficial, of making deeper connections, and of finding themselves a spiritual home. Weighing choices is difficult; however, choices are not static. Vulnerability and strength can be transformational.

Finally, we found that labels, although oftentimes viewed as a form of oppression, can also bring a sense of safety. Geographically far from home, labels such as “international student” serve as a reminder that there are certain groups where one belongs, as well as campus or national situations one can “leave...” Labels are oppressions; they are protections: the contradiction and complexity of such identity borders are worthy of more attention in further studies.

Our research essentially explored our understanding the complex, full experiences of a small but significant sample of international students; we intended our study to serve as the first stage of moving toward institutional change on campuses that interviewees described as not diverse. We believe that such institutional change is the collective work of international students and the different stakeholders on our campuses.

Title of Project: Wrestling with God: Three Approaches to the Role of Religion in the University

Project Summary:

This summer I researched the ways in which three universities handled the integration of religion into their curriculums. For this project, I looked into the Catholic University of Ireland (the modern-day University College Dublin), the University of Virginia, and Colgate University. Each university was founded in the nineteenth century and offered different perspectives on the ways in which universities attempted to try to create a Christianized version of education. Using the historical models of the Catholic University of Ireland and the University of Virginia, I was able to compare and contrast the ways in which Colgate shifted away from its historical ties to the Baptist Church. Additionally, I looked at the ways in which religion has been treated in the core curriculum.

While both the Catholic University of Ireland and the University of Virginia provided Christian models of education, they differed in their approach to denominational affiliation. The first university I looked at was the Catholic University of Ireland as outlined in John Henry Cardinal Newman’s famed treatise on Catholic higher education: The Idea of a University. This work was a collection of lectures given by Newman in an attempt to explain his vision on what a university should be and what it means for a university to be Catholic. Newman argued for a complete synthesis of religion within higher education by arguing that religion contains as much truth as any other branch of knowledge. He also aimed to mitigate the widespread misconception that religion must be opposed to the sciences. Newman’s university aimed at cultivating the intellect through the liberal arts in a way that students learned the technical skills necessary to enter any career field. This educational philosophy also believed that students should receive a general understanding of the Catholic faith in order to nurture their moral and spiritual natures.

The University of Virginia took a different stance on religion as it tried to create a non-denominational Christian university. The university was founded in 1819 by Thomas Jefferson in an attempt to create national public university that would embrace the new nation’s idea of separation of church and state to create a university that would not provide any Christian denomination preferential treatment—an unusual concept given that most American universities were seminaries at the time. Jefferson’s university attempted to create this generalized Christian education by not creating a divinity school and by not appointing any theology professors. While this seems like a complete eschewal of religion, Jefferson believed that all students should learn the aspects of Christianity that were common to all denominations. To do so, Jefferson relegated all religious learning to the professor of ethics.

Colgate University’s history is quite different from the previous two universities as it was originally a seminary for future Baptist clergy. Colgate’s path to secularization began when it introduced the liberal arts to its curriculum. By 1839, the first non-ministerial student was admitted to the seminary. From this point on, the number of non-ministerial study rapidly grew. In 1926, the seminary was relocated to Rochester while the liberal arts school remained in Hamilton. At this time, President Cutten introduced the core curriculum as a way of providing students with exposure to various disciplines. The first of these courses was a survey class in philosophy and religion that focused on the influence of Christianity and western philosophy on the Protestant worldview of the time. This idea gradually changed so that the course was eventually designed to help students understand their own world views. The current iteration of this survey class is Legacies of the Ancient World. This class moves away from the idea that the course is a preparation for success in the Judeo-Christian western world. Instead, it offers a way of objectively looking at the ways in which western traditions have shaped critical thought and academic discourses. Using these changes and a critical reading of Colgate’s mission statement and “13 Goals of a Colgate Education”, I applied George Marsden’s study of the secularization of American Universities from his book, The Soul of the American University, to Colgate to show the ways in which Colgate has been influenced by its Baptists roots but has moved toward a pluralistic and nonsectarian identity. These shifts are representative of the development of Colgate’s identity as a progression from a denominational model similar to Cardinal Newman’s to a Jeffersonian non-denominational Christian university to the current nonsectarian identity.

Source of Support: □ AHUM Div. □ NASC Div. □ SOSC Div. □ UNST Div.  ☑ Other (specify): Center for Freedom and Western Civilization (James Madison Summer Research Fund)
Introduction
The Adirondack region in upstate New York is actually seismically active although it is not located near plate boundaries. The region has experienced tremors with magnitudes greater than 5.0 such as the 1983 Goodnow, NY earthquake and the 2002 Au Sable Forks, NY earthquake shown in figure 1. A possible explanation for these and other earthquakes might involve the fact that the Adirondacks are located on a boundary between two different geological provinces - the Grenville Province and the Appalachian Province - shown in figure 1. The Grenville Province is about 1 billion years old (Sbar 1972), making it older, cooler, thicker (Du et al. 2003) and less likely to attenuate seismic waves than the younger Appalachian Province (Viegas et al. 2010). The ultimate goal of this research is to develop a better velocity model of the Adirondack region by collecting and analyzing the waveforms of seismic events in and near the Adirondacks.

Methods
In order to improve the current velocity model for the Adirondack region, the geophysics lab requested data from public stations as well as downloaded data from our own stations. The locations of these stations are shown in figure 1. We used the programs “dbloc” and “dbpick” as they allowed us to analyze an earthquake's waveforms and pick more accurate P and S wave arrival times. After these arrival times were picked, we used the “dbloc” program and the Adirondack crustal velocity model - that takes into account the crustal velocities of the Grenville Province and the Appalachian Province - proposed by Viegas, Baise, and Abercrombie (Viegas et al. 2010) to locate the origins of local earthquakes. Having more accurate origin data - specifically distance between stations and earthquakes - meant we had more information on how seismic waves travel along the Adirondack’s crust.

Results
After looking at earthquake data from the past two years, we found that there was a slight correlation between the province boundary and the location of earthquakes. This is important, as the boundary shown in figure 1 may indicate an intraplate zone of weakness. In addition to these findings, the waveform analysis made this summer will contribute to the data needed for the development of a better velocity model of the Adirondack Mountains.

Seismic Stations

Figure 1. A red line represents the boundary between both provinces. The dots represent seismic stations across and around the Adirondack region. Different station networks are categorized and distinguished by color. The map also shows two earthquakes with a magnitude over 5.0 that helped determine where Colgate's geophysics lab placed seismometers.
Research Fellow: Brandon Doby (2018)  
Concentration: Art and Art History

Faculty Mentor: Penny Lane  
Department: Art and Art History

Title of Project: Gemini Film Post Production Research

Project Summary:

I used this summer research grant to actively pursue as well as investigate into the methods and process of post-production of a long-form short film. This grant not only allowed me to afford precious post production materials—[Terabytes of Storage to have sufficient backups of footage, a computer capable of editing and processing the 4K footage I shot, and Apple’s Logic X (a great digital audio workstation that can be used for film scoring)] but also the time needed to independently study previous great filmmakers, auteur and some experimental, in order learn from their processes. I focused a majority of my independent research into Andrei Tarkovsky, one of the greatest filmmakers to have lived. His work can simply be described as poetic. Specifically, his writings/theory on the edit of a film, as laid out in his book Sculpting in Time, were instrumental in guiding me on my own edit of Gemini.

“Although the assembly of the shots is responsible for the structure of a film, it does not, as is generally assumed, create its rhythm. The distinctive time running through the shots makes the rhythm of the picture; and rhythm is determined not by the length of the edited pieces, but by the pressure of the time that runs through them. Editing cannot determine rhythm (in this respect it can only be a feature of style); indeed, time courses through the picture despite editing rather than because of it.” - Tarkovsky. Sculpting in Time. 117. Gemini’s glue across a largely unorthodox story structure will be sonic dissonance. Due to its surrealist and at some points nonlinearity it took me at least a month’s worth of feeling out subtleties in pace and rhythm in what was shot so far in New York and on the deserted Island in Jamaica. I had to subconsciously and intuitively memorize and internalize every hour of footage I had. I discovered a darkness in all of it (intentional), which was common even when the color palette naturally had deep turquoises, baby blues, and highlighted pinks in the sky and sand. This darkness shown through the softness in the faces of those casted. This summer I found an internal rhythm that serves nothing more or less than the dark and the soft images in this film.

I dedicated the rest of the funds towards a full day 2-scene shoot, as when I applied to the grant I had the necessarily unrealistic (in order to motivate the team) goal/deadline of having the full film shot by the end of the semester. These two scenes are the dialogue that loosely attach pieces of the film together via dense and packed philosophical statements rooted in the characters understandings of this reality and the forces behind it, hidden behind deep black-American dialect and complex use of inflections in tone and voice. I expect many of the audience from certain backgrounds to immediately write off what Zoo is saying after witnessing him and others start their day before sunrise with a little bit of alcohol and marijuana. The spontaneous freestyle over a beat that comes on over the radio will be spontaneous high levels of creativity disguised as play. Just as the conversation turns, what us academically more privileged folks would coin as problematic, in terms of the roles men and women should play in our society, juxtaposed with hood humor, three black ballerinas dressed in full leotards escape from the trunk of men who have been carrying their masculinity their whole lives not only as an identity but as a shield, providing the visual metaphor of what we suppress to socially survive as a black man; our softness.

Lastly this grant has afforded me time to make the best decision in terms of a composer. Publicity from our short stint attempting crowdfunding led to two composers offering their services. We originally were going to work with one of them until we met Binta Kai, a black woman multi instrumental list that specializes with the violin. Her genius/talent lies in her ability to freestyle classically. When it is time I will be using the very last of the funds to book studio time with an audio engineer at Classick Studios Chicago with her for a few hours to provide the necessary samples and pieces to score and sound design the film.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): J. Curtiss Taylor ’54 Endowed Student Research Fund
Research Fellow: Colleen Donlan (2018)  Concentration: Political Science
Faculty Mentor: Julie Dudrick  Department: Upstate Institute

Title of Project: Local Farms, but Limited Access to Local Food: What Barriers do Farmers Face when Selling to Low-income Consumers?

Project Summary:
This summer, I worked at the Partnership for Community Development (PCD) as an Upstate Institute Fellow. PCD is an economic development nonprofit which serves the Hamilton area. They work closely with the Village of Hamilton, the Town of Hamilton, and Colgate University to ensure sustainable community-oriented change, success for our small businesses, and economic vitality. PCD brings Hamilton together through community-based projects in many different ways.

Food access is a concern in Madison County, as it is in many rural areas. Some residents participate in the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps). However, these participants cannot use their benefits everywhere. Residents cannot redeem them at the Hamilton Farmer’s Market or at almost any farms in the county, even though there is a process to make this happen. So while we are surrounded by farms, which sell meat, vegetables, dairy, and other produce, community members still struggle to access local food. On the producer side of this issue, trying to accept SNAP is not easy. That is why, among other barriers, it is difficult for farmers to go through the process of accepting SNAP.

For my project, I looked at these barriers for farmers and other local producers to sell to low-income consumers, specifically through accepting SNAP. PCD wants to make this easier for farmers so that producers can increase sales by reaching a new market and community members can gain access to local produce through their benefits and other incentives. We would like to simplify the process for farmers and make it as simple as possible for them to start accepting SNAP at their farm or store. Throughout my research, I have determined that while there is interest from farmers in offering SNAP as an option, there are strong barriers that are discouraging. A major barrier is time. The process of accepting SNAP is very bureaucratic, and the paperwork does stop once the farmer’s application is accepted. Another barrier is cost. While many costs are refunded, initially purchasing equipment can be difficult for farmers.

Additionally, marketing to let the community know about this program will take both time and money. Hopefully, we can streamline the process and help both farmers and consumers in our community. Finally, there is no organizational structure in place to help farmers go through this process.

Throughout this work, I have learned the most from speaking with farmers and community partners proving the reason why community based research is so important. Communities that have successfully implemented a SNAP program, farmers who have tried but not been successful, and producers who have interest but are presented with too many barriers, have all been essential to determining the complexity of these issues and mapping out our solution. We will continue working with these stakeholders to increase food access in Hamilton.

Source of Support:
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.
☒ Other (specify): Upstate Institute
Title of Project: Diatoms as Paleoceanographic Tools in Southern Ocean Sediments

Project Summary:

In order to understand present climate change, it is important to study past climate change via paleoceanographic records. This may be accomplished by examining diatom assemblages. Diatoms are microscopic algae that are sensitive to environmental conditions such as temperature, light, and nutrient availability. Their siliceous skeletons are preserved in the sedimentary record, enabling diatoms to be used as a proxy for past climate conditions. The Antarctic is a region particularly sensitive to climate change. This project focused on the Sabrina Coast, East Antarctica, an area of interest because (1) satellite and airborne geophysical studies indicate substantial loss of glacial ice over the past decade, and (2) the region is underlain by a deep subglacial basin, a configuration that is susceptible to “runaway” ice loss.

A series of kasten cores were retrieved from the continental slope during a 2017 research cruise to the region. These marine sediment cores provide a record of oceanographic conditions during the last glacial period and the current interglacial, a time period known as the Holocene. Two complementary cores were selected for study, IN2017-V01-KC05 and KC13. Diatom abundance and assemblage data in the two cores provide a detailed account of the transition between glacial and interglacial periods, informing how the Antarctic environment will respond to climate change today. During the last glacial period, diatom abundance was low, possibly due to increased sea ice cover, resulting in light limitation of primary production. In addition, a greater proportion of reworked, extinct species are present, due to the input of older, glacially-scoured sediments into the ocean. The environment transitioned gradually from a glacial to interglacial setting, marked by an increase in diatom abundance by up to 3 orders of magnitude. The mid-Holocene is characterized by the highest productivity. The assemblage is dominated by a single diatom species, Fragilariopsis kerguelensis, the signature species of the Antarctic circumpolar current. Changes in minor species reflect smaller scale changes in seasonal sea ice cover.
Research Fellow: Meghan Duffy (2018)  
Concentration: Geology

Faculty Mentor: Amy Leventer  
Department: Geology

Title of Project: Paleoclimate Record of Glacial-Interglacial Cycling from the Sabrina Coast, East Antarctic Margin

Project Summary:

The greatest problem facing our world today is that of climate change, yet only through understanding Earth's climate history can we hope to understand the future of our planet. My research this summer was part of my senior thesis project, studying the cycling of glacial and interglacial periods over the last few hundred thousand years with a focus on comparing today's interglacial period to those of the past. This project is based on microfossil proxies from marine sediment cores taken off the Sabrina Coast of Antarctica in January-March of 2017 aboard the RV Investigator during cruise IN2017_V01. The area of study is located offshore from the Totten Glacier, a notably understudied ice system which holds significant potential for sea level rise in the face of modern climate change. As a student researcher on IN2017_V01, I traveled to East Antarctica with an international team of scientists and helped take cores and began preliminary processing and analysis. In the micropaleontology lab at Colgate this summer, I used samples from two cores (PC05 and KC04) and prepared quantitative microscope slides using a settling technique. This technique involves disaggregating the sediments and settling the microfossils over a known area, resulting in quantitative microscope slides that were then analyzed for overall diatom abundances as well as relative abundances of individual species. Diatoms are microscopic algae that have siliceous frustules and are well-preserved in the fossil record. Because of their small size and fast population turnover, diatoms are highly specialized to conditions such as temperature, salinity, and presence of sea ice, and therefore make excellent proxies for past climatic conditions. By analyzing how diatom abundance and species assemblages fluctuate throughout the cores, I began to identify trends in climatic conditions over several glacial/interglacial cycles. Additionally, I began learning to identify certain extinct species of diatoms that act as biostratigraphic markers to help constrain the ages of the cores. This biostratigraphic data will be useful to the other collaborators from IN2017_V01 who complete other types of analyses on the same cores.

Analysis of the diatom assemblages in PC05 and KC04 will continue throughout this coming academic year as part of my senior thesis project. Preliminary data will be presented to the scientific party of IN2017_V01 at the Past Antarctic Ice Sheet Dynamics Conference in September 2017 and continued research will contribute to the Sabrina Seafloor Survey project.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☒ Other (specify): Norma Vergo Prize
During my time as an Upstate Institute Summer Field School Fellow I worked with the Mohawk Valley Resource Center for Refugees (MVRCR) in Utica, New York. While my job tasks did vary greatly due to the nature of working at a not-for-profit, my primary responsibility was to work with One World Artisans, a micro-enterprise created by the MVRCR that seeks to empower refugees and immigrants in the Utica-area by giving them the opportunity to sell their traditional handmade crafts to earn a supplemental income. In addition, the artisans are taught entrepreneurial skills that can help them one day start their own small businesses.

One World Artisans has supported many artisans from highly diverse backgrounds since its inception in 2009. As it continues to grow and evolve, the program seeks to increase the size and diversity of the group of artisans it works with, develop a curriculum that teaches entrepreneurial skills to its artisans, and foster partnerships with local organizations and businesses. As is the goal of refugee resettlement in general, One World Artisans hopes to one day become self-sustaining and function independently of the MVRCR.

As the One World Artisans intern I was tasked to create various documents that would help standardize the operations of One World Artisans. The nature of these documents ranged from agreement forms to guides detailing the do’s and don’ts of vending. Since One World Artisans does not currently have a storefront, it relies primarily on vending at Utica-area events. As such, I was also tasked to compile a spreadsheet of potential vending opportunities. In addition to this I also assisted in completing the application process for some of these events.

The most interesting responsibility I was tasked with was interviewing some of the artisans in order to create materials to help market their products. Listening to their stories of struggle and perseverance greatly put into perspective the importance of this work and that of the MVRCR as a whole.

Working in the Upstate community this past summer was a very rewarding endeavor. In reflecting on this experience I am amazed at the extent to which the work I completed has and will continue to impact the community. As a result, I have attained a great sense of satisfaction from this work because I know that my efforts will impact members of the Upstate community long after my time as a Fellow.
Quasars are a category within Active Galactic Nuclei and are among the objects that emit the most energy in the universe. It is thought that these Active Galactic Nuclei are due to gas falling from the accretion disk into the center of the supermassive black hole, theorized to be at the center of most, if not all, galaxies. Particles are then accelerated at such a rate that high-energy photons are emitted. A jet is produced perpendicular to the accretion disk, and when the jets are oriented towards the Earth, it is considered a blazar. Although they can be up to billions of light-years away, observatories across the world are able to witness the fluctuations in luminosity and therefore energy. Since quasars cover such a wide spectrum of wavelengths, there are various filters that are used when observing. These filters allow photons with specific wavelengths to pass through and hit the detector. Although the I (infrared), V (violet), and B (blue) filters have been used throughout Colgate’s history, most observing is done through the R (red) filter now.

One particular quasar, OJ287, has been studied at the Foggy Bottom Observatory since 1988. This quasar is thought to be a binary supermassive black hole about 3.5 billion light-years away. In order to obtain data, a CCD, an electronic camera, is attached to the back of the 16-inch telescope. The values of the pixels in the image produced are proportional to the number of photons that interact with the surface of the detector. Exposure times of the image vary somewhat; however, at the Foggy Bottom Observatory, most images are two-minute exposures of the quasar. Twelve images make up a sequence, and within that group of twelve, six images are taken in a group, then a dark image is taken, then another six images are taken. The dark image is used later in analysis to account for anomalies in the sensor. Most nights are spent moving from one object to the next after twelve images; however, there are some nights where a single object will be observed for an extended period of time.

The image below illustrates a night when OJ287 was observed for eight separate sequences, lasting from 01:40 to just before 06:30 UT, almost five hours straight. Throughout the almost thirty years of observing OJ287 at the Foggy Bottom Observatory, the magnitude ranges from around 17.0 to around 13.5. Magnitude is backwards, so the smaller the number, the brighter the object. On this particular night, it is relatively bright.

The optical variations of the blazar OJ 287 on March 30, 2016 observed at the Colgate Observatory.
Research Fellow: Jessica “Jess” Eldridge (2019)  
Concentration: Educational Studies

Faculty Mentor: Julie Dudrick  
Department: Upstate Institute

Title of Project: Field School Fellowship with Pathfinder Village

Project Summary:

This summer I had the opportunity to complete a Fellowship with the Upstate Institute at Colgate. During my fellowship I spent ten weeks working on a project at Pathfinder Village located in Edmeston, New York. Pathfinder was originally founded as the first and only community established specifically for individuals with Down syndrome. The mission of Pathfinder Village is to promote a healthy, progressive environment that respects each individual, supporting a life of value and independence for children and adults with Down syndrome and related developmental disabilities. Recognizing the gifts, talents and abilities of each person they support, the Pathfinder Village community enables individuals with disabilities and their families to envision and to create a “life with meaning”. This includes friendships, independence, community involvement and the freedom to pursue individual interests and life goals.

For my project I worked closely with the Senior Director of the Kennedy Willis Center, Helen Stepowany and Director of Residential and Clinical Services, Taylor Brose. During the first two of weeks at the Village, I spent time reading about the workforce issues exist across the nation with Direct Support Professionals (DSP). The two challenges that were consistent in all of the research I did was: high turnover rates and low wages. Next, I researched how some organizations are working to create solutions for these issues such as creating high school programs to integrate students to becoming DSPs.

After gaining the background information I needed, I worked on creating a series of interview questions. The questions were used to interview twenty DSPs that currently work at Pathfinder. Before conducting my interviews, I completed an IRB proposal to insure that my research was going to be conducted in an ethical way. When the Colgate review board approved my IRB I spent the next six weeks in three different residential houses to complete my interviews. The goal of the interviews was to collect data for the Village in hopes of strengthening recruitment and retention rates to help lower the turnover rates that exist at Pathfinder. Until this project, I had never completed interviews before and this was a great opportunity for me to practice this skill.

In addition to my research I had the opportunity to attend the Adult Day Service Program at the Village and interact with residents and DSPs. Throughout the program I participated in therapeutic horseback riding lessons, harvested vegetables in the greenhouses, and volunteered packing food for the local food bank. As an educational studies major with hopes of working in the disabilities field this experience provided me with realistic picture of what the field entails. I was able to see the different positions available within the field as well as the challenges and rewards that come with them. This also gave me a chance to take understand exactly where the DSPs that I interviewed were coming from and helped bring my research to life.

Pathfinder Village is an incredible community and I am very fortunate that I was able to be a part of it. In the ten weeks that I spent in the Village, I was impacted by a lot of incredible people who made each moment special for me. I would like to thank the Upstate Institute and my project leaders, Taylor Brose and Helen Stepowany for this opportunity. I know it will not be long until I find myself back at Pathfinder!

Source of Support:  □ AHUM Div.  □ NASC Div.  □ SOSC Div.  □ UNST Div.  # Other (specify): Upstate Institute
Project Summary:

Thanks to the generosity of the NASA Space Grant, this summer I spent eight weeks studying the strengths and possible sources of accretion activity and mass outflows in the DQ Tau binary star system, and learning about the presence of cool star spots on the surfaces of both stars. Accretion is the process by which material gathers. In this case, material is falling in “streams” of material from a circumbinary disk, which surrounds both stars, onto the surfaces of the two stars. Material is also ejected outward by stellar winds, and polar jets. When material accretes onto the stars, or is ejected outward, emission features record this activity on the spectra of each star, which we observe from Earth using a high-resolution Echelle spectrograph. The same tool also allows us to observe absorption features which indicate the presence of cool regions on the stars’ surfaces, or star spots. We can determine the presence, size and lifespans of these spots by measuring TiO absorption features in each spectrum.

A significant portion of my time was spent educating myself on how to use an astronomical toolkit called IRAF, which is a set of image and data reduction packages which each contain commands that can garner information from our 107 order, cross-dispersed input spectra of DQ Tau. This process required me to learn a new command language, UNIX, and through the acquisition of this new skill, I edited a set of commands written by Karen Kinemuchi and amended by Prof. Jeff Bary. Once the script was ready to run, each 107 order spectrum was processed, which eventually produced a plot of Intensity (W/m²) vs. Wavelength (Angstroms) for each order. Continuum fits were manually produced for each order, and removed from the spectrum. The orders were then stitched together, radial velocity corrected, and Doppler corrected. The result was a one-dimensional plot of normalized flux vs. wavelength (Angstroms). I analyzed each of these final plots for spectral features that have been associated with accretion activity, such as He I, Ca II, Na D (Figure 1) and H I features. The strengths of the lines were calculated by fitting Gaussian, Lorentzian or Voigt curve profiles to each feature. The curve profiles allow us to measure the flux, equivalent width, full width half max, and central wavelengths of each feature. From this data, we determined the strengths and velocities of the features, as well as the orbital phase at which they occur. Using this information, we can determine if accretion activity is occurring at periastron, apastron, or at some phase in between, which can shed light on the causes for increased accretion rates. Similarly, measurements in the strength of forbidden oxygen transitions [OI] can shed light on the rates of mass outflow via stellar winds and polar jets. For future research, I hope to measure the strengths of absorption features such as TiO, a molecular feature which only forms in regions of cooler temperatures. Such spectral features produce predictable variation in the brightness of the system. While it is probable that these features are present in our current dataset, we must first correct for telluric absorption features which are produced by the Earth’s atmosphere.

Fig. 1 The Na doublet, at λ5889.9 and λ5895.9 is a signature of accretion activity.

Source of Support: □ AHUM Div. □ NASC Div. □ SOSC Div. □ UNST Div. □ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund; NASA / New York Space Grant
My project, *Examining the Role of Selective Colleges in Producing Graduates Committed to Altruistic Good* seeks to evaluate what factors contribute to selective college students committing to altruistic good and prosocial behavior. Mission statements of selective colleges often claim goals of producing graduates that will enact positive social change. For example, one of the Thirteen Goals of a Colgate Education is for its students to “be engaged citizens [that] strive for a just society.” While a variety of literature in the social sciences debunks the myth that selective colleges attract the most talented or qualified within society, suggesting instead that they suggest the most affluent and white within society, whether or not they produce graduates who are committed to enacting positive social change, and who engage in prosocial behavior is the primary question that my project seeks to better understand.

This summer I employed a multi-method approach to try to better understand both which students engage in prosocial behavior and how institutional offices may influence this engagement. One of the measures of prosocial behavior that I was initially interested in was career pathway. In an attempt to better understand how students get funneled into socially oriented and individualistic career pathways, I interviewed career services officers from five different New-York Six institutions, compiling seven interviews in total that I transcribed and coded. One major theme from my interviews was that each of my respondents was adamant in stating that their office does not actively suggest or funnel students into certain career pathways over others, but rather that their mission is to give students the tools to navigate whichever career fields they are interested in. While multiple officers told me that they loved when students displayed a passion for social change and a desire to help others through their career, they would never make an effort to push students either into or away from an altruistic career path. Conversely, six of my seven respondents talked about perceptions that their office does more for students entering the finance field than for other students. They told me that the nature of the field causes finance opportunities to be much more visible on campus than opportunities in nonprofit organizations or in education, for example. While some respondents actually expressed dismay at the proportion of bright students that they saw going into the finance sector, they felt that taking any action that may reduce the flow of students into the finance sector would be overstepping into students’ interests, and would be outside the scope of their work with career services.

To conduct quantitative analysis, I’ve been working with the National Longitudinal Survey of Freshman (NLSF), a comprehensive survey conducted over the course of four and a half years studying the experience of selective college students. The primary gauge of prosocial behavior that I’ve studied through the NLSF has been volunteering. The respondents in the sample experience a dramatic drop-off in volunteering when they move from high school to college, and volunteer less in wave 4, which measures their junior year of college and the last wave that measures volunteering during the school year, than they did in their first-year of college (wave 2). One of my missions with this project has been to better understand this volunteering drop-off and to figure out who stops volunteering, who continues volunteering, and what experiences correlate to this. Identity plays a huge role in changes in volunteering habits, and white-identified students drop off in volunteering at rates significantly higher than black-identified students, and African American females volunteer in college much more than all other groups. To get started on my analysis I went through all five waves of the NLSF, identified all questions that I thought could reasonably correlate to prosocial behavior, and cleaned and recoded about 250 variables to prep for analysis. In addition, I ran bivariate analysis to see how these variables and compiled a document of over 500 tables mapping out correlations between different experiences and volunteering behavior. So far, along with racial and gender identity, I’ve found that religious identity, civic engagement in high school, and peer influences have been powerful correlates to volunteerism. I plan to continue my project for my sociology senior thesis, and hope to run continued quantitative analysis to better identify which specific experiences explain changes in volunteering, and other gauges of prosocial behavior among selective college students and which experiences may explain the racial and gendered differences in prosocial behavior. I also plan to conduct qualitative interviews with current students to better understand the rationale and mechanisms guiding students into both altruistic and individualistic pathways. My results suggest that students of different background are socialized to commit to prosocial behavior to different degrees and through different mechanisms. This dimension to prosocial behavior is largely unexplored by existing research, and calls for further research to better understand how the selective college experience influences students from different racial backgrounds to differing degrees.
T. rex as preferred qualities demonstrates how male attributes are placed onto dinosaurs and greatly emphasized. These descriptions of dinosaurs as 'monsters,' 'violent,' 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals." This general consensus about dinosaurs being violent and power, and also attempts to dispel this mentality: "Of course a lot of the kids are like … ‘all the dinosaurs are 'mean' or 'evil.' And I like to remind people, dinosaurs aren't monsters; they're animals."
Increasing air temperatures and altered hydrological regimes associated with global climate change are expected to contribute to permafrost thaw in the Arctic. Permafrost is soil that remains frozen for two consecutive years and, due to the high amounts of organic matter it contains, it may yield carbon dioxide and methane, two greenhouse gases, when it thaws. Boreal forests influence the permafrost by shading it as well as further altering the movement of water via transpiration. Siberia, Russia contains a unique type of boreal forest which is made up of one tree species, the Cajander larch- a deciduous needleleaf tree. This summer, under the supervision of Professor Mike Loranty and Heather Kropp, I conducted research in Cherskiy on two different boreal forests stands to test for differential effects of forest structures on permafrost thaw depth. Both of the forests were burned in the same fire about seventy-five years ago. One forest stand had a very high density of trees and low thaw depths compared to the other forest stand which had low tree density and high thaw depths. These sites are being analyzed to assess how different forest structures affect the energy balance of the entire system and thus the permafrost, giving us a better understanding of how climate change will affect this unique area.

One of the goals of the project was to understand how water moves through the entire system, movement which is largely controlled by plants. Plants use water for a variety of processes, such as photosynthesis and nutrient transport, and control the flow of water from roots to trees through transpiration. To measure the transpiration of the trees and shrubs, sap flow sensors input heat into the stem of a plant and measure the change in temperature above and below the heat input. The change in temperature indicates the amount of water moving through plant stems for transpiration. We measured plant water potential, an integrated measure of plant water status and stress. To quantify the water moving through the smaller herbaceous plants, lichen, mosses, and from the soil itself we set up flux plots. Fluxes of water vapor and carbon dioxide are measured by using an infrared gas analyzer and a chamber to isolate and quantify the different gases. Quantifying the flow of water through the system is important to understanding the way that heat moves which affects the permafrost.
Title of Project: The Integration of Non-Western Immigrant and Refugee Adolescents within the Danish Efterskole

Project Summary:

After spending my fall semester in Denmark studying their educational system, I chose to focus my Lampert Fellowship project on non-Western students’ integration into Danish efterskole. Efterskole, which translates most directly to “after school” or “continuation school”, is a uniquely Danish institution that students can attend for an optional tenth grade year before continuing onto upper secondary school or entering the work force. Efterskoles are private residential schools; however, they are becoming increasingly popular in Denmark for students from all backgrounds, and are made affordable to all through government subsidies and scholarships. Past research focusing on more traditional schooling options has found that in Denmark, as well as in other countries, non-Western immigrants, descendants, and refugees are more likely to be involved in bullying and fighting than native students, and more likely to feel lonely or isolated. Yet, because efterskoles are such unique institutions and they often value social relationships over academic learning, I wondered how students with non-Western backgrounds would fare in Danish efterskoles compared to their native peers. Through in-depth interviews with a number of efterskole students, teachers, and administrators throughout Denmark, I was able to gain a better understanding of how efterskoles operate, and how students with non-Western backgrounds fit into these institutions.

Overall, very little bullying or fighting was reported to be occurring by any students, and all students reported feeling accepted and fitting in. Notably, a number of students spoke of bullying and fighting in compulsory school. Although non-Western students’ backgrounds and identities were still salient to them in efterskole, the unique structure of efterskole functioned such that these institutions were a place where bullying and fighting would not be tolerated, and where all students felt respected. Teachers and other students worked in various ways to support the social integration of all students, and although there were rarely protocols designed explicitly to help immigrant, descendant, and refugee students fit in socially, intervention would occur to help any student struggling socially, regardless of background. While individual schools and teachers varied to a degree, overall, efterskoles seemed to strike a fairly effective balance of treating students as individuals, while also recognizing their backgrounds and cultures.

Since the 1980s, diversity in Denmark has increased drastically, and the proportion of non-Western immigrants in the Danish population has risen from less than 1% to around 13%. Yet, immigration is a highly controversial topic within Denmark at the moment, and the Danish government has, in many ways, taken a hostile stance toward immigrants and refugees. One key issue has been non-Western immigrants’ perceived lack of success integrating socially and economically. I believe that efterskoles provide an opportunity for students with non-Western backgrounds to acculturate quickly and effectively during a crucial period of their lives. For young people faced with making the decision between continuing their education and entering the work force, future success in Danish society hinges upon being well acculturated. The structure and function of efterskole facilitates the acculturation process, providing students with a safe space to learn and be social. At efterskole, students are immersed in Danish language and culture, and leave with increased fluency and understanding of how to fit into Danish society. They also develop a network of Danish contacts and friends, some of whom they may stay in touch with their whole lives. Although non-Western students’ in efterskoles are surrounded by a culture that is not their own, many efterskoles and efterskole teachers also made efforts to support their students’ cultural and religious backgrounds and beliefs, allowing them to live and learn amongst Danes, while also encouraging them to be proud of who they are and where they came from. I saw the potential in efterskoles to promote successful integration, rather than simply forcing assimilation. Although there is room for improvement, efterskoles could play a role in making Denmark as successful multicultural nation.
Research Fellow: Holly Geranen (2018)  Concentration(s): Educational Studies; Women’s Studies
Faculty Mentor: Ashley Taylor  Department: Educational Studies

Title of Project: An Examination of the Language Used to Talk About Immigrants in ELD Classes and the Languages Used to Talk About Students Labeled with Disabilities in Special Education Classrooms

Project Summary:

My qualitative research project this summer was centered around the intersection between English Language Development and Special Education classrooms. The goal was to analyze the language that teachers use to describe their students and the processes within their classrooms with the hypothesis that they tend to limit their opportunities based on the students’ labels. These ideas revolve around the standards of normalcy that exist within our society in the United States. My research dives into how we construct a sense of belonging for some people more than others and what kind of behaviors as well as abilities are privileged within the classroom. We live by standards of normalcy everyday as to how we are supposed to act in certain environments, what we are supposed to look, and this plays a factor because we put pressure on people to conform to those standards and punish them with exclusion if they are unable to do so.

By deconstructing normalcy, I was able to look at the way it affects citizenship and how powerful the idea of citizenship is. It creates the understanding of who does and does not belong here with extending to look at the way citizenship is constructed and is not just a legal status. While some people in minority groups may have citizenship status, they face the barriers of being accepted if they do not fit into society’s expectations. My research takes these ideas in order to see how they become a factor within the educational system. By interviewing six teachers from multiple schools and school districts, I was able to analyze their language to see how it was perpetuating disability within the classroom by limiting opportunities. The importance of normalcy shines through in this aspect because these students do not meet those standards and are therefore considered not to have the same intellectual capabilities as the general education students.

This study takes a critique of the deficit model with a critical disability lens in order to look at the assumptions that are made about emergent bilingual and special education students. The notion about who belongs in this country and who is going to be a “productive member of society,” translates into who belongs and can be successful in the classroom. I argue that ELD and Special Education classes in fact inhibit these students from having further success either in higher education or in the professional world. The interviews and research on the schools show that these students are seen more as a burden than students who learn in different ways and speeds. Again, this ties back into the idea of normalcy as to what a student is supposed to accomplish in a certain amount of time.

The results found that three main themes continued to recur throughout the six different interviews. The first was Age Appropriate Language, which explains how teachers would describe their high school students as kindergarteners or other elementary school leveled children which creates the idea that they are only as good as a six-year-old. This is an issue because the teachers do not take into account their life experiences of being a teenager and give others the opportunity to treat them as if they are six instead of sixteen. The next theme was Maturation which is contributed to by the first theme and taken to the level that these students are seen as stagnant and non-developing children. They are continuously called little and not having the ability to attain healthy adult-like relationships. Finally, the last theme was the assumption of dis/ability in the ways that the language used in these classrooms created both ability and disability. They assumed what these students could not do and limited what they could do to a certain level without strongly encouraging and assisting them to move past their low benchmark.

This research tries to connect the gap between the two classrooms and show that they might have different processes in each of them, but they both have environments that construct their disability and limit their opportunities based on what is expected of them. They are created, by society, to be people who are not capable and are stuck in the box that their label of “learning disabled” or “English deficient” and therefore are not given the same opportunities for growth and success within the education department. It all starts by the language surrounding people with these labels and how we expect them to behave and learn which was proved by the way that these teachers talked about their students and the goals of their classrooms.

Project Summary:

My summer research, still continuing now into the school year, works with reovirus, which is a respiratory virus that is closely related to the diarrheal disease-causing rotavirus that is common among young children and infants. The aim of this research is to identify the interferon stimulated genes (ISGs) with antiviral activity against reovirus, subtype T3D. While many different ISGs have been characterized for various viruses, anti-reovirus ISGs are not yet fully identified. In this research, numerous candidate ISGs are being screened for antiviral activity through transfection, immuno-labeling, and flow cytometry procedures. Upon completion of the screening process, ISGs with potential antiviral activity will undergo further testing, through various assays such as viral replication and infectivity assays, as well as through fluorescent microscopy. Ultimately, ISGs with strong antiviral activity against reovirus will be identified and characterized, which will be beneficial towards research for both reovirus and rotavirus.
Project Summary:

Nuclear power plants in the US today face an uncertain future. An increasing number of plants are shutting down before their licenses expire, leaving host communities struggling to cope with the economic shock of decommissioning. Yet few studies focus on where the power lies in decommissioning decisions; what roles do the state, county, grassroots activists, and residents of the host community play? This case study investigates two nuclear power plants with divergent decommissioning outcomes: the James A. FitzPatrick Nuclear Power Plant in Scriba, NY, which was not decommissioned, and the Vermont Yankee Nuclear Power Station in Vernon, VT, which began decommissioning in 2014. Theoretically, this study draws on the work of Rick Eckstein in *Nuclear Power and Social Power* (1997), a case study on the commissioning of the Shoreham and Seabrook nuclear power plants, and investigates whether Eckstein’s findings also apply to decommissioning. The results of this study echo Eckstein’s conclusion: the state-level “official” perspective carries the most weight, and those acting at the local level are minor players in decommissioning decisions. Interviews with 26 people, including state and county officials, reporters, grassroots activists and community members, supplement analysis of written material. The interviews also show how, despite their lack of control over the outcome of these processes, local people are engaging with processes surrounding decommissioning. Ultimately, this project contributes to the body of research on how nuclear decommissioning plays out at the community level, and will be of interest around the country as more and more towns find themselves facing nuclear power plant closure.

![Figure 1. Sign for the main industrial facilities in Scriba, including the James A. FitzPatrick Plant. Photo by author.](image-url)
Title of Project:  Model Strengthens Molecular Link between Circadian Polymorphisms and Major Mood Disorders

Project Summary:

Anxiety and mood disorders, such as major depressive disorder (MDD) and seasonal affective disorder (SAD), affect nearly one-fifth of the global population and disproportionately affect young adults. In addition to personal costs, such disorders have large economic costs to societies. Individuals affected by mood disorders are frequently plagued by sleep and circadian problems and recent genetic studies provide ample support for the association of circadian and sleep syndromes with depression and anxiety. Mathematical modelling has been crucial in understanding some of the essential features of the mammalian circadian clock and is now a vital tool for dissecting how circadian genes regulate the molecular mechanisms that influence mood. Here, we model the effect of five clock gene polymorphisms previously linked to anxiety, depression, and seasonal affective disorder (SAD), on circadian gene expression and, ultimately, on the period length and amplitude of the clock. We then test whether these gene variants are associated with the predicted circadian phenotypes from the model and well-supported measures of depression (BDI) and anxiety (STAI) in undergraduates. In our undergraduate population, we find significant allelic and genotypic associations between CRY2 and diurnal preference and chronotype scores are significantly associated with CRY2 and two PER3 variants. Although all polymorphisms showed a higher frequency of depressed individuals with BDI scores >14 and individuals with these allele variants displayed 1-2-fold higher in anxiety levels, only CRY2 rs10838524 was significantly associated with depression and only PER3 rs228697 with anxiety in this sample. Our simple model satisfies available experimental genetic knockdown conditions, as well as existing experimental data on clock polymorphisms associated with anxiety and depression and one polymorphism previously implicated in SAD. In addition, our model proposes functional explanations for intronic single-nucleotide polymorphisms (SNPs) linked to mood disorders and mechanisms that may be involved in SAD. Due to the user-friendly structure of our model, we anticipate that it will be useful for future chronobiological study.

Title of Project: Developing a Spaceflight Mass Spectrometer for Extraterrestrial In Situ Geochronology

Project Summary:

This summer I worked for Professor Levine in the physics and astronomy department to support the development of a spaceflight mass spectrometer. The end goal of this project is to create a mass spectrometer small enough to be sent off to space for in situ dating of lunar and Martian rock samples, which eliminates the need to collect samples and bring them back to Earth for processing and dating.

What sets this project apart from other forms of mass spectrometry is the usage of a relatively novel technology known as Laser Ablation Resonance Ionization Mass Spectrometry, or LARIMS. In a very rudimentary sense, the way that this process works is that a laser is shot at the sample which “explodes” particles off of the sample. In this plume of particles are different elements with differing ionization energies, or energies required to knock electrons out of the atoms’ electron sublevels. Once the elements of interest are ionized, they are sent down a channel via an electric field to the mass spectrometer’s detector plate which then records the signal and produces a spectrum of the isotopes, where each peak corresponds with a different isotope.

Since there are a whole bunch of different elements present within a lunar or Martian sample, there are several different ways that geologists and astrogeologists can date a rock. This is all based on the principle of isotopic decay: unstable forms of a given element, over time, will decay into other elements. The relative concentration of these isotopic systems is what allows us to calculate the age of a sample. The system we are currently using for this project is based around rubidium and strontium, where rubidium-87 decays into strontium-87. By plotting the ratios of \(^{87}\text{Sr}/^{86}\text{Sr}\) versus \(^{87}\text{Rb}/^{86}\text{Sr}\) from our data (known as an isochron) and putting the slope of the best-fit line through some quick math, we can determine the age of the samples.

Where my work this summer fits into all of this is essentially in analyzing the data and troubleshooting the errors produced by the apparatus. This project began in 2014, when Professor Levine and his colleagues at Southwest Research Institute out in Boulder, Colorado had a larger, more reliable apparatus. However, since moving to the miniaturized machine, they’ve lost accuracy in their age calculations of the same samples and sample data they took with the larger machine, using the same methods to calculate the age as they did in 2014.

We began my eight-week-long research stay by creating models to test various hypotheses that we thought could explain the strange trends we were seeing in the data. For example, the data showed a general decreasing trend in the ratio of rubidium to strontium signals which we thought to be explained by a “deadening” model, where the charge lost on the detector plate as each isotope hits the plate was not being replenished by the capacitors and power supply quickly enough before the next isotope hit, thereby hypothetically saturating the detector and giving a smaller signal size than what should be the “true” signal strength for the isotopes.

We later took this hypothesis in a different direction and ascribed the trend to the fact that rubidium and strontium have different enthalpies of vaporization and therefore respond differently to increasing ablation energy. Since rubidium has a lower boiling point than strontium, as the ablation energy increases we see an increase in strontium signal since the rubidium has essentially “boiled off,” so when taking a ratio of rubidium versus strontium, it would make sense then that an increase in the value of the denominator with little or no change to the numerator would yield a smaller ratio.

We decided to treat each spot on the sample as its own test run and plot an isochron in this way, as opposed to taking a day’s worth of data and treating that as a single test run. This, in theory, should eliminate any spot-to-spot dependence and provide a more accurate (and precise) result. Surely enough, using the old data from 2014 we calculated the age of the Duluth Gabbro to be 1.14 Ga ± 234 Ma; the accepted age is 1.096 Ga ± 14 Ma. For the future, we are looking to implement more methods in the code to further reduce the uncertainty in the age and increase the accuracy of our calculations by various means, such as correcting for mass-dependent fractionation at the one percent level, as well as increasing the sample size by using \(^{85}\text{Rb}+^{87}\text{Rb}\) as a proxy for our rubidium signals, and likewise with strontium where \(^{88}\text{Sr}+^{86}\text{Sr}\) will serve as a proxy for \(^{86}\text{Sr}\) to reduce variability in the calculations.

Title of Project: Ruthenium-catalyzed Ester Hydrogenation

Project Summary:

My research this summer under Prof. Chianese's supervision is closely related to my research last summer, where Linh Le 18', Ed Liu 18' and I synthesized and modified CNN-pincer catalyst for ester hydrogenation. An important feature of the pincer catalyst is that it undergoes a rearrangement under room temperature in the presence of triphenylphosphine and sodium tert-butoxide:

![Figure 2: Transformation from Ru-CNN pincer catalyst to rearranged catalyst](image)

This rearranged compound was found to be an active catalyst for ester hydrogenation as well. Based on last summer's finding, we decided to use computational chemistry to find out the mechanism for the rearranged compound for future improvement of the rearranged catalyst. The pathway which I was working on was adapted from a previously described mechanism.1

![Figure 3: Proposed reaction mechanism](image)

All computations are performed with Gaussian 09 under M06L with the extended basis set 6-311G(d,p). My attempt focused primarily on optimizing the proposed intermediates (11, 12, 13, 14), finding transition states from optimized geometries. Once transition states have been found using either TS or QST2, a frequency calculation is performed on which an IRC (intrinsic reaction coordinate) calculation is performed, which in turn finds the two ground states (forward and backward) which the given transition state converges to.

My research this summer has shown that the proposed mechanism is not plausible because we were unable to characterize the proposed transition states and intermediates. For example, the proposed intermediate 12 cannot be located. 12, upon optimization, converges to 11 where the Ru–H–C agostic bond is broken. Various attempts have been made to locate 12. For example, I have attempted to freeze the Ru–H–C bond with reduced step sizes and let the rest of the molecule optimize so that it would be easier for Gaussian to locate the energy minimum of the Ru–H–C bond. However, this attempt has not been successful, as the “partially optimized” molecule would still converge back to 11 once the restriction has been removed, which is the starting material. The attempts to locate possible transition states (TS1, TS2, TS3) have also been unsuccessful with similar issues. This means that the Hasanayn pathway is not a plausible pathway of our catalyst. This piece of information is particularly useful because it allows us to eliminate one possible pathway and provides valuable insights for future mechanistic studies.

1Hasanayn, Faraj; Baroudi, Abdulkader. Direct H/OR and OR/OR′ Metathesis Pathways in Ester Hydrogenation and Transesterification by Milstein's Catalyst. Organometallics 2013, 32, 2493-2496.

Research Fellow: John “Jack” Herrick (2019)  
Concentration: Molecular Biology

Faculty Mentor: Rebecca Metzler  
Department: Physics and Astronomy

Title of Project: Exploring Barnacle Exoskeleton Formation

Project Summary:

_Balanus Amphitrite_, the common acorn barnacle, is a small marine organism found in most warm ocean waters across the world. The barnacle is a sessile organism that, after searching in its mobile cyprid stage, will adhere to one surface for the duration of its adult life. As it becomes immobile and unable to escape from predators, the barnacle responds by growing strong protective plates. A flat baseplate secretes the adhesive material which binds it to a surface. The parietal plate wraps around the organism’s side regions, creating a small opening (operculum) that is protected by another separate plate. The two protective plates are composed of calcium carbonate, a compound that forms a strong crystalline structure called calcite. The barnacle takes the calcium it ingests and incorporates it into the shell in a process known as biomineralization. This is the same sort of process that creates human bones and teeth. Our research examines the timeline of mineral formation throughout the course of the barnacle’s early stages of development. By using barnacles of various ages, we can track the progress of biomineralization based on the amount of calcium present in those barnacles’ shell plates. Theoretically, we should see increased levels of calcium as the barnacle grows older and adds more calcite to its shell.

We measured calcium content using energy dispersive x-ray spectroscopy (EDS) settings on a scanning electron microscope (SEM). The electrons shot by the SEM at the sample cause x-rays to be released, and each element releases them in a unique way. Using a detector, we can correlate the x-rays with a specific quantity of each element. We took EDS measurements of parietal plates aged one hour, one day, two days, and several months to track calcium content over time. Our observations indicate that while very little calcium is present during the first hour of development, those levels increase soon thereafter during the next two days. By the time the barnacle is several months old, the parietal shell is roughly 40% calcium by weight. Our measurements of carbon show the inverse trend, as calcite crystals are deposited on top of the carbon-based organic material.

Next we examined trends in atomic disorder of the barnacle shell based on pH level. The relative heights of certain FT-IR spectroscopy peaks have been shown to indicate the amount of atomic disorder of a crystalline sample. In barnacles, this disruption is mostly due to organic material interfering with the crystal pattern. As the crystal structure becomes more disordered, the ratio of \( \nu_2 \) to \( \nu_4 \) peak increases. We took FT-IR spectra using grinding curves methodology on barnacles grown in varying pH conditions (7.5, 7.8, and 8.1) and discovered no significant trends. The 7.5 and 8.1 samples showed practically the same levels of disorder, while the 7.8 was much more disordered than the others. We suspect a confounding variable in the 7.8 sample has caused such disruption.

Source of Support:  
☐ AHUM Div.  
☐ NASC Div.  
☐ SOSC Div.  
☐ UNST Div.  
☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project: Exploring the Correlation between Structure, Composition, and Strength in Biominerals

Project Summary:

The project I worked on this summer was called Polarimetry Imaging of Biominerals. Essentially, what I did was I shined light on a sample – either a sea urchin spine, pearl, or a various species of shell – using a Helium-Neon laser and I took a picture of either the reflected or transmitted light. The aim of the project was to use light to learn about a sample’s microstructure. And by shining light on a sample and recording the reflected or transmitted light, we could determine not only if the sample influenced the light, but also how it influenced it. And by determining this how, it was then possible to learn about a sample’s structure such as how its calcium carbonate layers – the material most biominerals are made up of – are formed.

To talk more about the technical details of the project, we passed a 632.8nm Helium-Neon (HeNe) laser through several optical elements. The apparatus can be seen in Figure 1. The encoding stage of the experiment included a Vertical Polarizer (VP) to make sure the light was uniformly polarized, and a Quarter and Half Wave Plate (Q and P, respectively). The Wave Plates changed the polarization state of the incoming light and were adjusted six times to give the incoming light a specific polarization state: either vertical, horizontal, diagonal, anti-diagonal, right or left circular. The polarized light would then pass through the beamsplitter (BS) and through the lens (L3) to the sample. The light would be reflected off of the sample and then pass back through the lens to the beamsplitter where it would then be beamsplit and pass through the decoding stage. The decoding stage consisted of two Polarizers, two Half Wave Plates, and a Quarter Wave Plate. For each polarization state given to the light in the encoding stage, the decoding stage would be adjusted six times to detect the polarization state of the incoming light. Finally, the light was sent through the last polarizer – to decrease its intensity – and to the camera, where 36 images were taken for each sample. The images were analyzed using a MatLab program that created graphs of the amplitude and polarization state for each imaged point of the light. The four colorful pictures in Figure 2 are the result of the MatLab program. The color is artificially inserted to represent the different polarization states (i.e. blue is for vertical, red is for horizontal, green is for diagonal, and purple is for anti-diagonal). The four graphs were set to detect anti-diagonal light. What this means is that if the light was not influenced by a sample, the color of the graph would be uniformly purple. The four samples shown were a pearl, a *pinctada fucata* shell, a *haliotis* shell, and a sea urchin spine. The pearl, as seen by the mostly uniform distribution of purple, did not significantly influence the polarization state of the light. The other three, however, all influenced the light in significant ways. The *pinctada fucata* graph shows smoothly varying light, revealing that the calcium carbonate layers that form it are oriented in the same direction while the graph of the *haliotis* shell shows rapidly polarized, revealing that it’s layers are oriented in all different directions. The venomous sea urchin spine graph shows completely randomized light, which is still a mystery.

Over all, what the biggest take away from this experiment was that reflection polarization works just as well as transmission polarization, which means that in the future we could use this technique to image opaque materials in addition to translucent ones.
Title of Project: Volatile Organic Compound Expression in Response to Herbivory in Tomatoes

Project Summary:

Over the next two years at Colgate, I will be conducting an independent research project with the assistance of my advisor Professor Frank Frey on Volatile Organic Compound (VOC) expression in three different cultivars of tomato plants (cultivated, heirloom, and wild type) in response to various types of herbivory. When many species of plants are attacked by herbivores, they release chemicals as defense mechanisms. There are two schools of thought on how this defense system works: some studies suggest that increased VOC emission recruits parasitic and carnivorous insects which eat the herbivores, whereas others suggest that increased VOC emission deters herbivores directly through adverse chemical accumulation in leaves.

I am seeking to see if selection in the agriculture industry for redder, juicier, more flavorful tomato fruits has come at the cost of reduced defensive abilities in tomato plants. In the final study design, I will grow 120 cultivated tomatoes (which have been highly selected for in terms of color, smell, etc.), 120 heirloom tomatoes (which have been intermediately selected for), and 120 wild type tomatoes (which have not been selected for at all). I will expose these tomato plants to six different experimental herbivory treatments: 1) control, 2) simulated herbivory through mechanical damage (hole-punching), 3) simulated herbivory through chemical induction with methyl jasmonate, 4) simulated herbivory through both mechanical damage and chemical induction with methyl jasmonate, 5) herbivore attack through deposition of tomato hornworm moth eggs, and 6) herbivore attack through tomato hornworm caterpillar damage.

In the summer of 2017, I grew approximately 200 plants of thirteen different varieties of tomatoes (5 cultivated, 5 heirloom, 3 wild type) and took certain baseline measurements of volatile profiles and other characteristics of these plants. I will use these data in the upcoming months when I choose which cultivars to include in my final study design. Professor Frey and I collected and measured VOCs within the leaves using gas chromatography. We also began measuring lycopene content, the chemical that causes redness in tomatoes, using a spectrophotometer. Additionally, we measured trichome abundance and density, leaf weight, and leaf area for the different varieties of tomato plants. In the future, smell, taste, acidity, and other measurements may also be taken from the tomatoes in order to accurately correlate the defensive abilities of tomatoes with certain expressed traits, which may be selected for in the agriculture industry.

The data Professor Frey and I collected this summer will be highly useful moving forward with this research. We found that leaf area and leaf weight are linearly and positively related to the same degree among all tomato varieties. There is minimal variation in these data between varieties, indicating that leaf thickness is similar among all tomato varieties studied. Additionally, we found that trichome density is both measurable and consistent among plants of a given cultivar, but variable among them. There is significant variation in the total volatile abundance among varieties, and not all of this variation is due to differences in trichome density, indicating that different varieties of tomato plants produce different quantities of volatiles due to factors other than the absolute amount of trichomes present. The relative abundance of volatiles also differs among varieties, especially with respect to the relative abundance of limonene, beta-phellandrene, and caryophyllene.

In the future, we will analyze these data closely in combination with fruit color and lycopene data and determine which cultivars of wild type, cultivated, and heirloom tomatoes we will include in the final research project. It will be important to consider the volatile expression, in both type and quantity, and other phenotypic traits such as color when making these decisions. This summer’s research allowed for baseline information to be collected which will be critical in further steps of my research project analyzing how volatile organic compound expression in three different cultivars of tomato plants differs in response to different types of herbivory.

Title of Project: Field School Fellowship with the National Abolition Hall of Fame and Museum

Project Summary:

This summer I worked as a Fellow for the National Abolition Hall of Fame and museum in Peterboro, NY through the Upstate Institute at Colgate University. The Upstate Institute is a department at Colgate University that works to connect students interested in working with the surrounding communities with different opportunities. These opportunities can take on many different forms, ranging from research to supporting the organizations through donating time and labor while being compensated by the Upstate Institute. This allows for potentially underfunded organizations, often non-profit or NGO's, to still benefit from the students work without worrying about financial constraints.

At the National Abolition Hall of Fame and Museum I worked under Dot Willsey promoting the museums fund raising offers and running the actual hall of fame and museum. The promotion and advertising aspect of my internship dominated my day-to-day activities; however, whenever a patron would come to visit the museum this would become my new top priority. When I was not working with outreach or patrons, I would work on the research poster that would be presented at the end of the summer. My work focused primarily on anti-slavery dinners that have become a tradition at the museum to commemorate the anti-slavery work that occurred in the mid-1800s. This involved going over documents regarding menus and constraints to the food to avoid anything that was produced with slave labor. These dinners were focused on the historical events that occurred in Peterboro by their very own famous anti-abolitionist: Gerrit Smith. The menu’s that are served at the annual remembrance were derived from a rendition of what would have typically been eaten during the time period in now Central New York. Thank you to both the Upstate Institute and Dot for the opportunity to learn so much about the rich history of historic Peterboro and the philanthropic efforts of Gerrit Smith.
Research Fellow: Jin Won “Jin” Huh (2019)  
Concentration: Physics

Faculty Mentor: Beth Parks  
Department: Physics and Astronomy

Title of Project: Improving THz Spectroscopy to Enable Studies of Carbon Nanotubes

Project Summary:

Terahertz Time-Domain Spectroscopy (THz-TDS) is a method used to perform spectroscopy in the far-infrared, which ranges from some hundred GHz ($10^9$ Hz) to few THz ($10^{12}$ Hz). The unique challenge in dealing with terahertz region of electromagnetic spectrum is that the particular frequency range is in a gap region lower than the reach of optical spectroscopy techniques such as visible spectroscopy or Fourier Transform Infrared Spectroscopy (FTIR) but at higher frequencies than can be accessed using electronic spectroscopy techniques due to limits in current electronic equipment. THz-TDS is a method that can be used to extract data on electromagnetic spectra inside the gap region. The electromagnetic spectrum in the terahertz region is important as it contains information regarding interactions at the molecular, nanoscale level. Our goal is to use our THz-TDS equipment to analyze carbon nanotube structures in the future.

The setup for THz-TDS starts with a titanium-sapphire mode-locked laser that generates short laser pulses. The laser goes through a beam splitter and then the two separate beams are sent to two Hertzian dipole antennas located on two opposite sides of the sample being analyzed. One of the antennas, called the emitter antenna, is connected to an AC source generates an electromagnetic pulse that travels through a set of collimating mirrors and the sample before reaching the other antenna, the detector antenna. Unlike the emitter antenna, the detector antenna is connected to current amplifier that allows us to read the electric signal that is generated when the detector antenna is gated by the laser pulse. Because the signal is much longer than the laser pulse, a small part of the signal is recorded at a time. To map out the entire signal, a time delay line adjusts the length of travel of the laser pulse, altering the time at which the laser pulse arrives at the detector antenna. The spectral signal can be then described as a function of time, giving the technique its name, Time-Domain Spectroscopy. The time domain data can be translated to frequency domain data using Fourier transformation.

Title of Project:  Rise of Insurgencies in the Sahel and The United States' Counterterrorism Efforts in Northwest Africa from 2003 to 2016

Project Summary:

The Sahel, a transitional zone spanning the area from the North West African coasts of the Atlantic to the Red Sea, is distinguished by its quasi-state of being part Sahara and part Savannah. It incorporates the borders of many African states such as Algeria, Chad, Mali, Mauritania, Niger, Nigeria, and Senegal. Like the transitory characteristics of the Sahel, so too did the region’s relative security and stability find themselves becoming more volatile and in a state of lawlessness and chaos. A region that was at one point run by nomadic groups and tribes has developed into a haven for African-based terrorist and insurgent activity since 2003. The Sahel has become a territory suitable for illicit trade and insurgencies because of the political instability, corruption, lack of surveillance, and lack of development that has plagued it for decades. With this recipe for disaster, it has come to the attention of foreign governments such as the United States and various European Union member states such as France, as the region poses threats to not just matters of national security, but also on matters pertaining to economic security. With such concerns over the condition of the regional stability, scholars, regional experts, and policymakers have all attempted to understand and pinpoint the reasons for the region’s lawlessness and progressive increase in criminal and terrorist activities, as well as come up with recommendations for states and international organizations to prevent the Sahel from becoming a safe haven and breeding ground for said activities and operations.

The works created by scholars specializing in the region, policymakers, and governmental institutions were all used in order to conduct a comparative analysis of the literature on the subject. From the research collected, it appears as though the United States has focused on developmental projects as well as training national armies to handle security risks that threaten their countries. These projects aimed at preventing the Sahel and the surrounding Sahara desert from becoming a safe haven for illicit and terrorist networks as well as securitizing any foreign investments in the region. There is a general consensus regarding northern Mali and Niger as hotspots for terrorist (i.e., AQIM) and insurgent (i.e., rebel groups) and criminal operations, as security in these areas is either nonexistent or difficult due to the sheer openness of the geographic range. From the initial Pan-Sahel Initiative (PSI), to the following Trans Sahara Counterterrorism Initiative (TSCTI) and ultimately, Trans Sahara Counterterrorism Partnership (TSCTP), the US administrations that were in office either updated or incorporated more developmental projects into the mix, which indicated that the administrations regarded the already in place strategies as efficient in terms of governmental budget allocations. However, with the Mali crisis of 2012 and the Libyan Civil War of 2011 as a result of the Arab Spring, counterterrorism efforts have gotten more challenging due to the increased political instability and weakened national security that has consumed the region.

In addition to this comparative study, I attempted to test the scholarly literature against a series of primary source government documents made available through the Wikileaks site. The analysis of these documents did not lead to any strong contradictions to the scholarly literature used but instead demonstrated that scholars had a more or less similar understanding to the issue despite lacking access to internal US government debates and analysis.

In conclusion, though my research did not yield any significant findings, it nonetheless provided me with an experience that is unparalleled as it has allowed me to delve deeper into my geographic field of study as well as utilize the knowledge and research methods I have amassed throughout my time at Colgate University.

Differential privacy in intuitive terms is a guarantee that the presence or absence of an individual’s data in a dataset does not significantly change the output of an analysis on the dataset. This is necessary because an individual’s privacy may be compromised if they decide to opt in and contribute their data to studies. Cynthia Dwork, one of the inventors of differential privacy, describes it as ‘a promise, made by a data holder, or curator, to a data subject: “You will not be affected, adversely or otherwise, by allowing your data to be used in any study or analysis, no matter what other studies, data sets, or information sources, are available.”’ Formally, differential privacy states that the probability of getting the same output from running a randomized algorithm on two datasets that differ by only one record is bounded by $\varepsilon$, a parameter known as the privacy budget. One way of achieving differential privacy is by adding noise drawn from a probability distribution and scaled by $\varepsilon$ to the dataset.

My research project focused on evaluating and comparing different differential privacy algorithms on public datasets. My first task was to think about a discrepancy in the proof of the DAWA algorithm and its implementation in Python. DAWA (Data- and Workload-Aware Algorithm) answers range queries under differential privacy by assigning a score to each possible partition of the dataset, finding the least cost partition, and using it to answer the query. It computes the least cost partition using noisy bucket costs to achieve differential privacy. In the proof, a predicate was defined and used to determine whether a bucket was in the lowest cost partition; it was true if and only if the assignment of noise to a given partition made it the lowest cost partition. In the implementation of the algorithm, the noisy bucket costs were rounded up to 0 but there was no assumption of that in the proof. My task was to figure out if the predicates still held up in the Python implementation. I concluded that the predicate broke down when the noise became negative enough to force a rounding up for the noisy bucket cost.

Following that, I compared a new implementation of the PrivTree algorithm in Python to an existing one in C++ to check for correctness. PrivTree stands for Private Tree and is a differentially private algorithm to answer count queries on a dataset. It recursively constructs a tree by breaking up the domain of a dataset into quadrants and comparing noisy counts at each quadrant to a threshold based on $\varepsilon$ to decide whether to prune at that quadrant or keep dividing. I debugged the Python code to get it to match the output of the C++ code and ran both implementations to compare errors on different public datasets at different $\varepsilon$ values. This involved a close reading of the research paper describing the algorithm, listing its arguments, and cross-referencing them with both implementations. I also implemented PrivTree as a directed probabilistic graphical model called a Bayesian network to get a probabilistic view of how the algorithm constructed its tree. I thoroughly tested my implementation by writing test cases for it, which involved making trees, assigning conditional probabilities to values at each node, calculating by hand the marginal probabilities for values at the nodes, and comparing outputs to the expected results.

A proposed alternate algorithm for PrivTree relies on using the Exponential mechanism on a tree, which uses utility scores based on the cost of pruning at a child, to construct an undirected probabilistic graphical model called a Markov random field. My ultimate goal is to determine key differences in models made with the PrivTree algorithm and the Exponential Mechanism; potential differences could be that one model tends to prune trees higher up than the other etc. The first future task is comparing the results of the Bayesian network implementation of PrivTree to the tree-based implementation to make sure they are consistent. Following that, I will compare the models made by the two algorithms to determine whether there are any significant differences, which will involve comparing them on the same datasets. Finally, I will create data visualizations of the trees as heatmaps to show the differences between the different algorithms.

Source of Support: [ ] AHUM Div. [ ] NASC Div. [ ] SOSC Div. [ ] UNST Div. [x] Other (specify): National Science Foundation Grant
Research Fellow: Yinuo “Tayshaun” Jin (2020)  
Concentration: Undeclared

Faculty Mentor: Aubreya Adams  
Department: Geology

Title of Project: Crust and Upper Mantle Structure of the Adirondack Mountains

Project Summary:

This summer I had the opportunity to work with Professor Adams in the Colgate Geophysics lab and join the research to locate earthquakes in the Adirondacks. The Adirondacks region is one of the most seismically active areas in the Northeastern United States. In the last 50 years, several damaging earthquakes, including two earthquakes with magnitude > 5.0 happened in this area. The primary goal of the research is to use seismic programs to locate local events from 2016 to 2017 by analyzing seismic data from stations in the Adirondack Mountains. The long-term goal of the research is to find the best-fit crustal velocity model specifically for the Adirondacks, and to better understand the subsurface geology in the region.

Data Collection: The Geophysics lab collected seismic data during the past year from 43 stations (including 40 public stations and 3 Colgate stations) around the Adirondacks. For the public stations, I obtained data by sending request codes to IRIS (Incorporated Research Institutions for Seismology). For the Colgate stations, I visited the sites with Professor Adams and downloaded data from SD cards inserted in the seismometers. The Geophysics lab built the database with the program dbe on the server.

Waveform analysis & Events relocation: There are several Linux programs including pql, dblock2 & dbpick that can read the miniseed data files in the database. The program pql can visualize seismic data and generate graphs. In the first 2 weeks, I learnt the basic patterns of seismic waves, including p-waves, s-waves and surface waves, by using pql. Our group used another Linux package called Antelope (including dblock2 & dbpick) to analyze the seismic data. Applying the STA/LTA (short-time-average through long-time-average) trigger algorithm with shorter LTA duration parameter, the program automatically detects p-waves and s-waves, records their arrival times and locates the earthquakes. However, due to the relative imprecision of the program, the Geophysics group further used dbpick to adjust the arrival times of p-waves and s-waves of the seismograms, and eliminated teleseismic events mistakenly picked by Antelope. After adjusting the arrival times of waves, the Geophysics group relocated each event with a revised regional model compared with the default iasp91 model. During the summer, the group relocated 51 events between Apr.1 2016 and Jun.15 2017. The comparison between the original events (Figure 1; picked by Antelope) and the modified events (Figure 2) shows several results: 1. both figures show at least 14 events laying near the boundary of the Grenville province and the Appalachian province, which might indicate a potential fault or weakness underneath the boundary. 2. The average epicentral depth of the events decreases after the relocation, with 84.3% shallower than 5 km.

Fieldtrip: Besides laboratory works with seismic programs, I also joined several fieldtrips with Professor Adams to the 3 Colgate seismic stations in the Adirondacks in order to check their working status and download seismic data. Specifically, at NHCG station, we added a large solar panel and leveled the tilted seismic sensor. At CPCG station, we fixed the flooded seismometer and reinforced its waterproof box. At all of the stations, we added another 12V battery in order to extend the working period of the seismometers during the winter.

Preparation for future work: During the last two weeks of the research, I wrote a shell script to format the station information in the database to a file that is readable to hypoellipse, another seismic program. In the future, the Geophysics lab will use hypoellipse to further refine the events locations and depth. Based on the more precise data, the ultimate goal of the research is to define a better-fit velocity model for the Adirondacks.

Faculty Mentor: Julie Dudrick

Department: Upstate Institute

Title of Project: Field School Fellowship with the Young Scholars Liberty Partnership Program and the Utica Children’s Museum

Project Summary:

Our research for the Field School this summer concerned two educational institutions in Utica. We worked with the Young Scholars Liberty Partnerships Program and the Utica Children’s Museum to improve their overall operation. The Young Scholars Program gives high-achieving students in the Utica City School District the academic, cultural, and social-emotional support needed to reach their full potential as scholars and community members. This program is designed and staffed by education professionals who motivate a diverse and talented pool of students to stay in school, earn a New York State Regents Diploma with Advanced Designation, and pursue post-secondary education. Since its inception in 1993, 93% of Young Scholars have graduated high school and 88% have entered college. 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. With a focus on STEAM education and tactile learning, the museum provides an enriching environment for young children from central NY to grow as independent and critical thinkers. Though the museum suffers from chronic funding issues, they remain a beloved institution in the Mohawk Valley and are working their way up to financial stability. Recently, they were chosen by the Konosioni Senior Honor Society at Colgate University, Class of 2017, to receive $2,500 from their Madison County Gives fund to put toward creating a new Sensory Zone on the first floor of the Museum. This is one component of their initiative to incorporate STEAM programs into the learning experience of young visitors.

We worked with the Young Scholars Program to grow their alumni network and build a foundation for better involvement. First, we determined the best way to reach out to alumni and diagnosed the effectiveness of the program’s social media presence. Using the alumni database compiled by previous Upstate Fellows, we were able to increase the program’s connection with alumni from 50% to 67% of graduates. Next, we were tasked with coordinating alumni outreach for an event taking place at the end of the summer program, a STEAM Poster Fair. We reached out to former STEAM Scholars, Young Scholars personnel, recent graduates, and alumni who work in STEAM fields. Then, we created advertising materials and used the various Facebook pages to promote the event and gauge attendance based on Facebook’s Insights feature. Our main project was researching and articulating long term means by which Young Scholars can foster group affinity with alumni in the future. We primarily referred to Colgate University and Hamilton College’s alumni councils regarding the structure of an alumni council. Additionally, through researching alumni engagement strategies at Marlborough School, Harvard Westlake School, and University of Chicago, we found that regional and vocational networks and affinity groups can serve as ways for alumni of all ages to connect, as well as groupings to which to refer in the future for mentoring or internships for students. Additionally, the London School of Economics and Political Science provided multiple inspirations for alumni events with a wide range of activity that can be utilized in the future.

For the Utica Children’s Museum, we were asked “How have children’s museums in small cities used innovative collaborations or other creative efforts to achieve economic stability? Have children’s museums contributed to – and benefited from – urban renaissance movements?” We began with the Alliance of Children’s Museums to compile a comprehensive list of similar institutions to emulate. To narrow down this list, we selected museums that were in economically stagnant regions, in cities with declining populations, located in the Rust Belt, had financial troubles, and possibly housed in old buildings. Some common factors that we have discovered are museum partnerships with local colleges, libraries, immigrant/refugee communities, and a strong website design. Our final products for the museum were a report on strategies to achieve financial security based on the methods of these other museums and a proposal for website changes to increase accessibility and engagement as they are looking for ways to better market the museum’s exciting new programs.

Andalusia conjures up two disparate images – one of touristic paradise, with consistently warm weather, endless beaches, golf courses, resorts, and a rich and varied history of art and architecture to explore at one’s leisure. The other—less idyllic—of tremendously high unemployment and far-reaching economic woes. How can these two images be reconciled? While scholars debate one another regarding the relative pros and cons of tourism, this study delves into the heart of the matter by seeking out an emic perspective on the phenomenon. An emic perspective favors local understandings of tourism and seeks to explain its experience in terms of natural rather than superimposed elements. Speaking to a broad cross-section of Andalusian society reveals that Andalusians are more concerned by certain types of tourism than others, that the magnitude of tourists affects the impressions it generates, and that the economic benefits of tourism are generally accepted but only with a number of qualifications. Specifically, locals prefer cultural or historic tourists to what has been termed turismo basura, or trash tourism, comprising foreigners attracted to a locale by the opportunity it presents to shed the inhibitions of home and behave wildly. Tourism is better received in areas with a lesser magnitude of tourists, as sudden and explosive booms in tourism engender a number of novel phenomena, including scarcity of housing, overcrowding, and compromised working conditions. Finally, the economic benefits of the tourist industry are mixed as it tends to create seasonable, unstable work primarily in a limited range of service sector positions such as waitressing, bartending, or as a hotel receptionist. Studying an emic perspective on the impacts of tourism helps situate scholarly debate on the matter, reveal unforeseen benefits and pitfalls of the expansion of the tourist industry, and guide the development and implementation of future government policy in line with the hopes and expectations of the local citizenry.

The scope of this project was to investigate whether the Wave Model of linguistic change, which originated in Italy, is still applicable to modern Italy through an analysis of the current literature on the subject of Italian dialects, using observed changes in Japan, to which it was later applied, as a guide. The Wave Model suggests that linguistic features, or innovations that originate in the speech or writing of one localized area, spread out from that area and become part of the language of progressively more distant areas by means of “borrowing events,” in which one speech community adopts an innovation from interactions with another. The model suggests that there is a “linguistic centre” wherein such innovations originate, and from which they radiate, such that over time they become distributed in a pattern of concentric circles. The linguistic centre lies in the middle and progressively older words lie farther out towards the peripheries, as it would take time for innovations to spread. The motivation for this project was the observations in Yamaguchi (2007)¹ that young people’s speech was influenced by that of dialect features used by comics on national television. Additionally, some similarities between Japan and Italy (the presence of historical and modern economic and social capitals, the long, thin shape of the country with a “spine” of mountains, the presence of a robust and recognized standard language, the plethora of diverse dialects that are increasingly less spoken, etc.) suggest that similar phenomena might be present in literature on current trends in Italian language and dialect.

The results of this investigation support to a large degree the hypotheses of the researcher. Perhaps the most significant trend in support of a weakening of the Wave Model in Italy is the prevalence and increasing standardization of the Italian spoken across the nation. Both in Italy and in Japan, such shifts as industrialization (and thus migration) and universal public education have encouraged mixing of dialects, necessitated a language that can be spoken and understood nation-wide, and instilled a national literary and linguistic canon in young people. As the standard language has increasingly become the day-to-day language in Italy, local innovations and linguistic centres have lost some of their power, and linguistic distances between language communities have become shorter. In this way, the Wave Model has become weakened.

There was little to no evidence that current literature on Italian language thinks exclusively in terms of borrowing events or the Wave Model. Phylogenetic networks, or those that identify “genetic trees” of languages, admit borrowing events, but predominantly as a secondary layer to the genetic relationship. It is precisely the lack of recent literature relating specifically to the Wave Model that pushed this research toward more historical texts, in an effort to identify the features of past linguistic change that might be traceable to today, and to investigate past features of the Wave Model that might be identifiable as lacking in modern Italy and Japan. As noted above, industrialization was found to be the primary factor in driving the use of a standardized form of Italian. Formerly rural agricultural workers who found themselves unable to be understood in the cities of the North had to speak in a way that would allow them to communicate everywhere. Italy had possessed a largely standardized and universal language for a while before this movement, one based on the Florentine dialect, but it was more an official standard language, used for governmental and literary purposes, and certainly did not reflect the speech of the average Italian, who used dialect exclusively or almost exclusively for day-to-day speech. The linguistic mixing that this migration caused also contributed to a “watering-down” of the distinctiveness of local dialects, as linguistic features were transported across the country and adopted by very different dialect groups.

To illustrate the effect of the standard language on the diversity of Italian dialects, and therefore their ability to adopt linguistic innovation from elsewhere, the standard language has become the “unmarked,” or default language in many places and social situations in Italy. When meeting someone for the first time, for example, it is more common to speak to them in standard (at least until one identifies that they speak the local dialect) than in dialect. This produces a situation where young people are able to operate exclusively in the standard language, and thus do not have to or want to learn the dialect.

Research Fellow(s): Jourdan Kidd (2019)  
Molly Klare (2018)  

Concentration: Molecular Biology  
Molly Klare (2018)  
Concentration: Neuroscience  
Faculty Mentor: Jason Meyers  
Department(s): Biology; Neuroscience  

Title of Project: Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate  

Project Summary:

Unlike mammals, zebrafish are able to regenerate damaged sensory systems, including the retina. Our research project focused on understanding the mechanisms and signaling pathways behind retinal regeneration, which could possibly lead to the ability to induce regeneration in damaged human retinas. It is understood that damage in the zebrafish retina results in activation of Müller glia. These glial cells then dedifferentiate and asymmetrically divide to produce a new Müller glia cell and a retinal progenitor cell. The retinal progenitors then proliferate, migrate to the sites of damage, and replace the damaged cells.

It is hypothesized that Notch signaling plays a role during retinal development and regeneration, and downregulation of notch has been shown to be necessary for proper differentiation of Müller glial cells during development. Our research aims to determine if notch signaling controls whether glial cells divide symmetrically or asymmetrically during retinal regeneration. In order to study changes in patterns of glial activity upon damage, we utilize a transgenic line of fish that expresses GFP when glial fibrillary acidic protein is present, a notch reporter line, and a lineage tracing line.

**Figure 1:** Blinded fish were treated with Ly411 to inhibit notch signaling, and their glial cells were visualized and quantified over the course of six days. Notch inhibition led to a loss of glial cells by day 6 of regeneration when compared to blind controls. Based on these results, we hypothesize that Notch prevents asymmetrical division of Müller glia during retinal regeneration. In order to test if this hypothesis is true, we plan to inhibit notch, allow the fish to regenerate their photoreceptors, and then blind the fish again. If our hypothesis is correct, the notch inhibited fish would be less able or unable to regenerate their photoreceptors again due to the loss of Muller glia.

**Figure 2:** The blind retina of a Ubi:Zebrabow;hsp70:cre zebrafish shows a green glial cell and its progeny streaming from the inner nuclear layer to the photoreceptor layer. We plan to use this transgenic line to visualize the migration and progeny of individual glial cells in response to damage and notch inhibition.

This data supports the hypothesis that Notch signaling plays a role in the initial asymmetric division of the Müller glia in response to retinal damage.

☒ Other (specify): Michael J. Wolk ’60 Heart Foundation; Oberheim Memorial Fund
Project Summary:

My Lampert Fellowship research focused on how Korean youth activists negotiate established systems of knowledge to create new sites of learning through their activism. Drawing on participant observations and interviews with 14 Korean youth activists in the summer of 2017 in Seoul, South Korea, this study explores how Korean youth activists disrupt of dominant structures in their activist spaces of learning, resisting and dreaming. Youth activist negotiate established systems of knowledge and power perpetrated through schooling. The educational structure reproduces the banking concept of education in which students are positioned as passive receivers of knowledge from dominant structures. Youth activists, however, disrupt and resist dominant narratives by producing alternative knowledge that challenges structures of power. Through their activism, youth activists create spaces of learning where the knowledge each person hold is valued and alternative knowledge is shared, disrupting narrowly defined concepts of knowledge and dominant structures. Youth activists dream of transformative possibilities through their activism, guiding their knowledge-making, learning, and resisting through collective dreams of justice. The study highlights youth activists’ voices as counternarratives to dominant narratives that dismiss or infantilize youth activism. This study is situated in activist research and scholar-activism, endeavoring to engage critically with structural injustices and inequality and to advocate for justice. This research has been funded by Colgate University’s Lampert Fellowship in Public Affairs.

Research Fellow(s): Christopher “Chris” King (2018)  Concentration: Computer Science
Tinotenda “Tino” Zinyama (2018)  Concentration(s): Computer Science; ARTS

Faculty Mentor: Elodie Fourquet  Department: Computer Science

Title of Project: Handy Dandy Tracking: A Simple Hand Gesture Recognition System

Project Summary:

Hand gesture recognition widens the ways in which we can interact with our devices and has many applications in robotics, sign language interpretation, video games and virtual reality. Gesture recognition systems have been built using machine learning algorithms, probabilistic models and specialized hardware. However, none of these approaches are based on an understanding of the intrinsic nature of the hand: its qualities and mechanics.

The goal of our work is to design and implement a hand gesture recognition system that is in line with the structure of the hand. Our system captures video frames from a simple webcam and filters out unnecessary information to extract key points that define the state and orientation of the hand. These key points, the thumb and wrist, are then used to detect and recognize fingers by their angular relationships to the wrist. Fig 1 shows a flowchart of the system.

![Figure 1 system flow chart](image)

The system analyses a video stream frame by frame. We use motion detection to filter out the background and discard frames that represent a static scene. If there is motion in the scene, we filter out all the non-skin pixels of the frame. Combining the results of motion detections and skin segmentation yields our regions of interest i.e. moving body parts. Hand detection is done next to separate the hand from other parts of the body. An open palm gesture, is required for calibration so that system can extract the wrist and thumb locations. Following successful detection of the calibration gesture, the system is then able to match preceding gestures to a set of predefined gestures.

The project is still ongoing. The major takeaway is that although angles provide a scale invariant template for gesture recognition, the reference point should be carefully selected to be in line with the structure of the model. Previous approaches to hand gesture recognition using the angular relationships of the fingers to the center of the palm fail to define the true range of motion of the fingers relative to each other, for such motion is not centered around the palm but the wrist, from which the hand tendons radiate.

Source of Support:

- AHUM Div.
- NASC Div.
- OSOC Div.
- UNST Div.
- Other (specify): Science and Math Initiative-SMI (NASC Division)
Title of Project: Sensation and Satire: Scanlation Part III

Project Summary:

The goal of this project was to scan and translate into English a single issue of the 1928 illustrated satire and arts magazine *Shanghai Sketch* to make it accessible to non-Chinese readers. The original read right to left, top down, thus we changed it to read left to right, across. We worked on finding the best terminology to use without losing the expression of the original while figuring out how to best place the text and images in the scanlated version. We mainly used Photoshop to complete this project.

Professor Crespi first took pictures of the magazine from the Fudan University in Shanghai (where scanning of materials was prohibited). Thus pages appeared bent and the lighting on each was uneven. With Photoshop, I straightened out noticeable bends and brightened the pages. While Professor Crespi translated the text from Chinese into English, I cleaned up the pages and placed in the translated versions of the text.

These passages were translated with care as certain elements of a piece can be lost in translation. Thus we spent much time trying to capture the flavor of the original Chinese from the 1920s, and reworked the visual layout of the scanlated version so that it approximated the atmosphere, themes, visuals, and messages of the original version. Thus, images and text had to be flipped and moved around digitally (Figure 1 & 2). We did this throughout the span of the project with frequent revisions.

The advertisements were especially tricky. Unlike Chinese characters, English words took more space. We carefully chose the right words so that the style and imagery of the original remained. The ads were also all handmade so we did research on some brands that had English names and used those for reference for the scanlated version. For the others, I recreated what I imagined the font to be in English. (Figure 3 & 4).

We did this for all eight pages, working and reworking every page over the eight weeks. We wanted it authentic and enjoyable, but also faithful to the original Chinese version. With careful thinking and a perceptive eye, we have scanlated a 1928 magazine into an easy read, enjoyable magazine for more readers to access and enjoy.

This summer we conducted research on the topic of Municipal Waste Water Treatment Processes and nearby surrounding stream water. Through conducting our research we took samples from 9 various locations, 5 located within the treatment plant and 4 from locations both up and down stream of the plant. Once we got our samples we performed three various tests: COD, TSS and VSS. COD, Chemical Oxygen Demand, is defined as the amount of a specified oxidant that reacts with the sample under controlled conditions. The goal of COD is to measure how much organic material found in a specific water sample. TSS, Total Suspended Solids, are the solid materials retained by a filter. In order to obtain these results we have to pre-weigh the filters and aluminum trays and then place the filters in an oven at 103-105° C for one hour. We then took the filters out and weighed them. In order to calculate the TSS we took the difference between the mass before and after the filtration and heating. VSS, Volatile Suspended Solids, occurs after TSS whereby after we weighed the filters from TSS we placed them in another over at 550° C for one hour. Once the hour was complete we would take the filters out and reweigh the filters. The volatile suspended solids were whatever solids were ignited during this time period. We calculated VSS by taking the difference between the mass of the sample before and after it was placed in the 550° C oven.

After completing all of our tests we would then look at all of our results and data and would plot the various data points against each other in hope to find a trend line. Unfortunately, we were unable to find any significant trend line for all of our data samples this summer. In hopes to try to find some explanation as to why we were not getting a trend line or why some data was higher/lower for particular samples we tried researching some potential explanations. Some of the things we looked into were the weather patterns for the week prior, geographical locations, animal frequency in the area, various actives taken place around those areas and any water data that may have been collected over the years. Through all of the research none of the data we found resulted in any significant trend line, as you can see in Figure 1 where we tried to compare VSS vs. TSS for one of our data sets.

![Figure 1](image)

Being that this was the very beginning of our research process we are planning on continuing the research into the next year. By continuing our research we hope that we will be able to eventually find some trend for our data. The bonus in continuing our research throughout the next year will be that Colgate will be in session so the town population will nearly double in size. Additionally, the general area will be experiencing severe climate changes which will have major effect on the water quality and levels. With the change in climate the nearby roadways will be having a major influx of salts added to the roads and the farming will come to a stop which will cause a decrease in fertilizer use. We are also hoping to try to look into measuring the water levels and stream flows of the areas we sample at to see if this has any correlation without data points. All in all, our goal is to find some correlation between all of the data points or find potential explanations for why various data points jump low/high at random.

**Source of Support:**

- [ ] AHUM Div.
- [ ] NASC Div.
- [ ] SOSC Div.
- [x] UNST Div.
- [ ] Other (specify):
Title of Project: Paleoenvironmental Reconstruction of Warm Periods of Earth's History: Diatom Records in Marine Sediments from the Drake Passage

Project Summary:

This study focused on developing a longer term perspective on Earth’s warming climate, using marine sediment cores from the Drake Passage, the oceanic passage that separates South America from the Antarctic Peninsula. The Antarctic Peninsula is a region that is warming today at a rate that is greater than the global average; for this reason, reconstruction of its climate history can inform us about the scale of past warm intervals in comparison to today. Two periods of time were selected for study, the Pliocene, ~ 5-2 million years ago, when CO₂ levels are estimated to have been even higher than today, and interglacial intervals within the Pleistocene, the past 2 million years, when the earth has alternated between glacial and interglacial intervals.

My research consisted of utilizing diatom assemblage and abundance data to evaluate the paleoceanography of the Drake Passage during the late Pliocene to early Pleistocene. Diatoms are single-celled algae with a siliceous test. They are very sensitive to upper ocean conditions, and their valves often are well-preserved in Southern Ocean sediments. Approximately 50 samples from ODP leg 113 site 696A were selected for study. The samples were chosen based on their low magnetic susceptibility signature, often associated with diatomaceous materials, which likely are more common during warmer periods. The first stage of my study aimed to develop a chronology for the core samples, based on biostratigraphy of diatom species. This required documentation of species occurrence over time. The initial work focused on detailed microscopy and the production of a suite of plates with photomicrographs to assist with consistent identification. The second step, acquiring diatom abundance and assemblage data, will be completed over the course of the next several months. These data will be used to evaluate changes in the level and style of primary productivity over time, with the overall goal of comparing modern warming to previous warm periods in this sensitive region of the planet.
Research Fellow: Peishan “Lillian” Li (2020)

Concentration: Mathematical Economics

Faculty Mentor: David Robinson  Department: History

Title of Project: Early Modern China and Its Foreign Relations

Project Summary:

I did research with Professor Robinson on Chinese history of the Ming dynasty (1368-1644CE) during the summer. The topics we focused on are the military strategies, diplomatic relations, and court cultures, which may seem separate but are closely related to each other. These various perspectives consistently show that the Ming court in its early phase tried to consolidate its ruling by establishing an image that emphasized on Han traditions, value military powers, and conform to the will of Heaven. To contribute to the process of research and develop a deeper understanding of this time period, I read primary and secondary resource, wrote summaries and excerpts, and edited the translation of Professor Robinson’s book, the Martial Spectacles of the Ming Court.

The primary resource we used, Grand Emperor Ming Imperial Collection (大明太祖皇帝御制集), recorded literary works of the first Ming emperor, Zhu Yuanzhang (朱元璋), which gives us an insight to the politics, diplomacy, military, social structure, economics, and humanities during the period of Hongwu (1368-1398). The forms of these works are various: imperial edicts, letters, poems, and so on, from which we see the multiple ways that the emperor used to communicate with central and regional officials, foreign countries, and more importantly, his people. In addition to this primary source, I also read a book about the military system and strategies during the Ming Dynasty, the History of Nine-side Great Wall of Military Towns in the Ming Dynasty (明代九关长城军镇史) written by Zhao Xianhai (赵现海), and wrote summaries for the parts related to our research. The author stated that during the early phase of the Ming Court, it followed traditional value of Han people, separating Han from foreigners without further expansion in order to win people’s support. On the other hand, in spite of the appearance of distinction from the Mongols, the Ming Court actually inherited some military regimes from the Yuan Dynasty, such as the system of enfeoffment which allowed sons of the emperor took control of military power over certain regions. The contrast of the surface and the underneath reflects how the Ming Court appealed to Han people’s national feelings and, at the same time, enhanced its power by learning the advantages of the Yuan court. In addition, the book also discusses the shift of power throughout the Ming Dynasty. As the ruling became unshakable and the Northern Yuan’s power diminished, the military leaders’ power decreased in order to ensure that the emperor had the absolute control over the court, the people, and the country. Consequently, we saw the complex internal relations among diplomacy, military, and the court.

In addition, I also proofread and edited translations of the Martial Spectacles of the Ming Court written by Professor Robinson to prepare for its publication in China. The book describes the roles of “Martial Spectacles,” which includes the royal hunt, polo matches, archery contests, equestrian demonstrations, and the imperial menagerie, in politics, diplomacy and the society in general. Through poetry, artworks, and other records, we see the dynamics of ruling power and the emperors’ common image: generosity, discernment, and respect to family tradition. During the translating process, I developed a deeper understanding of the book, the history, and also the language.

□ Other (specify):
Brain computer interfaces (BCIs) aim to measure and interpret an individual’s brain activity into physical commands. Applications range from directing motion in wheelchairs, controlling prosthetic limbs, and virtual reality (VR). Our project in particular aims to map brain signals related to the motor control of the hand. In its most basic sense, the BCI process can be broken down into three steps: first, you need some hardware equipment that can measure brain activity; for this project, we used a commercial grade electroencephalogram (EEG) which non-invasively measures electrical fields on the scalp. Second, the incoming signal needs to be processed; in this step, we got rid of external electrical noise by passing the signal through a series of filters. Third, an algorithm needs to be able to learn and predict these filtered signals; our project uses a free implementation of a support vector machine (SVM) algorithm which is a very powerful machine learning technique. And lastly, the prediction from the algorithm has to be fed into something to elicit a physical change; we printed out a robotic hand and used the decision to make the hand either open or close.

There are three main pieces of hardware for this project: the EEG board, the EEG headset, and the robotic hand/arm. We purchased the EEG board from OpenBCI (http://openbci.com/) using personal funds, and printed out the headset taking the blueprints from their website as well. The parts robot hand/arm as printed from blueprints provided by InMoov (https://inmoov.fr/), and assembled by us.

In terms of actual coding for this project, the software was implemented in Java due to both of us having a much higher comfort level with Java than other languages. The code includes: byte interpretation and translation from the EEG headset, an experimental slideshow that is used to collect data to train the SVM, and all data preprocessing. Our software uses a series of algorithms taken from different sites: we used an implementation of Fast Fourier Transform (FFT) from the Princeton Universities CS department website, and our machine learning algorithm, LIBSVM, is publicly available and created by the University of Taiwan.

As of now the project functions offline; That is, it can use pre-recorded brain signals to predict whether or not the participant was thinking of opening or closing their hand (prediction accuracy is about 86.7%), and we will be continuing this project into the fall semester, and potentially the spring as well as our neuroscience senior thesis.

Research Fellow: Yimei Lin (2020)  Concentration(s):  Music; Biology
Faculty Mentor: Barbara Hoopes  Department: Biology
Title of Project: The Molecular Genetics of Size Variation in Dogs

Project Summary:

Because of generations of selective breeding, domestic dogs exhibit variation across breeds but less than normal variation within breeds. Because of this, dog can provide us with a simpler model system to study complex traits, which are things that are affected by multiple genes. Previous research has suggested that single nucleotide polymorphisms (SNPs) at only six genes (SMAD2, IGF1R, STC2, GHR1, GHR2, IGF1, and HMGA2) can explain the wide variation seen in dog body height across breeds. Recent research has suggested additional novel genes on several other chromosomes contribute to body size variation. It is unclear to what extent variations in all these genes can explain individual size difference, particularly within a single breed.

My research this summer focuses on determining the effects of genomic variation at candidate SNPs on individual height variation within a single breed (the poodle) and predicting height of poodles by genotyping these candidate SNPs. The variations I chose are located in or near SMAD2, IGF1R, STC2, GHR, LCORL, TBX19, and unknown genes on chromosomes 11 and the X. By isolating genomic DNA from cheek swabs of 27 particularly small-sized poodles and performing polymerase chain reactions (PCR), I amplified the genes containing the 9 candidate SNPs for each poodle. I then sequenced and analyzed my products to obtain the number of derived alleles at the candidate SNPs for each poodle. With the data from total of 119 poodles, I obtained a formula that would predict their body height using linear regression. My new formula and predictions for poodle heights (Figure 2) are more accurate and more precise than Rimbaut’s prediction (Figure 1), suggesting their prediction for dog size across breeds is not applicable to predicting individual size within a single breed.

In conclusion, there are many genes across a dog’s genome in which variation contributes to complex traits such as body height. Genotyping derived alleles at candidate SNPs from SMAD2, IGF1R, STC2, GHR1, GHR2, LCORL, TBX19, chromosome 11, and X improved height prediction within the poodles breed. However, these 10 SNPs are sufficient to predict only 50% of dog height. There might be other genes, environmental factors, and measurement errors that can contribute to height variation. In the future, genotyping more novel SNPs and obtaining more smaller and larger poodle samples to sequence might improve our ability to predict size based entirely on genetic information.

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

Figure 1: Predicting poodle size with only Rimbault SNPs (SMAD2, IGF1R, STC2, GHR1, and GHR2) is not precise, with $R^2$ value of 0.06249. In the 119 poodles genotyped, Rimbault’s prediction can only explain about 6% of the height variants. Rimbault’s data provided formulas that are used to predict poodle heights: $\ln(\text{weight})=2.975-0.189[\text{SMAD2}]-0.202[\text{IGF1R}] - 0.125[\text{STC2}]-0.106[\text{GHR1}]-0.130[\text{GHR2}]$ and $\text{height}=0.4684[\text{weight}]+7.1603$

Figure 2: Predicting poodle size with 9 SNPs (SMAD2, IGF1R, STC2, GHR1, GHR2, LCORL, TBX19, chr11 and X) is more precise, with $R^2$ value of 0.50239. In the 119 poodles genotyped, my prediction only explains about 50% of the height variants. Multiple linear regression has formulated height prediction to be: $\text{height}=10.031-0.168[\text{SMAD2}]-0.0353[\text{IGF1R}] - 0.581[\text{STC2}]+0.229[\text{GHR1}]-0.816[\text{GHR2}] +0.248[\text{TBX19}]+0.33[\text{chr. X}]+1.43[\text{chr. 3}]-0.05998[\text{chr. 11}]$
Reducing carbonyl groups has always been a challenging yet useful reaction in organic synthesis. Current stochiometric methods including the usage of sodium borohydride (NaBH₄) and lithium aluminum hydride (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, ketones and amines since the 1980s. The Chianese research group has been working on synthesizing and applying different ruthenium pincer complexes for ester hydrogenation for past summers. In this summer, using tools in computational chemistry, we strive to understand the underlying mechanism of ester hydrogenation. The underlying mechanism of how our catalyst work can guide future synthesis of numerous catalysts significantly.

In the past summers, we have synthesized six different ruthenium pincer complexes and tested their ability of doing ester hydrogenation. Last summer, we observed a surprising rearrangement of our most studied catalyst 1-a, when we added triphenylphosphine (PPh₃) to the catalyst. The product 1-b was tested its catalytic ability for ester hydrogenation. We used to believe that the hydrogens on the linker carbon acted as a crucial part of the catalytic circle. However, the fact that our new catalyst, with the linker carbon and its two hydrogens so far away from the ruthenium center, still can do ester hydrogenations. The hydrogenation reactions were carried out with catalyst to substrate ratio 1:50 for various substrates without the addition of bases. We want to understand the underlying mechanism of this new catalyst.

Previous researchers have found a mechanism that could also work on our new catalyst. Therefore, we decided to compute the energies of intermediates and transition state structures similar to this paper. We constructed molecules using Gaussview and computed the energies of these structures using Gaussian 09. Shown to the right 2-a are some of the optimized structures we have found during the process.

However, after we computed the whole pathway according to the work done by the previous researcher, we found out that for our complex, the energy barrier of the reaction is so high that makes the mechanism impossible. Moving on, we could research on more possible mechanism of catalytic ester hydrogenations. We will also try similar rearrangement experiments on other complexes that we previously synthesized and test their ability for ester hydrogenation. Although computational approach did not yield positive results for us this time, it is still a powerful tool that may help us in the future.

I want to thank Professor Chianese, Professor Buck, and Professor Keith for their help and guidance. I also thank Colgate University and the National Science Foundation (Grant: No. CHE-1362501) for financial support. Finally, I thank previous and current group members (Tianyi He, Daniel Kim, Linh Le, Myles J. Drance, Kelsey H. Jensen, Kristijan Bogdanovski, Tia N. Cervarich, Melissa G. Barnard, Natalie J. Pudalov, and Spring Melody M. Knapp) who have contributed to this project.


Faculty Mentor: Kenneth “Ken” Segall  Department: Physics and Astronomy

Title of Project: Nonlinear Dynamics in Superconducting Networks

Project Summary:

This summer, I looked at modelling the behavior of a certain type of equation of motion using an easily observable object: a pendulum. An equation of motion is simply a means of writing down, mathematically, how the characteristics of a system (velocity, position, etc.) evolve with each other. Professor Segall’s lab has been looking at the behavior of circuit elements known as Josephson Junctions. These junctions will potentially be very important in the future. Fortunately, they have a similar equation of motion to that of pendulum. It was my job, over this summer, to take careful measurements of a specially designed pendulum so as to physically observe the manifestation of this very important equation of motion. Later in the summer, I moved on to using a design program to design a Josephson Junction chip. This chip will be used for data collection in the future.

The EOM mentioned is as follows:

$$\Gamma = l \frac{d^2 \theta}{dt^2} + b \frac{d\theta}{dt} + Mgh \sin \theta$$

The equation of motion above is the one that in pendula describes the relationship between the torque being applied to the pendulum and the “whirling velocity that results. In Josephson Junctions, it describes the relationship between the current and the voltage across the Junction. It should be noted that there is no analytic solution to this EOM and due to its non-linearity it brings about hysteresis. The non-linearity is due to the sine term. Hysteretic systems are interesting because in order to evaluate one the state of one variable of the system, you need not only know the state of the other variables, but also the previous state of the variable in question. This can be seen in the graph below, which shows how the velocity of the pendulum varies with applied torque for a given pendulum mass and damping. There is a line for increasing torque (red) and another for decreasing torque (black). In order to know which to choose a y value from, the previous y- value must be known (so that whether velocity is rising or falling can be known). The term Switching refers to the torque at which the pendulum begins moving, while retrap refers to the torque at which it stops moving as the torque is reduced.

![Graph showing the relationship between torque and velocity.](image)

Similarly, the Josephson Junction IV curves display hysteresis. Josephson Junctions, as mentioned above are circuit elements. They are superconducting Junctions made of a conductor-insulator- conductor sandwich and require temperatures below 9 kelvins in order to demonstrate behavior modelled by the equation of motion above. Since they are described by an EOM that they share with pendula, we were able to explore complex relationships between variables analogized by the mass and damping of a pendulum. We observed the effect that changes in mass and damping had on the “how hysteretic” the pendulum’s behavior was. The variables, mass and damping are captured in a variable called alpha. So, we were in essence observing the effect of alpha on the hysteresis. Josephson Junctions also have an alpha, where mass and damping are replaced by relevant variables.

Source of Support:  
- [ ] AHUM Div.  
- [ ] NASC Div.  
- [ ] SOSC Div.  
- [ ] UNST Div.  
- [x] Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
This summer I conducted a Field School Fellowship with the Legal Aid Society of Mid New York (LASMNY) through the Upstate Institute. LASMNY is a not-for-profit legal services group that provides civil (i.e. non-criminal) legal help to low-income residents of thirteen counties throughout upstate New York. They have a wide array of practice areas to serve the legal needs of their low-income clients, including consumer protection, housing, education, access to health care, and domestic violence. They deliver advice over a helpline, represent individual clients, conduct clinics and engage in impact litigation. Put together, these programs help thousands of people across upstate New York each year.

One central focus of my summer work was a continuation of my work on bankruptcy cases, through the Consumer Bankruptcy Law Project (CBLP), that began during the academic year. The CBLP is a collaborative effort between the Upstate Institute, LASMNY and local pro bono/volunteer lawyers that pools the resources of these groups to assist local low-income people in filing for Chapter 7 Bankruptcy. The program provides its clients with the opportunity to seek the relief of bankruptcy to provide them with a fresh financial start free of their often-crushing debt burden. During the academic year, other Colgate students and I participate in client interviews and draft a portion of the necessary pleadings; notably those that require due diligence and background research. This summer, I worked on a number of bankruptcy cases by editing and expanding upon prior student work, as well as drafting pleadings on new cases. Once these documents are completed, I will work with the staff at LASMNY to refer all of the cases to outside pro bono attorneys who will finalize the few remaining pleadings and help the client file for bankruptcy in Federal Court.

In addition, I worked to assist the LASMNY staff in other practice areas. For example, I conducted research to update a publication on debt and provided general assistance to lawyers on consumer, housing and social security cases.
Project Summary:

The heating and cooling of buildings, including houses, represents a significant portion of energy consumption in the United States—around 20 percent of the total. By reducing our energy consumption, we can progress towards using entirely sustainable energy. One way to reduce the amount of energy used in heating and cooling is to improve the insulation in buildings. Better insulation requires less energy to maintain the internal temperature. Improving insulation requires knowing the current R-value—the thermal resistance of that insulation—and replacing it with insulation with a higher R-value. Currently, there are no practical devices for measuring the R-value of building insulation. Ultimately, our goal is to produce such a device that can measure the R-value of insulation and that individuals can use in their own homes. Supplying people with a measurement of the insulation informs them if increasing their insulation would save them energy and money. Our work has focused on making improvements to the design of this device.

The device we're testing consists of a foam insulation square, roughly one foot across and one inch thick, that is placed against an exterior building wall. The temperature difference between opposite faces of the square is measured using thermocouples, as well as the temperature difference between inside and outside air. The measured temperature differences enable us to compare the insulation of the attached square to that of the entire wall using the relationship $\frac{\Delta T_{\text{insulation}}}{\Delta T_{\text{total}}} = \frac{R_{\text{insulation}}}{R_{\text{total}}}$. Since the R-value of the insulation squares used is known, we can calculate the total R-value. However, if the heat flow is not perpendicular to the wall surface, then this simple relationship will break down, as shown in the diagram. Therefore, we investigated if there is an effect of the size and R-value of the insulation square attached to the wall.

Our setup used a test house, made of rigid foam insulation, to test the device on a known amount of insulation. The test house contained wall surfaces with two different levels of insulation, R10 and R20. We heated the interior of the test house, and on the outside of the walls, we attached insulation squares of varying sizes and R-values.

Because heat travels along the path of least resistance, heat near the edges of our insulation squares will escape around the sides of the square, as shown in the diagram above. Here, the arrows represent the flow of heat through and around an insulation square attached to a wall. As a fraction of the total, more heat flows around a smaller square than a larger square, making smaller squares record smaller temperature differences than larger squares. A smaller temperature difference means that the total calculated R-value is higher, as shown in the formula above. Additionally, more heat travels around a thicker square, one with a higher R-value. Therefore, we expect better accuracy for larger squares, smaller R-values of the squares, and larger R-values of the wall insulation. However, since the measurements are easier with smaller squares that have larger R-values, it’s important to determine what values will give sufficient accuracy.

Our data demonstrate the expected relationship between size and R-value of insulation square and the accuracy of the measurement. The plot shows the ratio of the measured R-value to the expected R-value for each condition. For example, the column labeled R3-6-20 refers to the R3 insulation square with side lengths of six inches attached R20 wall surface. The data demonstrate this expected relationship is within the measurement accuracy and show that the effect of the square size and R-value is small, within the tested range, since a 10 percent accuracy in measuring insulation is considered quite good. In the future, we hope to use this data to constrain a model that will allow us to determine the necessary device characteristics for measuring walls with higher R-values.

There has been a noticeable increase in the prevalence of allergic diseases in the modern era. The ‘hygiene hypothesis’ proposes the explanation that decreased exposure to infectious agents due to modern sanitation has made our immune systems more susceptible to autoimmune disorders. Current literature is conflicting on whether hygienic habits are risk factors or actually protective against allergic symptoms.

Our purpose was to calculate the prevalence and associated risk factors of allergic diseases and atopy among rural school children in Ethiopia.

Clinician administered surveys asked guardians to self-report cases of allergic diseases, demographics, and various lifestyle habits related to hygiene and cleanliness. Of the 542 participants surveyed, blood and stool samples were collected and a skin prick test was administered. Multivariate analysis was conducted to determine adjusted odds ratio for atopy or allergic disease against the multiple associated risk factors surveyed.

Potential risk factors such as high income, low crowding, being dewormed, and frequent hand washing had no statistical significance for either atopy or allergic disease symptoms. Insecticide use (AOR=2.051; p-value=.008), river bathing (AOR=8.728; p-value=.003), and parasite infections (AOR=3.516; p-value=.027) were among the most significant risk factors for autoimmune disease.

According to the logic of the ‘hygiene hypothesis’ we expected low crowding, high income, and deworming to be significant risk factors for allergies, yet we found no statistical evidence to support these claims. Additionally a few of the risk factors identified were opposite the trend predicted by the hygiene hypothesis—wearing closed toe shoes, trimming finger nails, and washing fruits were all protective influences. The results were inconsistent, showing that allergic risk factors are not as straightforward as the hygiene hypothesis may suggest, yet there is still some strength behind the claim.

Source of Support: □ AHUM Div.  □ NASC Div.  □ SOSC Div.  □ unst Div.  ☑ Other (specify): Michael J. Wolk ’60 Heart Foundation
Over the past 20 years, there has been a huge increase in publicly-funded but privately operated schools, known as charter schools. Though charter schools began in the 1990s as teacher-initiated spaces to better serve students who found traditional classrooms difficult for learning, education policies such as No Child Left Behind furthered charter school support from politicians and practitioners from both sides of the political aisle: for the political Right, charter schools represented free market principles and privatization, while for the political Left, charter schools were seen as social justice alternatives to under-resourced schools. Critical education scholars, however, have been interrupting these triumphant narratives, framing the rise of charter schools as being aligned with neoliberal economic and political ideologies, and arguing that charter schools represent the marketization and privatization of public education, the loss of democratic control of schools and knowledge, and the rise of new markets within public education.

The Knowledge Is Power Program (KIPP), the nation’s largest charter school network, has 200 schools across the United States, and serves over 80,000 PK-12 students. The school was founded upon and structured after a set of core principles which they call the “Five Pillars”: High Expectations, Choice and Commitment, More Time, Power to Lead, and Focus on Results. On their website, KIPP links these pillars to character and moral development that aims to develop students’ seven Character Strengths: zest, grit, optimism, self-control, gratitude, social intelligence, and curiosity. These pillars and the discourses about character education have led to lots of public and philanthropic support. The Walton Foundation (Wal-Mart), the Doris and Donald Fisher Fund (The Gap), and the U.S Department of Education have each donated or granted over $60 million to the KIPP organization. The influx of funding and rapid expansion of these schools has given rise to lots of media attention highlighting KIPP schools’ impressive graduation rates and other statistics, especially in relation to their low-income students of color.

Nonetheless, critical education scholars have argued that KIPP’s “No Excuses” language oftentimes reproduces and perpetuates cultures of deficiency, white-supremacy, and meritocracy. It’s argued that KIPP and other charter schools foreground behavior management (the seven Character Strengths), explicit teaching of white middle-class values and norms, and a technocratic focus on data and test score production, which are carried out through longer school days, longer calendar years, more discipline and structure, and more rigorous testing. In these ways, KIPP schools insist on a discourse of need for improvement, which structurally heightens and maintains control in the form of racial and economic segregation.

What has been left out of much of the research on KIPP schools are voices of current and future students. My qualitative research project focused on the lived experiences of recent KIPP graduates (like myself) in order to gain a more holistic understanding of how students reflect on their KIPP years. Broadly, I was interested in three main aspects: in what ways KIPP affected their sense of identity; in what ways KIPP set them up for success in college academically; and in what ways KIPP set them up for success in college socially. My findings paint a complicated portrait of both appreciation for their teachers and the support they were provided, as well as some concerns regarding the heavy-handed culture of discipline and a looming sense of appeasing donors. More, students also reflected critically on their college readiness: in terms of scholarly-readiness, student’s responses varied widely, while, in terms of their social-readiness, my participants recognized that though their KIPP schools provided them with a tight-knit community, this also generated a false sense of what other educational institutions might be like.

Importantly, this study adds nuance through human voices and experiences that are sorely missing from the debates surrounding education policy and how America continues to think about the intersections of race, class, justice, and public education.
Title of Project:  Everyday Law, Russia: 1693-1730

Project Summary:

This summer we had the privilege of working with Professor Kira Stevens on her research into the Russian legal system. The goal of this work was to gain insight into the way that the Russian court operated in the 18th century, under the rule of Peter the Great (Petr I). Professor Stevens conducts her work in the history department of Colgate University, so the research question posed examined changes to the legal system during the rule of Petr I and the way everyday law has been adjusted to reflect the new system. As research assistants, we worked collaboratively, but each one has been assigned her own years to investigate. Each researcher read through the summaries of police case files and cataloged them in an excel spreadsheet. Different aspects of the case (e.g. sex of the plaintiff/defendant, rank, crime) were recorded and trends were compiled. This way, data science was used to determine the way everyday court operated. Finally, we attempted to explain some of the trends using the history of the time period.

The military court that we were examining was called Preobrazhensky Prikaz. It was active in the 18th century, during the reign of Peter the Great. It was a time of rapid political change, so the goal of the research was to see how the court reflected the changing political structure. We started the research by gathering information: reading the case summaries and cataloging them in an excel spreadsheet. Each case summary was cataloged by plaintiff and defendant’s name, sex, rank and number, as well as the crime committed. Numerical codes were set up for crime severities and rank. Once a researcher encountered a rank/crime not pre-listed, they would have to look it up online and make a judgement as to where it fit in the code sheet. The new code would then be added to the collaborative coding sheet. Similarly, as we went through the catalog, each researcher personally noted any trends and posed questions, for example, many were about the way in which the scribe recorded particular or bulks of cases, or the reason a prominent and especially high-ranking figure appeared to make a peculiar order (orders from Petr I appeared multiple times). Occasionally, we solved problems with the records of the cases, in which the scribe would leave out crucial data or significantly change the phraseology. But most importantly, our research consisted of analyzing the cataloged data and answering proposed questions. Much of this work was concerned with numerical data: as we would derive the number of pages the scribe used to record the cases, the average cases per month, the average pages per case per month, and etc. By graphing the results we organized into tables, we could point out patterns and anomalies. Another large bulk of the coding was related to gender- crime by gender, or the sex of the plaintiff and defendant- which we were able to use to trace large disparities between crimes ascribed to female and to male defendants. Due to the large amount of preserved recorded cases per year, such results would be hard to arrive at without coding and electronic organization. Afterwards, we also took time to link information from our excel sheets to the events in history. The Preobrazhensky Regiment (Preobrazhensky Polk) was branch of Petr I’s army for which the military court was created, and we worked with recordings of the regiment’s movement throughout the early 18th century. Looking at our own analyzed results, we were able to compare find periods of cases with less military involvement and relate them to historical events.

Throughout our research we acquired much new vocabulary and became adept at reading pre-reformed Russian. We also got a glimpse into the hierarchy and status quo of the time through this unusual court, where ¼ of all accusers were women. And furthermore, we learned and honed our skills with coding and excel, using formulas, pivoting and others, for the precision to which we applied our ability to adapt and analyze code to make this data science project a success.

Title of Project: I. Activation of Molecular Oxygen by Transition Metal Species Insertion of O2 into Rhodium III Complexes
II. Pre K-Edge Features of Aluminum Coordination Complexes

Project Summary:

I.
Using the Gaussian suite '09 computer program, a computational study of the reaction pathways of O2 insertion into tetramesitylporphyrin rhodium, (TMP)RhIII, was carried out. Calculations were performed on a computer cluster to determine the stability of molecules based on Density Functional Theory (DFT). The products of these reactions can be used as catalyst in aerobic oxidation reactions.

(TMP)RhIII is a Rhodium complex with a porphyrin ligand equatorially surrounding the transition metal. In the study, substituents were added and removed from the complex at the axial positions and the energies of the starting materials, products, intermediates, transition states were calculated. Using the data, potential energy surfaces (PES) were constructed displaying the energy changes as the reaction progressed.

The data obtained in this study will be used in conjunction with data from a previous study conducted by the Jason Keith Lab involving Rhodium III cyclam complexes; a similar complex with a different equatorial ligand. The idea behind the comparison is to observe how the stericity of the molecule influences the reaction pathways.

II.
Using the Gaussian suite '09 computer program, a computational study was carried out on Aluminum coordination complexes. The goal of this study was to obtain data leading to the determination of x-ray absorption pre K-Edge features of these Aluminum complexes. X-ray excitation and molecular orbital calculations were performed on the computer cluster. The data resulting from these calculations provide insight into the composition of the excited states.

I.

![Fig. 1: \((\text{cyclam-Rh}^{III}\text{H}_2\text{O})\text{H}^2\text{+}\) ![Fig. 2: (TMP)RhIII.H](image)

![Fig. 3: \((\text{BDI})\text{Al(CF}_3)_2\)](image)

My research project focused on finding ways to accurately represent perspective when using Processing, a programming language, to recreate abstractions of images such as paintings. After discovering the best ways to create the illusion of perspective, my colleague and I wrote tutorials which we put in an online blog intended for use by students in the course “From Paintings to Pixels”, an FSEM which uses Processing to make connections between art and technology. Initially, my goal was to recreate a tile floor pattern using a vanishing point, since this pattern appears in many paintings. I then used my solution to this problem to create “three-dimensional” prisms which appear accurate in the context of the other objects in the painting.

I found the algorithm for the tile floor by studying the painting “Sun Table” by Salvador Dalí, which can be seen to the left alongside my recreation. I read several books about perspective and combined the information I gathered from them with my own knowledge of art in order to come up with a way to accurately make the tiles seem like they were getting farther away.

I implemented the pattern in two different ways: using a for-loop and using an array. Students can choose which method they prefer; however, the for-loop method is more basic and would likely be more useful to students in “From Paintings to Pixels”.

Using my findings from the tile floor problem, I developed a way to create rectangular prisms which are drawn accurately based on the painting’s vanishing point. The tile floor in perspective can be seen as a grid which prisms with faces parallel to the viewer should fall along. The prisms in the image below were created using for loops, with no three-dimensional rendering. Rather than writing a tutorial explaining the prisms, I created an interactive Processing sketch and uploaded it to my blog along with the code, and encouraged students to connect this problem with the information they learned from the tile floor tutorial.
Title of Project: The Effects of School-Based Mass Deworming on the Risk of Cestode and Protozoan Infections in Rural Ethiopia

Project Summary:

The World Health Assembly proposed a strategy of controlling soil-transmitted helminths (STH) through the usage of the cost-effective anthelmintics. These commonly available drugs would be mass distributed to high-risk groups. The Ethiopian Federal Ministry of Health practiced a mass school-based deworming program, in which a single-dose of albendazole was routinely administered to school-aged children biannually. Previously, studies demonstrated that the reduction of helminths from anthelmintic treatment might cause the host to be more susceptible to other gastrointestinal infections, such as protozoa or cestodes.

We aim to investigate the effects of mass deworming with albendazole on the risk of protozoa and cestode infections in school-aged children attending schools in rural Ethiopia.

A cross-sectional study was conducted in four rural schools in the North Western areas of Addis Ababa, Ethiopia. Social demographics, socioeconomic status, and behavioral factors were collected from participants using interview administered-questionnaires. Fecal samples were collected from 524 school-aged children and intestinal parasites were identified by using direct microscopy, Kato-Katz technique, and formol-ether concentration technique.

The prevalence of any protozoa infection or any cestode infection was 10.2% and 8.7%, respectively. Protozoa infection and cestode infection were both positively associated with biannual mass deworming program (AOR= 1.902, 95% CI: 0.760- 4.760; AOR= 2.076, 95% CI: 0.243-17.738, respectively).

The removal of STH may allow for other intestinal parasites to occupy the niche because there would no longer be a competition for resources and space with the STH.

Source of Support: □ AHUM Div. □ NASC Div. □ SOSC Div. □ UNST Div. □ Other (specify): Michael J. Wolk ’60 Heart Foundation
Faculty Mentor: Jason Meyers  Department(s): Biology; Neuroscience
Title of Project: Signaling Coordinating Sensory Cell Progenitor and Stem Cell Fate

Project Summary:

Neuromasts contain sensory hair cells which allow zebrafish to detect changes in water flow. Zebrafish can regenerate their sensory organs, including neuromasts, after damage. Other mammals, humans included, do not have this same regenerative capacity. Studying the mechanisms of regeneration is important for understanding human sensory organ regeneration and developing treatments for hearing loss and blindness. My research focused on gaining a better understanding of the outer-most layer of cells in the neuromast, the mantle cells. Mantle cells have been shown to have stem cell-like characteristics. I investigated how the mantle cells in the zebrafish neuromasts function in response to damage as well as during tail development.

Continuing the work of a past Colgate student, I was able to ablate entire neuromasts along the zebrafish side body and observe the effect using confocal microscopy. Three days post-ablation, the zebrafish had entirely regenerated the three ablated neuromasts (Figure 1). The roles of the interneuromast cells (located in between neuromasts) and of the leftover mantle cells during this process is unknown, so we attempted to use time-lapse confocal microscopy to visualize the regeneration of entire neuromasts after ablation. This particular experiment required more time to perfect than was available, so more research is needed to fully execute it. However, we were able to observe within the first 24 hours after ablation that interneuromast cells and mantle cells were actively moving. This suggests that mantle and interneuromast cells are responding to the neuromast damage, which could also suggest they are involved in regeneration.

![Figure 1: Regenerated neuromasts after fine needle ablation. Neuromasts of transgenic et20 fish (with mantle cells labeled) are suctioned off at 5dpf and allowed to regenerate for 3 days. Fish were imaged using confocal microscopy. White arrows indicate that all three ablated neuromasts regenerated.](image)

The second part of my summer research focused on tail development. Little is known about the development of neuromasts in the zebrafish tail, which begins to form around 7dpf and becomes fully formed around 21dpf. I imaged et20 transgenic fish during the two-week period of tail development to identify key time points for tail neuromast development. It was observed that between 7 and 10 days, the terminal neuromast in the posterior lateral line become active. It is still unclear if the terminal neuromasts are dividing and/or migrating to create the neuromasts for the tail. However, image at around 12dpf show interneuromast cells exist between newly developed neuromasts in the terminal cluster region, suggesting their lineage. If mantle cells are responsible for giving rise to these entirely new neuromasts, in addition to regenerating new neuromasts in the pLL, this would strongly support the classification of mantle cells as stem cells. More research is needed to further illuminate how these new neuromasts are forming and which specific cells in the terminal cluster are involved.

Title of Project: Analysis of Approach Behavior in Male Juvenile Zebra Finches (*Taeniopygia guttata*) During the Sensitive Period for Song Learning

Project Summary:

The zebra finch (*Taeniopygia guttata*) has been used in many studies as a strong model organism for neuroscience research involving areas such as vocal learning and circuit development. Zebra finches are songbirds that are a particularly comparable animal model because they demonstrate strong connections between social interaction and song learning capability. A number of parallels can be drawn between the development of the zebra finch song learning circuit and the development of the language learning circuit in humans. At the most basic level, both species contain analogous brain structures involved in these circuits. Sexual dimorphism of these brain structures (i.e. vastly diminished size of the robust nucleus of the arcopallium, a structure necessary for the song learning component of vocal output) allows for a comparison of vocal (male) and non-vocal (female) learners within the same species. From a behavioral standpoint, only males are of interest, since the females will not learn the song. Juvenile males are typically studied from 0-60 days post-hatching, a time frame commonly referred to as the sensitive period of song learning. During this time, male offspring will approach their fathers in order to learn the song. At around 30 days, the juvenile males begin to attempt to mimic their father’s song, creating a rudimentary version of the adult melody known as subsong. Subsong is generally equated to babbling in human babies. Throughout the sensitive period, juveniles will continue to approach and interact with their fathers as they improve their song. The sensitive period concludes with song crystallization at around 60 days post-hatching. At this time, the offspring are considered adults and can survive independently without parents.

In studying the connection between vocal learning and social interaction, it is useful to have a method to quantify both parameters. Software to quantify vocal output already exists, as well as data from various points throughout song development. However, a way to quantify the social interaction component has yet to be developed. Turning behavioral observations into statistical data would be an easy way to prove effects of different types of manipulation on social interaction or to compare effects of abnormal social interaction on vocalization. In this study, we used a novel experimental setup to track social interactions between subjects with reflective paint and a video camera (Fig. 1). Families were kept together in a standard cage size that was modified to optimize the background for recording by replacing the top with plexiglass. Each male was painted with a large dot on the top of its head using various UV paint colors to maximize color saturation and brightness in the video recordings. The video camera was set up with an external microphone to visualize and record the entire cage during recording period, using an SD card with sufficient memory to track birds for several hours. We also recording during the morning, which is the preferred time of day for singing, in order to naturally maximize social interactions. Video recordings were then analyzed frame-by-frame using a program in MATLAB (Fig. 2). Preliminary results indicate success using five paint colors for simultaneously tracking multiple interacting individuals than previous methods. Future research will involve data collection of father-son interactions during the sensitive period for song learning, as well as improvement of the protocol and MATLAB program for accessibility and reproducibility. This methodology will provide a simple and noninvasive way for researchers to quantify the effects of genetic and environmental manipulations on laboratory test subjects, particularly zebra finches.
Research Fellow: Revée Needham (2018)  Concentration(s): Environmental Studies; Geography
Faculty Mentor: Julie Dudrick  Department: Upstate Institute
Title of Project: Wastewater Treatment Survey and Radon Mapping

Project Summary:

Recently, homeowners of lakefront properties have been shifting their residence from seasonal to fulltime and renovating their homes to accommodate the upgrade. When a large renovation occurs, the septic system in place must be inspected and updated if deemed necessary. Traditional septic systems require a minimum size of suitable land to properly treat the water. With many lakefront homes, the parcel size is small and the proximity to the lake requires more advanced treatment to protect public health. Enhanced Treatment Units (ETUs) provide such additional treatment and can even reduce nitrogen levels, one factor that can lead to unsightly algae plaguing many Madison County lakes. While the additional treatment is excellent, these systems are more complicated and require additional maintenance. Therefore, my task for the summer was to see if homeowners are maintaining their systems as instructed by NY State Sanitary Code and the approved plans submitted to the county. Overall, this seeks to protect the health of those who live around lakes, their drinking water supplies, those who use lakes recreationally, and the environmental quality of the lakes.

My project consisted of researching ETUs, specifically aerobic units that surround lakes. I created an inventory with details on all of these units in the county and from that, developed a map using Geographic Information Systems (GIS). Additionally, I surveyed homeowners to ensure that they are being maintained and to see how the units are working. With this information, the county is better informed of the higher risk septic systems surrounding lakes. From the people that I spoke to, the majority are maintaining their systems with a current service contract. Further, I’ve been able to narrow down the companies who service these systems, another resource for the county to obtain maintenance records from.

In addition to the survey, I utilized GIS to update radon maps. Radon is a colorless gas caused from the decay of uranium in soils. The EPA estimates that radon is the second leading cause of lung cancer in the US behind smoking. Homeowners in the US are encouraged to test their homes, as radon can differ based on soils and structure type. Madison County is an especially high risk county and, as shown below, the spread of high radon is variable between towns. For example, in the town of Hamilton from 1987 to 2017, 47% of radon tested homes were above the EPA recommended limit of 4 picocuries/liter. With this information, and other maps I created, the county can assist towns to ensure homeowners are radon testing in high risk areas.

Project Summary:

This summer, I researched visual search tasks with an emphasis on how time of day can affect individual performance. In addition, I formed a basis of understanding of circadian rhythms and diurnal preference. “Visual Search” is a type of cognitive task which both requires focused attention and can be a measure of this attribute. Though there are a range of tasks that could be performed in this area, I focused on designing a feature/conjunction task that could be used for my senior thesis this fall. In addition, I developed a basis of understanding of circadian rhythms and diurnal preference. The addition information I studied this summer supports development of a senior thesis experiment by extending the field of study to incorporate how time of day can affect the individual.

Feature and conjunction search are subsets of the visual task experiment I helped to design, along with the guidance of Professor Albert. In feature search, the targets pop out of the field, no matter how many distractor items are present. This is because they vary in such a distinct way from the distractors. Conjunction search, on the other hand, requires the search of each item in the array until the participant either spots the target or sees that it’s not present. This slower search is due to the fact that conjunction targets have some similarities to their distractors, and thus do not pop out to the participant.

The visual search consisted of a “T” shape target in various orientations for all tasks. The distractor type changed to have both featured and conjunction trials. In the feature blocks, the distractors were straight lines that were with either horizontal or parallel. In the conjunction blocks, the distractors were an “L” shape in various organizations. Because the “T” shared a right-angle shape with the “L”, there was a shared element between those items, making it a conjunction task. Feature search, unlike conjunction, does not vary in search time as a function of the number of distractors (or additional items) in the field of search. In contrast, conjunction search has increasing response times as distractor numbers increase. This finding is based on the premise that conjunction targets share an element or feature with their distractors, and thus do not pop out easily. We had planned a pilot test of the task for the summer but were limited in time, and thus the task was only personally tested. However, the pilot testing was completed in the early weeks of coming back to school in the fall.

In addition to designing a visual search task, I measured the accuracy of Fitbits, Charge 2 models that are being used in the senior thesis study. Because we are looking at how time of day can affect attention, another important element is measuring how sleep duration affects attention. To measure the accuracy of Fitbits to measure sleep, we wore two Fitbits at a time for multiple weeks, comparing the heart rate and sleep stage data that was recorded. This had mixed results. On some days the data did not show the specific sleep stages that were collected on other days. Further evaluation of the Fitbit accuracy for sleep is continuing throughout the fall.

In summary, this summer was an exploration into a few different elements of my senior research project to create a strong foundation for the research design. We designed a visual search experiment to measure attention based on time of day. In addition to that, I review the literature on the relationship between time of day and Morning/Evening preference and its impact on cognitive and athletic performance. Finally, I evaluated the reliability of Fitbits with respect to measurement of sleep.

Source of Support:

- AHUM Div.
- NASC Div.
- SOSC Div.
- UNST Div.
- Other (specify):
Research Fellow(s): Emma Newmann (2018) 
Concentration: Environmental Geography

Jacob Wasserman (2018) 
Concentration: Geography

Faculty Mentor: Peter Scull 
Department: Geography

Title of Project: Landcover Change Dynamics Outside Church Forests in the Northern Ethiopian Highlands

Project Summary:

For the last several years, a team of professors and students at Colgate University and Bahar Dar University have studied the church forests in Ethiopia’s Northern Highlands. The overall goal of this research has been to understand whether or not the forests are being conserved, and which factors have an influence on that conservation. In order to holistically analyze the extent of conservation, the project consists of obtaining a combination of biological, geographical and social data from the forests and the communities that utilize them. The biological data comes from fieldwork directly within the forests. The geographic data comes from a mixture of old and new satellite images that can be compared via ArcGIS or similar mapping programs. Lastly, the social science data is collected via in-person interviews with individuals in each church forest community, known as a kebele. Our work was primarily within the geographical and social science aspects of the project, although we helped with the biological work for a substantial amount of time as well.

In terms of geographical work, we spent much of the summer mapping our research sites in the forests to make our future field work more efficient and to understand our progress more easily. We used GPS points taken from the field to map the locations of the forests and the locations of our long term monitoring plots to efficiently access them by road and/or trail. Since we have large data sets from several years and dozens of forests, we organized our measurements and show the history of data collection in each forest. We created diagrams of every tree in our research sites along with measurements of the trees’ diameters to easily see year-over-year change in the forests. The image on this page is an example of one of those maps. They will be printed and laminated for future hands-on use in the field.

Another component of our research was organizing social science surveys from the communities surrounding the Church Forests. By inputting handwritten surveys into a survey database, we can quantitatively and qualitatively analyze community responses to questions regarding forest preservation, religious involvement, and community life. This organization will hopefully lead to insights about perception of these issues from different demographics in the community.

When it was first acknowledged as a discrete curriculum over a century ago, civic education was considered synonymous with the Americanization process, which was aimed to help the new waves of immigrants assimilate into the American society and become good citizens. Civic education at that time was marked with the tone of great patriotism fostered through the two World Wars and early years of the Cold War (Quigley, 2001). Then the political turmoil of the sixties altered how civic education was taught, making it less about the comprehension of contemporary events but more about the memorization of formal structures of the federal government. However, regardless of the different ways that civic education has been interpreted and implemented in the classroom over the years, this process has always been responsive to the political situation of the time and has reflected “what types of citizens the state wanted to cultivate” (Parker, 2008, p.18).

As Cohen (2010) points out, there are several different fundamental conceptions of citizenship and “not holding a coherent conception of citizenship while engaging in the civic education process may be counterproductive” (p.18). While programs developed by many organizations and foundations have helped to encourage greater civic participation among students, they do not provide specific definitions for the political knowledge and civic virtues being transferred. Therefore, in order to move forward and effectively promote civic education, it is important to take a step back to analyze the knowledge and values that students are expected to obtain through learning civics.

This project aims to understand the concepts of citizenship that are either explicitly or implicitly endorsed in state standards. Due to limited time, I narrow the scope of the research to standards in D.C. and conduct a content analysis of the state guidelines for teaching social studies in grades 6-12. The theoretical framework is based on a number of contesting views regarding citizenship and democracy, such as liberal versus civic republican and liberal versus nationalistic.

One of the key themes that emerge from the analysis is an emphasis on the internalization of, and conformity to, given knowledge without critical examination. Four of the verbs that are used most frequently in the text to explain what students are supposed to do are “describe” (338 times), “explain” (300 times), “identify” (166 times) and “analyze” (134 times). Both “describe” and “identify” suggest the synthesizing of information but students are not expected to reflect or critically engage with the curriculum. Furthermore, even though students would need a certain level of understanding in order to “explain”, the very activity of explaining a notion could be a process of implicitly affirming its validity. Although there is room for critically thinking as students are also asked to analyze given information, that space is undeniably limited. Similarly, the activity of debating, which implies criticality and is considered crucial to a participatory democracy, is not included until grade 11 and appears 9 times.

In addition, the content of these activities is an important aspect to considered. Although students are asked to analyze several topics related to citizenship and democracy including the Constitution and the Bill of Rights, issues that affect minorities and underrepresented groups make up only a small portion, most of which are positioned as historical events rather than contemporary subjects.

It is worth noting that the standards only outline essential knowledge and skills students should acquire and teachers are encouraged to add and adjust activities and topics as they see fit. However, since teachers look to this framework for guidance, the language used in the text could influence teachers’ interpretations of which skill or knowledge is considered more important or relevant.

Title of Project: A Study of Nationalism in the French Indochina: An Ethno-Symbolist Approach

Project Summary:

During my time as a student of Vietnamese history, I find it peculiar how most scholarships on Vietnamese history either fail to define what constitutes the Vietnamese nation, or approach the topic of nationalism from a modernist angle without providing sufficient explanation for their choice. What is a nation? Once we have had a solid definition of the nation, how should one account for its rise?

About the first problem, in academia, the study of nationalism never has much agreement even from the most basic definitions. Charles Tilly once claimed that the ‘nation’ is among the most confusing concepts in political science, and to my mind, it is also the case in the field of history as well. There are only two propositions that almost all nationalist historians agree: nationalism is a modern phenomenon dating from the eighteenth century in Europe, and the European system of nation-states dates back to the Treaty of Westphalia in 1648 before spreading across the world through colonialism. Other than that, the issues of the nature, origin, and character of the nation are open to argument.

Regarding the second problem, the Western modernist model of nationalism tends strongly to make itself universal while it is particular as any other model. Therefore, it cannot be applied to other historical cases.

This research contributes by examining the model that is the most suitable for the case of the Vietnamese nation, and, after discovering ethno-symbolism as the fitting model, explains ways in which the present day Vietnamese nation is formed through ethno-symbolism.

Title of Project: Measuring Aspects of the Multilingual Web

Project Summary:

The Internet and web were originally designed by a largely English-speaking group of engineers. In recent years, with the continuing globalization, there has been a rapid increase in the need of multilingual web contents. Although capabilities were later added to support multilingual websites, there is currently little understanding of the nature or prevalence of mechanisms used to match a client's preferences in a web request with available content. When users browse the Internet, their web browsers send instructions to web servers that inform the servers of the languages in which the users prefer. The process of a web server receiving requests for content and returning content, ideally according to the preferences expressed in the request, is known as content negotiation. In order to understand the operational characteristics of web servers that provide multilingual content, we wrote a measurement tool that mimics the functions of a web browser. Using the tool, we sent requests to the 100,000 most popular websites (according to www.alexa.com) with different language preferences, collected their responses and analyzed the data. We hope that our findings will provide a better understanding of the technical landscape behind multilingual websites, and can suggest the potential for improving existing mechanisms and algorithms.

We used two types of tests on the language preferences in the request header. First, we had a group of requests that were sent from Hamilton, NY, without a VPN connection, and another group of requests that were sent from Switzerland and India by using VPN connections to masquerade our geolocation. The Accept-Language HTTP request header indicates a user's preferred language(s). By setting the Accept-Language headers to empty and the languages spoken in the country/region from which the request originates from, we were able to examine how the web servers respond to different users' language requests. For the non-VPN group, we sent requests with no specific language preference and with ten most popular languages spoken in 2016 to 100,000 websites respectively. One thing that needs to be noted here is that when requesting multiple languages, the preferences expressed were in reverse order of dominance in order to force the web servers to provide content in less-popular languages, if content is available. For time efficiency, a Python module called multiprocessing was used to parallelize the process of collecting measurements from a large numbers of websites.

From the data returned from the 100,000 web sites, we observed that English is the most dominant language used in Internet. Even in the experiment in which we intentionally set English as least-preferred, English was still the most returned language. For the experiment without language preference, the result is the same. For the group that runs with a VPN connection, the plots follow the same trend in general: with a large number of no specified language tag and English as the most dominant language. The only exception is that German is returned more than French in Switzerland, possibly because German is most widely-speaking language in Switzerland. During the process of analyzing data, we also noticed many instances of invalid language tags. The lack of a specific language tag, or erroneous language tags, makes it difficult to analyze factors that may influence content negotiation, and hinders users from getting content in their preferred languages.

As this research is still on-going, our future plan is to analyze additional indications of the use of languages in the web from the HTML file of a website, such as the "<meta>" tags, hreflangs and xml:lang attributes.
Title of Project: Field School Fellowship with the Horned Dorset Colony

Project Summary:

The Horned Dorset Colony is a non-profit interdisciplinary artist residency program in Leonardsville, NY. The program first began in 2012 and has successfully run for 5 seasons. The HDC’s mission is to support and sustain a community of exceptionally talented artists from different disciplines who wish to exchange ideas in a working environment and contribute to the larger community through cultural engagement. An important focus for the Horned Dorset Colony is the revitalization of the community of Leonardsville, a once thriving hamlet. This summer, I researched the potential uses of the vacant Leonardsville School Building, which the HDC sees as an excellent opportunity for community revitalization.

After the consolidation of the Bridgewater, West Winfield, and Leonardsville schools to form Mount Markham Central School in 1969, the Leonardsville School was used as an elementary school and then a daycare until it was closed altogether in 2011. Since then, the building has been maintained and kept for sale by the school district. The Horned Dorset Colony envisions the building as a mixed-use facility with the HDC being a primary tenant, using classrooms for studio and gallery space. The HDC sees this as major step toward bringing vitality back to the community, and believe that an art-based initiative would have a significant impact on this rural area. The HDC is committed to making this area a more vibrant place in which to live, work, and visit.

My summer research has consisted of collecting data about other area school buildings that have been repurposed, investigating funding sources, meeting with school representatives, town and county representatives, architectural consultants, potential partners, and area residents interested in the future of this property. The data I have collected will help the HDC in the early stages of planning and financial investigation moving forward.
Research Fellow: Allegra Padula (2019)  
Concentration: Molecular Biology

Faculty Mentor: Priscilla Van Wynsberghe  
Department: Biology

Title of Project: Exploring the Role of \textit{kin-20} in Regulating Developmental Phenotypes and MicroRNA Levels in \textit{C. elegans}

Project Summary:

\textit{Caenorhabditis elegans} is a model organism whose development through four larval stages and eventual adult stage is regulated by various genes. In order to better understand human biology and development, it is helpful to study \textit{C. elegans}, as nearly 40\% of the nematode’s genome is conserved in humans. The tiny worms can provide fascinating insight to gene expression, especially in an era where gene-editing techniques such as CRISPR are becoming more of a reality in recent news. This summer, a large part of my research involved microRNAs, which are small RNAs that post-transcriptionally regulate gene expression. In the heterochronic pathway of genes that are important for developmental timing, \textit{let-7} is a highly conserved gene required for proper vulva formation and adult fates, and it is even implicated in many human cancers. If development into an adult worm is impaired, certain lethal phenotypes such as dumpy (small and slow-moving), bursting, or bagging can occur. Our lab has studied LIN-42, a period protein homolog that regulates miRNAs and promotes proper development. This summer, I researched the impact of KIN-20, a \textit{Drosophila} period protein kinase homolog, on various developmental phenotypes and miRNA levels over time in \textit{C. elegans}.

\textit{Kin-20} is a gene important for developmental timing in \textit{C. elegans}. In order to determine whether \textit{kin-20} impacts \textit{let-7} transcription, I compared levels of seam cell fluorescence in wild-type (let-7::GFP) and \textit{kin-20} mutant (let-7::GFP x \textit{kin-20}) worms. Seam cells, which are present along the worm, are markers of proper development. In this experiment, with GFP fused to the \textit{let-7} promoter, the presence of green seam cell fluorescence indicates \textit{let-7} expression. Based on microscopy images, I found that let-7::GFP worms and let-7::GFP x \textit{kin-20} worms exhibit the same level of fluorescence. Next, in order to determine how \textit{kin-20} impacts various developmental phenotypes, I grew worms to the adult stage and observed their appearance using microscopy. Existing research suggests that \textit{kin-20} knockdown results in survival and no bursting phenotype (Banerjee 2005). In contrast, I found that a greater percentage of \textit{kin-20}(-/-) worms died. I also found that a greater percentage of \textit{kin-20}(-/-) worms exhibited oocyte asymmetry than did wild-type worms at young adult stages.

In addition to phenotypic analyses, I used qPCR (quantifiable polymerase chain reaction) to quantify miRNA levels in various samples of the worms at different developmental stages. I observed a \textasciitilde 2x reduction in \textit{let-7} levels between \textit{N2} and \textit{kin-20} worms throughout \textit{L3} and \textit{L4} stages, and young adult \textit{kin-20} worms contain a slightly greater quantity of \textit{let-7} compared to wild-type worms (p-value = 0.047). Next, in order to better understand miRNA processing, I used qPCR to measure pri/pre-miRNA and lin-41 levels and found that the levels of each do not vary at a statistically significant level across larval stages in wild-type and \textit{kin-20} worms. Finally, I used qPCR to quantify the amount of miR-58, a miRNA not involved in the heterochronic pathway. I can confidently conclude that \textit{kin-20} is not a global miRNA regulator; unlike LIN-42, \textit{kin-20} has no effect on miR-58 levels compared to wild-type. Going further, I will obtain qPCR data quantifying the GFP mRNA levels in the wild-type and \textit{let-7} mutant worms. I will also work to identify the place of \textit{kin-20} in the heterochronic pathway.

Overall, these results show that \textit{kin-20} is not a global miRNA regulator, but \textit{kin-20} knockdown has varying effects on \textit{let-7} levels depending on the timepoint. Based on seam cell fluorescence, \textit{kin-20} knockdown does not seem to have an effect on \textit{let-7} expression. Phenotypically, \textit{let-7} mutant worms treated with \textit{kin-20} RNAi have a greater percentage of bagging, lower percentage of dumpy worms, and overall, a higher percentage of dead worms. Given the conserved nature of \textit{let-7} and other genes, building upon these results provides insight to gene regulation in humans. Ultimately, these findings suggest that \textit{kin-20} has a place in the heterochronic pathway of developmental timing in \textit{C. elegans}, although that exact mechanistic place is yet to be determined.

Title of Project: Nonlinear Dynamics in Superconducting Networks

Project Summary:

In nature, there are many instances of coupled nonlinear differential equations governing the dynamics of the world around and inside of us. One may think of the weather and the brain as examples of these systems. As humans with conscious and curious thought, we are inclined to question our understanding of these systems, and often we wish to recreate or simulate these systems in the hopes that we might be able to predict, control, or produce synthetic equivalents of such systems. In this paper and in my research, I focus on the coupled nonlinear dynamics of Josephson junctions as superconducting circuit elements.

In the 1960s, Brian Josephson suggested the possibility of quantum tunneling in a superconducting circuit element, which would later become known as a Josephson junction exhibiting the Josephson effect. Josephson believed that two superconducting materials separated by a thin oxide could sustain a current and potential across the oxide. Furthermore, Josephson proposed that the voltage and current across these junctions were dependent not on one another but by the phase difference of the electrons in each electrode. In the diagram below, a Josephson junction is depicted with their corresponding phases.

\[ \psi_1 = A_1 e^{i\theta_1} \]

\[ \psi_2 = A_2 e^{i\theta_2} \]

Using the phase difference across the electrodes, \( \phi = \theta_2 - \theta_1 \), and the phase difference of junctions in parallel, \( \Phi = \phi_2 - \phi_1 \) Josephson proposed the following equations to describe the current, \( I \), and voltage, \( V \).

\[ I = I_c \sin \Phi \]  
(1)

\[ V = \frac{\hbar}{2e} \frac{d\Phi}{dt} \]  
(2)

\( I \) in Equation (1) represents the critical current, below which a Josephson junction can sustain a current with zero resistance. Above this critical current however, a Josephson junction behaves like a Josephson junction, resistor, and capacitor in parallel. Thus, current across a junction would take the following form:

\[ I_{tot} = I_c \sin \Phi + \frac{\hbar C}{2e} \frac{d^2\Phi}{dt^2} + \frac{\hbar}{2eR} \frac{d\Phi}{dt} \]  
(3)

Equation (3), however, does not account for the phases of neighbors in a ladder array of Josephson junctions. The some of the phases in a loop must be an integer multiple of the flux through that loop; therefore, the solutions to Equation (3) are restricted in accordance with the following equations:

\[ N(\phi_j) = \frac{\lambda}{\hbar} (\phi_j - \phi_{j+1} + \phi_j^b + 2\pi f) \]  
(4)

\[ N(\phi_j^b) = \lambda \left\{ \phi_{j+1}^b - 2\phi_j^b + \phi_{j-1}^b + \phi_j^b + \phi_{j-1} - \phi_j^b + \phi_{j-1}^b \right\} - i_{ext} \]  
(5)

\[ N(\phi_j^v) = -\frac{\lambda}{\hbar} (\phi_j^v - \phi_{j+1}^v + \phi_j^v + 2\pi f). \]  
(6)

From here, we arrive at the coupled nonlinear differential equations, which must be simultaneously solved to describe the dynamics of Josephson junctions in a ladder.

I then used a dynamic-step solver to integrate the seventy coupled, nonlinear, differential equations over a 101-step current ramp with a 500-normalized time unit integration duration for each step. The current was ramp was designed to mimic an experiment in which we believed vortices collided with breathers. A vortex is a moving magnetic flux along a ladder array of Josephson junctions, and a breather is a state where one or more junctions stay in the voltage state, storing energy. One can thinking of a long swing set, where a vortex is when one swing whirls all the way around and then its neighbor to one side whirls and so on, and a breather is one swing whirling on its own. A breather-vortex collision has never been observed, so I have been simulating the experimental conditions under theoretical considerations to determine if we have observed and interaction and how he can replicate such interactions. We have seen a strong correlation with our theoretical data and experimental data, but going forward, we will incorporate thermal noise in our simulations.

Title of Project: Chemistry of Garnet in the Lewis Wollastonite Deposit

Project Summary:

The research project was based on garnet samples obtained from the Lewis Wollastonite mine in the Adirondack Mountains. The wollastonite in the Adirondacks is found in skarns that formed in-between a silicate-rich anorthosite intrusion and the surrounding rock which contains calcite. When the fluids from the anorthosite intrusion and the calcite in the surrounding rock came into contact, a chemical reaction that produced wollastonite occurred (\( \text{SiO}_2 + \text{CaCO}_3 \rightarrow \text{CaSiO}_3 + \text{CO}_2 \)). Thus, the skarns in the Willsboro-Lewis mining district contains approximately 6 million short tons of wollastonite ore. Since wollastonite is a mineral that forms at high temperatures (700-1000 degrees Celsius), other minerals that form at similar temperatures, such as garnet and pyroxene, are commonly found with wollastonite. In my research project, I focused on the chemistry of garnets found along with the wollastonite in the Lewis Mine.

At the Lewis mine I examined core samples, which were drilled by the mining company. These cores have alternating layers of anorthosite, garnet and wollastonite. I collected garnet-rich rocks which are red and brownish-orange in order to analyze their chemical contents. Back at Colgate University, I photographed these rocks and labeled them. I crushed them to a pea-sized fraction with a rock hammer and then separated specific pieces of the rock that were garnet-rich. Then, I used a shatter box to crush the sample in order to create a powder. Approximately three grams of powder was weighed and subsequently heated in a furnace at 950 degrees Celsius in porcelain crucibles. When cooled, each individual sample was weighed again to calculate the loss of ignition. Afterwards, I mixed lithium tetraborate with the various garnet powders. This mixture was placed in the three-sample Claisse Fluxy fluxer machine which heated the mixture using a torch to create glass disks. These glass disks were placed into the Philips PW2404 X-Ray Fluorescence Spectrometer for X-Ray florescence analysis.

The X-Ray florescence analysis data was then collected for a total of fifteen individual samples. The \( \text{SiO}_2 \) content ranges from 35.86% to 39.95% with an average value of 37.93%. The \( \text{TiO}_2 \) content ranges from 0.04% to 1.12% with an average value of 0.63%. The \( \text{Al}_2\text{O}_3 \) content ranges from 0.75% to 18.27% with an average value of 13.15%. The Fe\( _2\text{O}_3 \) content ranges from 7.24% to 29.76% with an average value of 13.37%. The MnO content ranges from 0.05% to 0.30% with an average value of 0.22%. The MgO content ranges from 0.05% to 0.30% with an average value of 0.30%. The CaO content ranges from 33.44% to 35.12% with an average value of 34.10%. The Na\( _2\text{O} \) content ranges from below detection to 0.22% with an average value of 0.02%. The K\( _2\text{O} \) content ranges from below detection to 0.05% with an average value of 0.01%. The P\( _2\text{O}_5 \) content ranges from 0.01% to 0.67% with an average value of 0.23%. The values for LOI range from 0.15% to 0.57% with an average value of 0.38%.

The chemical analysis of these various garnet samples allowed me to identify the types of garnets I had collected around the Lewis Mine. Eleven out of the fifteen samples are grossular garnets, which are rich in aluminum. The other four garnets are rich in iron and are andradite garnets. Some of the garnets have compositions intermediate to both andradite and grossular garnets. Two of the grossular garnets are slightly andradite-rich and one of the andradite garnets is slightly grossular-rich.
Title of Project: Behavioral Measure of the Role of Feature Spaces in Scene Categorization

Project Summary:

This summer, I assisted in collecting and processing data for two projects stemming from the research question, “How does the brain process and categorize visual sensory information?” Humans rely heavily on categorization to facilitate the rapid comprehension that we experience when we see a novel scene or image. The mechanisms underlying the categorization process, and the relative importance or utility of each mechanism, are unclear. For example, we do not know the extent to which different visual characteristics of a scene affect our understanding of the scene. Current research suggests that in addition to characteristics such as a scene’s contrast levels and spatial frequencies, the objects present and the functions an observer may be able to perform in the scene also play a role in the categorization process (Green et al., 2016). The overarching goal of this summer’s research was to work toward clarifying our understanding of scene categorization’s role in visual perception. The first project examined the relationship between a person’s ability to categorize scenes and the number of scene categories the person has to choose from. The second project was a pilot experiment using transcranial alternating current stimulation (tACS) to discern a possible causal relationship between scene categorization behavior and specific neural populations.

The first few weeks were spent building programs using MatLab software that were able to process EEG data collected with NetStation. These programs were then used to process EEG data collected previously in an experiment that asked participants to categorize six different categories of images. After processing the raw data, I used a neural decoder to compute differences in the event-related potentials (ERPs) produced by each individual scene category. To draw meaning from the plotted ERPs, I looked at the following characteristics of the data: when the predictor accuracy peaked in relation to stimulus onset and where the electrodes reporting the highest accuracies were positioned. By looking at when the accuracy peaks in these plotted ERPs, we can make inferences as to when the information being analyzed by the decoder is being processed by the brain because a higher accuracy implies a higher signal-to-noise ratio. By looking at which electrodes, or where on the scalp, the decoder most accurately predicts the category represented in the EEG data, we can make inferences about how the brain processes the information shown to participants in the experiment. In this data set, the electrodes located over the occipital lobe reported higher accuracies than most other scalp locations. We compared the accuracies at several scalp locations computed for the six category experiment to the accuracies computed for a similar thirty category experiment and found that reducing the number of categories presented slightly improved the accuracy of the neural decoder.

Finding that the accuracies in the thirty category experiment did not differ sharply from the six category experiment indicated that using a smaller number of categories in further research would not have a significant impact on the results. We prepared a protocol for another scene decoding experiment that differed slightly from previous work in two ways: first, this experiment had the potential to provide evidence of causal relationships, rather than only correlational relationships; second, it piloted the use of tACS rather than transcranial direct current stimulation as an experimental condition for scene decoding experiments. We used four categories of scenes and four categories of objects, even though this small number is not representative of the nearly infinite number of possible scenes and objects a person could encounter, because of the comparative results described previously. The experiment focused on a brain region called the transverse occipital sulcus (TOS), which has been shown to play a role in categorizing scenes (Ganaden et al., 2012). By using tACS to stimulate the TOS (as functionally defined by using ERPs measured during a scene categorization task), it is theoretically possible to influence categorization behavior and performance by stimulating the region of the brain used in this behavior. In practice, no effects of tACS have been found in the small number of participants tested.

Project Summary:

Some of the most distant sources of light in the universe are a category of objects called quasi-stellar radio sources, contracted to “quasar” for convenience. These objects are actually the cores of faraway active galaxies, outshining the rest of the galaxy entirely – a supermassive black hole at the center of the galaxy accretes a disc of gas and a jet of ionized matter along the rotation axis, both of which accelerate particles and emit radiation across the entire electromagnetic spectrum. A specific kind of quasar, known as a blazar, is one which has a jet directed toward Earth causing intense fluctuations in luminosity in all wavelengths. These objects have been studied since the mid-1900’s and have been studied at Colgate’s Foggy Bottom Observatory since 1989. Since then, we have been compiling data about 15-20 of these objects and studying how their brightness changes with time. One of these objects, OJ 287, has been the subject of our work this past summer.

OJ 287 is a BL Lacertate object located 3.5 billion light years away. This category of object is known to be highly variable on hourly, monthly, and yearly scales, and part of our job is to understand these fluctuations. OJ 287 is a unique object in that there seems to be an 11.65-year period between huge outbursts, leading to it being modeled as a binary black hole system with the smaller black hole “punching through” the accretion disk every 11.65 years causing an outburst. Without multi-decade graphs, these kinds of trends cannot be predicted or studied in any sort of depth. Part of our research this summer was to make and edit graphs over decade-long timescales. We looked at images and data taken by Professor Balonek and past summer students between 1988-2017 for unusable images and data points. Images that are edited out often are chosen because of clouds or fog in the image covering the objects, a bright Moon nearby, or errors in the instrumentation such as the telescope not tracking the movement of the sky properly, resulting in the objects to all be doubled in the field of view. Taking these bad data points out, we can view a much more accurate picture of how OJ 287 changes with time, seen in the graph below.

Observations of this object will continue through the school year and into next summer.

The thirty-year light curve of the blazar OJ287 as observed at the Colgate Observatory.
Research Fellow: Annina “Anna” Pluff (2020)  
Concentration: History

Faculty Mentor: Barry Shain  
Department: Political Science

Title of Project: Researching Revolutionary-era American Pamphlet Literature in Context: A Documentary History

Project Summary:

The goal of this research was to contest the accepted historiography of the American Revolution in using the most widely published and distributed pamphlets to show that the American colonists were indeed opposing Parliament’s constitutional claims, but were not overtly advancing a democratic political theory as is often claimed. The pamphlets were meant to show that the colonists as a whole hoped to remain under the British Empire in the form of a limited constitutional monarchy.

The project focused on the drafting of 70-80 headnotes that are to precede the pamphlets that Professor Shain intends to publish in his book. The project required researching the authors of the pamphlets and uncovering the historical context in which the pamphlets were written. Publication information had to be sourced as well in order to represent the number of reprints that each pamphlet potentially went through. Some of the pamphlet headnotes had been worked on in previous summers, others had not. Extensive editing was required of the previously authored headnotes as well as further research in order to enrich the historical context. Organization of the headnotes was then required in order to arrange them not only in a chronological order, but also taking into account levels of completeness. The second element of the project focused on working with the pamphlets themselves. This required further organization and analysis of the pamphlets. Rearrangements in levels of completeness were conducted once more in order to assess which pamphlets needed to be rewritten in a modern font to aid the reader in reading the book.

If the evidence analyzed in the pamphlets can adequately support the research based on the sentiments of the most widely distributed pamphlets, then the accepted historiography may be potentially overturned.

This summer I was paired with the iServe Mohawk Valley program at Mohawk Valley Community College in Rome, NY to work on two of their initiatives targeting hunger and food insecurity. I was tasked with developing evaluative tools for their campus food pantry and establishing a community garden.

The iServe Mohawk Valley program is funded through a New York State Volunteer Generation grant and focuses on hunger and food insecurity because Rome has a higher poverty rate than the national, New York state, and Oneida County averages. The “Campus Cupboard” student food pantry was established to meet the demonstrated need among MVCC Rome students, 74% of which are from families with incomes falling within 185% of the federal poverty rate. This is an important statistic because having a family income within this threshold qualifies individuals to receive food from food pantries and soup kitchens. MVCC also found that many low-income students were forced to choose between paying for transportation to get to school and paying for food. The Campus Cupboard was created to provide healthy food for those individuals to make their education more accessible.

My project with the Campus Cupboard was to analyze the client intake forms to discover more information about who exactly was utilizing this resource on campus, and to develop a survey to be distributed during the semester. The survey will help MVCC to gain better insight into how these clients are utilizing the pantry and the ways that the pantry can be improved going forward. In my analysis of the intake forms, I found that 85% of the Campus Cupboard clients are full-time students, 50% are not currently employed, and 30% already receive SNAP benefits. These numbers will not only help determine which types of items are provided at the pantry but will also help iServe staff refer their clients to other available resources. The most surprising result from this analysis was discovering that the majority of Campus Cupboard clients (75%) were female. This vast gap between utilization of this resource by gender is not explained by the gender distributions of the student body as a whole and is a potential avenue for future study.

In addition to my work with the Campus Cupboard, I also helped the iServe program establish a community garden on the MVCC Rome campus. The garden project was designed for multiple purposes. The first is to serve as a space where different campus groups can volunteer to maintain the garden and learn more about the process of growing their own food. This summer the garden was also a host location for high school students from the Oneida County Summer Youth Employment Program. This program provides low-income Oneida County teenagers with the opportunity for three-weeks of work by matching them with various organizations in the county. The students matched with the garden project participated in the set-up and daily maintenance of the garden and learned about plant biology, landscape design, and the U.S. food system in a classroom setting.

The second purpose of the community garden is to provide fresh, healthy, and organic produce to the Campus Cupboard and elevate their clients’ access to nutritious food. Every initiative of the iServe Mohawk Valley program, including my projects from this past summer, is designed with the needs of the MVCC community and the surrounding Rome area in mind.
Title of Project: ISIS The Perfect Proxy

Project Summary:

If the cartoon image at the bottom of this summary resonates with you, you're not alone. Political cartoons like this are examples of what the world imagines when the term “proxy war” is used. Recently, the Syrian Conflict escalated from a Civil War to a bloodied interstate war that included many countries and ISIS. Much of the reporting and literature about the conflict uses the term “proxy war”. However, most of the platforms seemed to use “proxy war” slightly different when offering their interpretation of the conflict. This prompted my student-research questions; is Syria a proxy war?

The question, is Syria a proxy war, is a loaded one with the potential for many answers and interpretations. Some may oversimplify by answering yes or no. Others dive deep into the crevices of the war. Respecting both of these routes, I decided on a different path. My qualifications for attempting to answer this question fall short of the many political scientists ahead of me. However, combining my two majors at Colgate, English and Political Science, I was able to road map a different look into proxy wars that could answer my initial research question.

The common interpretation of “proxy wars” stems from the Cold War definition that dates back to the end of World War II. At that time, the world saw the rise of two great powers, the United States and the Soviet Union, and every political action they took had a trickle-down effect for the rest of the world. The Cold War has its name because of the fact that no actual fighting broke out between the US and USSR; none-the-less, this time was dominated by violent wars all over the world. A metaphor commonly used to explain this phenomenon is imagining the US and USSR as puppeteers, weaving and manipulating other countries armies like puppets to settle their dispute. Is the Syrian Conflict this? In short, no. The Syrian Conflict is much more complicated; it doesn’t fit the Cold War definition. This lead to researching potential proxy wars that predate 1945, a new definition of proxy war, and potentially considering the Syrian Conflict as a new conflict.

I found that the definition of “proxy war” has changed significantly since the end of 1991. The term first popped up in 1918, so that means that the definition rendered by the Cold War was an adaptation of the times. Now, in 2017, there is much more literature in defining proxy warfare; “the indirect engagement by third parties wishing to influence its strategic outcome.” (Andrew Mumford) This current definition of “proxy war” still didn’t adequately define the conflict in Syria. The biggest trend I found while studying the definitions was that the authors and scholars made modifications to their writing to fit what they interpreted; kind of how the news reporting of the conflict threw around the term proxy war freely. Upon this realization, I shifted my focus on what is Syria’s modification to proxy war; what tweaks needed to be made to the definition in order to properly use the term? My focus landed on the entity that complicated Syria the most- ISIS.

ISIS is not a proxy being funded by an external state in order to strategically change the outcome of Syria. ISIS isn’t on anyone’s side of this proxy war. ISIS has its own agenda, funding, and motives. However, I believe they are a proxy and that the Syrian Conflict is a proxy war. My research leads me to the idea of analyzing and conceptualizing “proxy agents” differently. ISIS’s presence in Syria is voluntary, but the role they play is much more complex in the game of proxy war. In my research, I turned to how the rhetoric of foreign policy of great powers is tailored to use organizations like ISIS to carry out politics. This new scope allowed me to consider ISIS as the perfect proxy for the world.

“ISIS needs the West to fulfill its apocalyptic prophecy in the Middle East; a final showdown between the Western world and ISIS’s vision of the Islamic world that would end all time. ISIS sought to attract the attention of Western leaders and did so in a way that validated their pseudo-success. As ISIS gained legitimacy, territory, and the fear of millions in the West, it failed to realize who was the cat and who was the mouse in this game of bait in the Middle East. Aside from the many horrific things ISIS has done, ISIS’s greatest disservice to the region was becoming the perfect proxy agent to the great power of the world. ISIS wanted the West, in-turn, the West dwarfed ISIS into the welcome mat to engage in Middle Eastern wars and diplomacy.”


125
My research was concerned with the molecular biology of the model organism *C. elegans*. *C. elegans* is a species of primarily hermaphroditic nematode (roundworm) that when fully grown are about a millimeter in length. These worms serve as an excellent model organism for biology research—they have a fully sequenced genome, the fates of each of their 959 cells are known, and they have sequence homology with other eukaryotes. Additionally, their fast generation time make them excellent animals to raise in a lab. I was tasked with determining the role of the gene *kin*-20, a period protein kinase homolog, in the heterochronic pathway, a series of genes that interact to regulate how and when the worm develops throughout its life. Specifically, I attempted to determine if and how *kin*-20 affects expression of known heterochronic genes, and how it affects the development of structures like alae and seam cells, which serve as markers of *C. elegans* aging.

Heterochronic genes are largely regulated via microRNAs, a type of post-transcriptional gene regulation that involves the synthesis of a very short RNA molecule. microRNAs are synthesized in three steps. They start as primary (pri) miRNAs, are processed into precursor (pre) miRNAs, and are further processed into mature miRNAs. Heterochronic genes are heavily involved in the life cycle of *C. elegans*, which is comprised of four larval stages (L1,L2,L3,L4), and the adult, with each stage ending in a molt of the cuticle.

Using brightfield microscopy, I analyzed the alae of wild-type and *kin*-20 mutant worms. Alae are a set of three parallel ridges that run the length of the worm’s body, and normally are only present in I.1, dauer larvae, and adults. There were no differences in the timing of alae development or the appearance of alae between the wild-type and *kin*-20 mutant worms.

Using fluorescent microscopy, I analyzed seam cell fusion over the course of development. Seam cells secrete the cuticle, including alae. There are sixteen seam cells that run the length of the body, but they divide and fuse over the course of development, and thus the number of nuclei among different timepoints is variable. The results of this experiment were inconclusive, but other studies predict a decreased number of seam cell nuclei in late L4 worms.

Additionally, I analyzed how knockdown of *kin*-20 expression would affect the formation of alae in worms mutant for the period protein homolog *lin*-42. *lin*-42 mutants exhibit a precocious alae phenotype, often paired with some kind of structural abnormality. *kin*-20 knockdown increased the frequency of precocious, abnormal alae in *lin*-42 mutant L4 worms. *kin*-20 knockdown also decreased the frequency of abnormal alae in *lin*-42 mutant young adult worms. Further experimentation is needed to determine the cause of these results.

By growing worms to a desired timepoint, extracting RNA, synthesizing cDNA, and performing qPCR, I was able to biochemically determine the effects of *kin*-20 on known heterochronic genes. *kin*-20 mutants had lower levels of *let*-7 expression, indicating *kin*-20 as a positive regulator of *let*-7. *kin*-20 mutants had higher levels of pri-*let*-7, pre-*let*-7 and *lin*-41 during the L3-L4 transition, indicating that *kin*-20 is a negative regulator of *lin*-41. *kin*-20 mutants had lower levels of *lin*-4 expression, indicating that *kin*-20 is a positive regulator of *lin*-4.

Moving forward, I would like to further determine *kin*-20’s relationship with *lin*-4 by analyzing levels of pri and pre miRNA for *lin*-4, repeat the *lin*-42 alae phenotype experiment to better determine how *kin*-20 interacts with *lin*-42, and continue the seam cell analysis experiment to determine *kin*-20’s effect on seam cell division/fusion.
In 1993, South African President F.W. de Klerk confirmed decades of speculation on behalf of the international community by admitting that South Africa had developed, and since completely dismantled, fully functional nuclear weapons. Although many have studied South Africa’s successful and responsible denuclearization as a paradigm to be replicated around the world, there is a noticeable gap in literature regarding South Africa’s decision to proliferate in the first place. My research examines the unique South African political and diplomatic landscape to determine why states choose to proliferate. This question has important ramifications in understanding why nations, particularly small nations, choose to proliferate and how their pursuit of nuclear arms can be curbed in the future.

In this piece, I argue that South Africa developed their nuclear weapons as a matter of domestic consolidation, as they believed that nuclear capabilities would quell internal dissent and coerce Western powers to come to their aid in times of crisis. I tested two hypotheses in addition to the one previously listed in order to fully investigate all possible reason why states might proliferate. The second hypothesis states that a small nation will pursue nuclear weapons in the face of ostracization from the international community because the benefits of national security and prestige outweigh the drawbacks of further isolation. The third and final hypothesis states that a small nation will pursue nuclear weapons in the face of intense domestic opposition, volatility, and rebellion as a way of suppressing dissent and consolidating the power of the ruling regime. I conducted this research by travelling to South Africa and visiting archives, nuclear power plants, and interviewing various experts in the field.

After examination of the evidence supporting and opposing each hypothesis, I concluded that each of these factors cumulatively played a role in South Africa’s decision to pursue nuclear weapons. Although my original hypothesis holds merit in its own right, it becomes much stronger when viewed in the context of external threats and international isolation that South Africa faced simultaneously. These findings could have worldwide implications, as small nations like North Korea continue to develop nuclear weapons in pursuit of their national interests. If applied correctly, this research would stress the need for a broad, intersectional view in dealing with small nations considering acquisition of nuclear arms.

Research Fellow(s): Caio Rodrigues Faria Brighenti (2020)  
Juan Saenz (2020)  
Emily Weaver (2020)  

Concentration: PCON  
Concentration: Music  
Concentration: Undeclared  

Faculty Mentor: Karen Harpp  
Department: Geology  

Title of Project: Virtual Galapagos Project  

Project Summary:  
This summer was the pilot phase of a long-term project in which our primary objective is to design a way for children around the globe to learn about science while using the Galapagos Islands as motivation. Most informal science resources are limited in several key ways: a) they assume students do not have much capacity for sophisticated scientific thought, stopping at minimal basics (consider many science documentaries for example); b) students have little agency about the intellectual paths they follow exploring topics, with linear trajectories through the topics (again, the documentary model is typical); c) most informal science resources focus on one scientific discipline at a time, in isolation; and d) most outreach materials convey the message that we have the “answer” to scientific questions, leaving little room to inspire students to pursue careers in science.  

In an effort to combat these challenges in informal science education, we designed a Virtual Reality (VR) experience to immerse students in science, in the context of the Galapagos Islands. For the pilot, we chose two interlocking pathways that link biology (divergence of the marine and land iguanas) and geology (the life cycle of a volcano). For each pathway, we have designed interactive activities that allow the user to feel as if they are actually in the space they are learning about as they move through the content. These activities, along with the narrator, guide the user through the scientific method systematically. The students make observations, develop hypotheses, and come to conclusions based on what they see in the virtual world. To encourage the students to more sophisticated levels, we have also produced animated whiteboard explanations that can also link to interviews with scientists active today in the Galapagos, who are discussing their cutting-edge research, should the student decide they want to learn more.  

We spent a week in the Galapagos to acquire images and video footage to supplement the material being created at Colgate. While there, we collected 168 segments of 360° footage to use in VR (including an hour of underwater footage); over six thousand still pictures, and hours of interviews and soundbites from important members of the Galapagos scientific community. These assets are being integrated into the virtual space, along with multiple 3D models, the whiteboard animations, and guiding narrative, as we have been developing our proof of concept pilot from scratch. Currently, we have an alpha of the proof of concept in the form of an executable.  

Over the course of the next semester, we will prepare the pilot for testing on a variety of student age ranges. This project was funded through a grant from the Office of Science and Society at McGill University, as well as contributions from NASC and the Geology Department of Colgate University.

☑ Other (specify): Bob Linsley/James McLelland Fund; Hackett-Rathmell 1968 Memorial Fund; Norma Vergo Prize
Research Fellow: Renee Roundy (2019)
Faculty Mentor: John Palmer
Department: Educational Studies
Concentration: Educational Studies

Title of Project: Black Women in Introductory Chemistry: Course Environment's Involvement in Decreasing Interest in STEM Fields

Project Summary:
This summer I conducted research entitled “Black Women in Introductory Chemistry: Course Environment’s Involvement in Decreasing Interest in STEM Fields”. This was qualitative research conducted through a series of interviews that began my first semester of this past academic year- my second year at Colgate University. While the original goal of the study was to include a more broad range of women of color who had taken at least General Chemistry 101, the participant response was majority Black women and I therefore edited the research to accommodate that. Factors that I had previously found to impact women of color in STEM (Science, Technology, Engineering, and Mathematics) included unwelcoming environments, lack of support (Joseph, 2012), and overall acculturative stress (Thompson, Anderson, & Bakeman 2000)- being in spaces that do not support women of color, for example predominantly white institutions such as Colgate University. These findings created a foundation for the interviews. What I found was that all of the participants validated these findings to various degrees and that there are active ways that Colgate University could alleviate these factors that inhibit Black women specifically, but overall women of color’s success in STEM at Colgate. I found that displaying grade distribution after tests and quizzes were not a catalyst for students to work harder as professors often think, but rather work as the opposite- contributing to stereotype threat (Steele, 1997)- validating students feelings of inadequacy based on social constructs of who is more capable of success. With the help of all of the participants contributions I learned that were the resources at Colgate such as Minority Association of Premedical Students (MAPS), the NASC Liaison Group, Center for Learning, Teaching, and Research (CLTR), and others to work more cohesively students may have the support necessary to work through being in majority white, male spaces and succeed despite the odds set against them.

Data Findings:
Throughout the interviews, students expanded on how they would compare grades with peers—this was more specific to the General Chemistry course, though competition is a well-known part of the Colgate environment. I found that students that were more successful, or had more positive perspectives of General Chemistry, had made an effort to ignore displays of grade distribution or refuse to talk about their grades with other students. These efforts were made difficult by professors often writing test grade distributions on the board or posting them as an unavoidable link on Moodle. For a lot of students the environment of the classroom makes attempting to avoid competition nearly impossible. This was in relation to the rhetoric of General Chemistry being a “weed-out course.” Olivia referenced this rhetoric, “why do people need to be weeded out… It’s also just the idea of how is it that success is made to be something that is not supposed to be able to happen for everyone-- when it would be great if we just all understood Chemistry!” In the context of the interview it seems as if “it is not supposed to be able to happen for everyone” is in reference to women of color, or more specifically black women.

Another theme amongst participants was a general feeling of a lack of student support, especially for women of color. While some students knew about Colgate University’s NASC Liaison Group and others found oasis in the student community of MAPS, a majority of the participants recommended ways General Chemistry could be improved. Students often brought up the ways they felt unprepared based on educational experience, sometimes feeling like professors were not approachable or accessible.

Moving Forward:
In the end of my research I proposed both a long term and a short term solution. A short term solution was based on Cheyenne’s interview who made it clear that all the resources were available at Colgate for women of color to be successful, but also clarified that the various organizations like the NASC Liaison Group, MAPS, and the CLTR do not work together. Something feasible in the short term would be a session for underrepresented first years pursuing STEM during orientation to present them with the various resources available to support them in their success. This would involve representatives/ members of the previously listed groups, as well as juniors and seniors who have gone through General Chemistry to give recommendations for ways to, as Jacqueline said, “Be visible in the classroom.” Students would strongly benefit from knowing they have faculty, staff, and student support and that they are seen. I believe that this is feasible and Colgate University has the ability to more strongly support their students of color, and especially women of color. The long term goal would be replicating University of California at Los Angeles’ PEERS program, or Program for Excellence in Education and Research in the Sciences. Other (specify): Walter Broughton ’63 Research Fund

References
Title of Project: Effects of Antidepressants on Nitric Oxide Production by Microglia and Astrocytes

Project Summary:

Microglia and astrocytes are two types of glial cells in the brain, both of which have neuroprotective roles. Microglia act as the macrophages of the brain by engulfing debris, whereas astrocytes make up the blood-brain barrier, protecting the brain from unwanted infiltration. These cells can be activated by inflammatory stimuli, causing the cells to release nitric oxide (NO), a free radical that damages surrounding cells. Treatment with lipopolysaccharide (LPS) increases the transcription of inducible nitric oxide synthase (iNOS), leading to higher levels of proinflammatory NO• molecules. These activated microglia and proinflammatory stimuli are correlated with periods of depression in Major Depressive Disorders (MDD).

Fluoxetine (FLX), Desipramine (DES), Imipramine (IMI) and Nortriptyline (NOR) are antidepressants that act at synapses to block the reuptake of serotonin or norepinephrine in the presynaptic terminals to increase its availability in the synaptic area. This increase availability prolongs the time of interaction between neurotransmitter and its receptors on the postsynaptic neuronal membrane. In addition, these drugs have been shown to have anti-inflammatory effects.

The inflammatory response, release of nitrite, was measured using primary mixed glial cultures (containing astrocytes and microglia), purified microglia, and a microglial cell line (BV2) treated with LPS. For BV2 cells and purified microglia, the addition of the antidepressants reduced the release of nitrite induced by LPS over a range of concentrations. The BV2 cells treated with 20µM FLX and DES were inhibited by 20% (at higher concentrations of LPS) to 100% (at lowest concentrations of LPS). 20µM NOR produced between 25-50% inhibition of nitrite release. Purified microglia were treated with LPS with or without the antidepressants. Once again, FLX, DES and NOR all inhibited the release of nitrite induced by LPS from 30% to 90%. In contrast, the mixed glial cultures containing astrocytes and microglia had an augmented release of nitrite when treated with the antidepressants and LPS. The increase ranged from 20-40% for FLX, DEX, NOR and IMI.

Purified astrocytes populations were obtained by addition of cytosine arabinoside (AraC) to inhibit the proliferation of microglia and subsequently treated with L-leucine methyl ester (LME) to eliminate any remaining microglia. The reduction of microglia by AraC and LME resulted in no detectable nitrite release when the astrocytes were treated with LPS.

Therefore, the cultured astrocytes are not producing NO themselves but rather are signaling to the microglia for the increased inflammatory response. Overall, our research indicates that antidepressants reduce the inflammatory response of microglia in isolation, despite increasing the response in mixed glial cultures. This suggests that the astrocytes signal to the microglia to increase the inflammatory response in the presence of antidepressants.
Title of Project:  Population Health Management Testing Hepatitis C in Rural Communities

Project Summary:

As a fellow for with the Upstate Institute Field School this summer, I worked with Hudson Headwaters Health Network on a number of public health initiatives addressing ongoing health issues within the local community, primarily focusing on expanding access to treatment and community outreach and education. Hudson Headwaters is a not-for-profit community healthcare system, comprised of 17 community health centers covering more than 5,000 square miles of the Adirondack North Country and Glens Falls region. In pursuit of their mission to provide access to the best health care to everyone in their community, Hudson Headwaters has continued to be a leader in rural healthcare systems, developing innovative public health programs that increase access to quality healthcare and meet the evolving needs of the local community. As a summer fellow this year, I was working with Hudson Headwaters on their ongoing Hepatitis C treatment program, analyzing patient data to identify patients in need of treatment, scheduling HCV appointments with these patients, facilitating continued provider education, and creating content for a new public awareness campaign.

Identifying the Problem: Hepatitis C

Hepatitis C or HCV is a virus that primarily affects the liver; if left untreated, it can lead to serious, life-threatening conditions including cirrhosis and liver cancer. The virus is transmitted through percutaneous exposure to infectious blood; the most common means of transmission include sharing needles and contaminated blood transfusion or organ donation. An estimated 2.7-3.9 million people in the US have an active, chronic HCV infection. However, because the infection is often asymptomatic, the vast majority of these patients (estimates range from 45-85%) have never been diagnosed and are unaware they are currently infected, making asymptomatic screening for the disease extremely important. HCV has the highest mortality rate of any infectious disease in the US, killing more Americans every year than 60 other infectious diseases combined, including HIV, TB, and pneumonia. And the problem is only getting worse; the number of people that have died due to HCV-related causes in the US is continuing to rise, reaching nearly 20,000 in 2014.

Approximately 75% of all HCV patients were born between 1945-1965, a group often referred to as the baby boomer generation. Most of these patients were likely infected with HCV when they were children or young adults (before universal screening precautions were established in 1992) and the infection has been left untreated for so long they have now developed severe liver damage. HCV is now a leading cause of liver cancer and the number one cause of liver transplants in the US, putting additional strain on our healthcare system as increasing numbers of these baby boomers start to experience liver failure. All this despite the fact that an incredibly effective, well-tolerated, curative drug treatment is now available.

Treating Patients at Hudson Headwaters

In order to begin expanding the HCV treatment program, Hudson Headwaters first needed to identify patients that would be good candidates for treatment. Using data collected from the network’s patient electronic medical records, I compiled a list of patients that had previously tested positive for HCV, had no record of being treated for their infection, and had no other health-related issues that might preclude treatment. I then coordinated with each patient’s primary care provider to confirm that they could be a candidate for treatment and made phone calls to these individuals to schedule an HCV appointment with one of the prescribing providers.

In addition to treating patients already identified as having HCV, the second major piece of the program was to increase HCV testing among at risk populations to identify patients that may not know that they are currently in infected with HCV. The problem was two-fold: first we needed to make sure everyone within these target populations were being offered testing and we also wanted to increase the number of people that agreed to be tested. To meet these goals, I created content for provider education materials and began presenting my information at several facilities within the network to encourage providers to continue testing for HCV, encourage and educate patients who decline testing, and refer HCV positive patients for treatment. I also designed a public awareness campaign for Hudson Headwaters to get more information to the general public: I created graphics to be used in waiting rooms and social media updates, and informational videos that could be posted online. If our program is successful, in several weeks Hudson Headwater should see an increased rate of HCV testing, which will eventually lead to a greater number of people being treated and eventually cured of their Hepatitis C.

☑ Other (specify):  Upstate Institute
Research Fellow: Alina Sabyr (2019)  
Concentration: Astronomy/Physics

Faculty Mentor: Jeffrey “Jeff” Bary  
Department: Physics and Astronomy

Title of Project: High-resolution Spectroscopic Monitoring of the DQ Tau Binary System: Pulsed Accretion and Starspots

Project Summary:

DQ Tau is a double-lined spectroscopic binary system, which means that we cannot visually discern the two stars but the spectrum contains lines from both sources. DQ Tau consists of two pre-main sequence stars so hydrogen fusion has not yet begun at their cores. This summer I studied DQ Tau binary system using spectra collected with an Echelle spectrograph at the Apache Point Observatory in New Mexico between 2014-2017. Spectroscopic study of DQ Tau over different epochs can shed light on formation of planetary systems, evolution of young stars and dynamics of tight binary systems among other interesting stellar processes.

Echelle is a cross-dispersed spectrograph, which produces 107 orders of high-resolution data covering all wavelengths between 3500 and 10000 Angstroms (Fig. 1). For the spectra reduction process, we used a script and IRAF tools. To ensure that the script works properly, we went through the reduction process step by step, fixing all the errors that we encountered along the way. Although most steps of the reduction process including bias subtraction, flat fielding, wavelength assignment, extracting of two-dimensional spectra (Fig.1) into one-dimensional flux curve can all run automatically by IRAF, the continuum fitting procedure has to be done interactively and was a step that my colleagues and I spent most of our time working on. Continuum fitting is a procedure where you interactively fit a curve to a spectrum to define where the continuum level is thereby defining which lines are absorption, emission or noise features (Fig. 2). The last steps of the reduction process include stitching 107 apertures into a single spectrum, normalizing it by the continuum you defined in the previous step and doppler correct the data for movement of the Earth in respect to DQ Tau.

I measured the strengths of different emission and absorption features such as H I Balmer series, Ca II Triplet (Fig. 3), Na Doublet, [O I] (Fig. 4) and He I by fitting a gaussian, voigt or lorentzian profiles to find the equivalent widths. The strengths, shapes and doppler shifts of these spectroscopic signatures can tell us about the kinematics of accreting material between circumstellar surfaces and circumbinary disk.

Fig.1 Two-dimensional spectrum of DQ Tau. 107 orders covering wavelength range 3500-10000 Å.

Fig. 2 One-dimensional flux curve with a continuum fit.

Fig. 3 Forbidden [O I] line at 6300 Å signifies a region of low density. The left peak is a night sky feature. We fit two Gaussian fits to measure the strength of [O I] without contamination from the night sky emission line.

Fig. 4 Two of the Calcium Triplet features: 8498 Å, 8542 Å. Combination of emission and absorption indicates presence of a hot source and cool and hot gases.

☒ Other (specify): Justus ’43 and Jayne Schlichting Student Research Fund
Title of Project:  Adhesive - Shell Interaction 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.

The original goal of this project was to determine whether there was a relationship between the structure of the shell and the distance from the adhesive. So far, no conclusive evidence exists to prove or disprove this theory. Every oyster has a different underlying microstructure. This microstructure is thought to be the reason we are not able to see the relationship between distance and composition. There are three different types of microstructure that make up the oyster; lamellae, prisms, and chalky region.

Each of these areas was indented using a Micro-hardness tester. The distance between the indents is about 50 microns and each indent is then assigned a hardness value. Each indent also has a distinct fracture pattern based on the microstructure of the shell. By studying these fracture patterns we are able to determine how each area of microstructure affects the hardness and the length of the fractures. Pictures of the indentations were taken at 50x magnification on the light microscope and the fracture radii were measured using the imaging software ImageJ.

Our results were particularly interesting. We determined that in areas of interlocking lamellae, as figure 2 shows, the fractures are significantly smaller. Likewise in the chalky regions (figure 1) there are no fractures at all. These results were measured and inputted onto the computer program MATLAB that was able to construct a color map of the entire shell (fig. 3) using the vertical and horizontal distances of the indents from the adhesive.
Research Fellow: Jonathan Santiago (2018)
Concentration: Geography
Faculty Mentor: Julie Dudrick
Department: Upstate Institute
Title of Project: Opioid Research at Bassett Research Institute

Project Summary:

Poisoning overdoses are one of the leading causes of death among White non-Hispanics in the U.S. Approximately 60% of New York State’s population is made up of White non-Hispanic.

This summer I worked at the Basset Research Institute in Cooperstown, N.Y. My job was to examine how geography may play a role in the propagation or diminishment of the opioid epidemic in upstate New York.

The major focuses of my research were policies that directly affect opioid availability. For example, Prescription Monitoring Programs (PDMPs) are confidential online databases used by prescribers to check the prescription histories of patients. Similarly, some states have initial limitations on the number of opioids that can be prescribed for acute non-cancer pain. In our region (NY state), the limit is usually 7 days; however, New Jersey uses a 5 day initial limitation on acute non-cancer opioid prescriptions. A more recent measure is e-prescribing. Only three states including New York currently mandate e-prescribing. The benefits of e-prescribing are increased access to prescription data as well as reduce fraudulent prescription practices. Some states have medication return programs in place however the accessibility of these programs varies. These programs can reduce the risk of medication diversion and accidental overdoses.

NY ARCOS Map 2016

Pharmaceutical Manufacturing in NY State

Fig 1: This map uses DEA information on drug manufacturers in New York to highlight 3 digit zip codes that might be at increased risk of opioid presence and diversion.

Fig 2: This map uses DEA ARCOS information on the sales and manufacturing of selected drugs as well as the census population for these zip codes in order to show per capita manufacturing and consumption in these areas. The goal of this project is to examine any trends that can be seen in this and similar maps.

The culmination of my project was a series of maps showing the spatial distribution of factors related to opioid prescribing as well as an introduction to a research paper about opioid prescribing and potential spatial characteristics.

Title of Project: Invasion of the Water Body Snatchers: Invasive Species of Lake Moraine

Project Summary:

This summer, I worked with Lake Moraine Association (LMA). The association aims to protect Lake Moraine, located 2.5 miles northeast of Hamilton, and its related environment from misuse, among other things. As a Field School Fellow, I took on a range of responsibilities to help LMA meet its goals.

A key responsibility was to act as a lake steward for Lake Moraine. As a lake steward, I inspected boats entering and exiting Lake Moraine for invasive species, which could have snagged on parts of respective boats. I briefed boaters on the issue of invasive species, explaining how to prevent the spread of invasive species from one lake to another, and why this was important. Currently, various invasive species have had established themselves in Lake Moraine, such as Eurasian watermilfoil, curly-leaf pondweed, and others. These species have no natural predators in Lake Moraine, so without human intervention, they can multiply very rapidly, causing a host of problems. It is therefore important to control the current population of invasive species in Lake Moraine, and prevent additional invasive species from entering or leaving the lake. As a lake steward, I also collected data about the boats entering and exiting Lake Moraine for use by the environmental department in Paul Smith’s College inside the Adirondack Park.

In addition, I built a digital archive for LMA. LMA had kept their records in hard copies, and had wanted to digitize their records for better preservation and accessibility. I compiled reports, memos and notes associated with Lake Moraine, but also more general resources on lake science and lake management, which LMA (or any interested party) can consult for decision-making or just for more information on a given topic. From my archival work and research, I also produced a number of write-ups for LMA’s website. These write-ups introduced topics such as invasive species and lake management tactics in an accessible manner, to engage more people and give them a good sense of practical steps which could be taken to achieve sustainable lake use in Lake Moraine or elsewhere.
Research Fellow: Ho Jun “Paul” Sim (2018)  
Concentration(s): Neuroscience; Music

Faculty Mentor: Wan-chun Liu  
Department: Psychology

Title of Project: Development of Optogenetic Transgenic Songbirds

Project Summary:

Optogenetics is a powerful method that allows the activation or inhibition of cells in a living organism. The use of optogenetic tools involves a genetic modification of cells to express light-sensitive channel proteins, or opsins. The most common opsin is the algae-derived channelrhodopsin-2, which induces depolarization, and therefore an activation, of the cell upon exposure to blue light. Once these proteins are integrated within the cell, a simple light switch can control its activity with strength, speed, and precision. Due to its capacity to provide spatial, temporal and cellular specificity, optogenetics has proven innovative and valuable to the field of neuroscience. Indeed, much research has employed this technology to conduct studies on rodents and shed light onto the function of particular neural circuits on behavior. However, exploring more intricate behaviors such as vocal learning and development demands the use of an animal model that contains an associated vocal circuitry. Songbirds, which possess a dedicated vocal circuitry, serve as a more favorable model for studying the neural mechanisms involved in vocal learning.

To date, not much progress has been made in the implementation of optogenetics with songbirds. Accordingly, my goal in Prof. Liu’s lab was to attempt to develop the first optogenetic transgenic zebra finches (Taeniopygia guttata) expressing channelrhodopsin-2 (ChR2) by injecting a lentivirus containing the gene. Following an injection protocol designed by Prof. Liu, I injected about 40 eggs throughout the summer. The injection was done in the following manner: 1) a small egg shell opening was created above the embryo, 2) the opening was moistened with albumin, 3) the embryo was injected using a micropipette, 4) the opening was covered with a small egg shell fragment, 5) the egg was dried at room temperature, and finally 6) the egg was placed in an incubator for potential development (see Figure 1). Among the injected eggs, one has hatched and is growing well, while two eggs are currently in their late stages of development. Preliminary results on the reporter gene in the first hatchling suggest effective transfection. By enabling the manipulation of specific neurons in specific brain regions, these transgenic optogenetic songbirds could soon offer a novel approach to investigate the underlying mechanisms involved in vocal development and other forms of learned behavior.

![Figure 1. A-B) Egg shell opening (clear solution on top shows albumin); C) injection apparatus (i.e. micropipette) is aligned above the embryo to prepare for injection; D-E) injection is confirmed from red color in the embryo (i.e. phenol red); F) opening is covered with egg shell fragment; G-H) egg is let dry at room temperature for an hour.](image-url)

Source of Support:  
☐ AHUM Div.  ☑ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
Project Summary:

This research aims to understand the physical and chemical characteristics of surface and wastewater in the Hamilton area as well as to discern wastewater treatment efficiency in the Hamilton wastewater treatment plant. In order to gain an understanding of the local stream water and wastewater, water and soil samples were frequently taken from sites upstream of the wastewater treatment plant, within the treatment plant at different stages of the process, and downstream from the treatment plant. The sampling site upstream from the treatment will be abbreviated as FD, sampling sites within the treatment plant include raw sewage (RS), mixed liquor (ML), return activated sludge (RAS), secondary clarifier effluent (SCE), and chlorination tank (CE), and downstream sites are labeled as MP and Silo based on landmarks nearby. Various procedures were conducted including filtering water samples through filter papers or plastic membranes, ion chromatography, chemical oxygen demand (COD), determination of total suspended solids (TSS) and volatile suspended solids (VSS), solid phase extraction (SPE), and gas chromatography/mass spectrometry (GC/MS) to ultimately identify chemicals present in the water. In order to process soil samples, a thermal solvent extraction procedure was followed. In addition, literature research was conducted in order to improve procedures already in use or learn about new procedures that could be implemented with the available equipment.

Chemical oxygen demand (COD) tests were done in triplicates for each sample. COD is used to indicate the amount of oxygen that can be consumed by reactions in a given amount of water or wastewater. Prepared COD vials with 1500 ppm detection limit were used in this procedure. After constructing a standard curve using d-glucose, the COD concentration could be calculated at the absorbance of 620 nm. Results from COD tests were variable. The standard deviation of the mean for the triplicate samples ranged from 2.4 to 87.3 ppm, further emphasizing this variability. Despite this variability among samples from the same sites, RS samples consistently had the highest COD concentrations in ppm rom all three samples dates. The COD for sites upstream and downstream from the wastewater treatment plant were consistently the three lowest concentrations.

Total suspended solids and volatile suspended solids procedures were also done in triplicates. On the day of sampling, the entire 1 L water sample was processed using a Millipore filtering apparatus and .45 mm glass fiber membranes. An aliquot of 20 mL of a given sample would be filtered through one glass fiber membrane and this process was repeated three times. The membranes were placed in pre-weighed aluminum dishes and put in the oven overnight at 105°C to rid the membrane of any excess water. After cooling the mass of the dish and membrane was recorded once more. The dishes were then placed in a furnace at 550°C for one hour and weighed again. At this temperature all organic matter would ignite and none would be left on the paper. This means that the TSS and VSS processes together allow for the measurement of the concentration of total suspended solids as well as the concentration of organic mass in 20 ml of the sample water. TSS and VSS concentrations were consistently higher on the earliest sampling date and decreased over the next two sampling dates for RAS and ML in particular, with RAS and ML having the highest TSS and VSS overall. This they had the highest concentrations of both organic and nonorganic solids, which makes logical sense as these samples are the darkest in color. The trend over time of decreasing is more difficult to explain. One possible explanation may lie in the fact that the wastewater treatment plant was undergoing construction when samples were taken and it seemed to be more fully underway at the time of later samplings. Blood worms were found in RAS samples on 6/9/2017 as well as 6/28/2017, indicating that there may have been an issue with some of the filtering processes, resulting in solids infiltrating into other stages of the wastewater treatment process.
Project Summary:

Over the last three decades, student researchers at Colgate's Foggy Bottom Observatory have monitored the brightness of dozens of quasars, or Quasi-Stellar Radio Sources. Quasars are the phenomena observed in the cores of galaxies. Quasars are the most luminous objects in the entire universe, and their study is one of the most active in the field of astrophysics.

The overarching goal for Colgate's monitoring campaign is to produce high quality multi-decade light curves for each object, which would give a near complete picture of how they vary in energy output over time. These light curves are extremely valuable tools for theorists to test models that explain the complex astrophysical processes that account for the variations in brightness we see. These light curves can contain thousands of measurements from individual images taken over the course of hundreds of nights, and each image must be analyzed to make sure that no anomalies exist in the images (i.e. clouds, telescope malfunctions, dust grains, etc.) that could skew the measurement by even 1%.

This massive task of reviewing each one of thousands of images is called 'editing' the dataset, and it can take an entire summer’s worth of work to complete. This summer, I overhauled a code written by Leah Jenks ’17 that produces a light curve for each night, which can divide a set of thousands of images into much more manageable format. The Python program, called Light Curve Generator, also divides images up into sequences of 2-13 images, which can then be averaged and fit with a best-fit line in order to spot any outliers in a data set that may contain the type of anomalies that cause inaccurate measurements. The measurements are further divided up and color-coded by wavelength of light and also by time.

Light-curve generated from the quasar OJ287 on 11/4/2005. The increase visible at the end of the sequence turned out to be attributed to sunrise and not an actual increase in brightness of the quasar. The data points were subsequently thrown out.

Light-curve generated from the quasar 3C454.3 on 7/29/2016. On this night, the quasar’s brightness was measured in three different wavelengths. Measuring how brightness varies across different wavelengths is fundamental towards understanding the underlying astrophysical processes that govern these massive sources of energy.
Research Fellow: Sierra Sunshine (2018)  Concentration(s): Anthropology; Native American Studies

Faculty Mentor: Carol Ann Lorenz  Department: Native American Studies

Title of Project: Lifetime Career of Peter B. Jones, Onondaga Ceramicist

Project Summary:

This summer, I was tasked with the monumental job of organizing the documentation of Peter B. Jones’ fifty-year career as a potter and sculptor. Peter is a member of the Onondaga tribe and much of his work is inspired by the life experiences and stereotypes of Native American peoples. My job was to compile research about Peter through multiple forms of media, be it books that featured him and his work, documentation from galleries and museums about their pieces of his on display and in their collections, or a simple internet search for news or other articles. The amount of information I encountered was enormous as Peter has been so active in his community as well as in the art world locally, nationally, and even abroad.

Before my research began, Peter dropped off several boxes of papers and miscellaneous materials to my advisor, Professor Lorenz. Being an artist, Peter had not necessarily kept the best records of his work, so each box contained countless papers, posters, and files that dated anywhere from the 1960's to this past year. Each item recounted any one of a variety of events in which he had taken part. I started my work by separating everything by year, categorizing each of those pieces by the event type, and finally a timeline of this work began to emerge.

After all of the papers were filed I also needed to find every book in which either Peter or any of his works were highlighted so to build a master bibliography of publications. In addition to this bibliography, I compiled a list of both public and private collections that had featured and/or purchased pieces of Peter’s. Public collections are those owned by museums or galleries open to the public, while private collections belong to individual collectors. I found that even museums as prestigious as the National Museum of the American Indian and the Museum of Fine Arts Boston had featured his pieces in their exhibitions, and over the years had acquired many of Peter’s pieces for their collections.

In the midst of all of these other projects, I also needed to scan photos that Peter had given us in slide-form, meaning several trips to the visual resources office and lessons on their equipment. Not only did I learn how to use a slide-scanner, but I was also given the opportunity to learn elementary Photoshop skills so to clean up the quality of the very old/dirty slides.

Overall, the work that I have done over the summer has significantly impacted my personal education. As I am now a senior, I am working on a thesis topic, and this research opportunity gave me several routes to pursue, as well as many contacts and a general familiarity in my field. I plan to use all of the knowledge and the new skillset that I have honed not only in the thesis capacity, but also going forward to graduate or law school.

□ Other (specify):

Faculty Mentor: Rebecca Metzler  Department: Physics and Astronomy

Title of Project: Exploring the Correlation between Structure, Composition, and Strength in Biominerals

Project Summary:

I have been working to investigate the biomineralization process of coral by examining the relationship between the growth and structural patterns in two types of coral (Acropora and Orbicella). Both of these corals are hard corals found in shallow reef environments. Coral is an animal that grows as a polyp inside a hard, calcium carbonate exoskeleton. The coral skeleton grows as cup-shaped deposits of the biomineral, aragonite, which is a specific type of calcium carbonate. The aragonite contains an organic matrix which influences calcification by providing sites for the biomineral to nucleate. This matrix contains magnesium, strontium and barium. I have been working to examine the growth pattern of coral by looking at the hardness values and chemical composition in different areas of the coral.

To begin this project, I started by taking hardness measurements on the coral samples using a digital microhardness tester. This machine uses a diamond tip to make indentations in the coral at a force of 0.98 N, and measures the vertical and horizontal distance in that indent to calculate a Vickers hardness value. I calculated more precise hardness values by using a brightfield light microscope to take images of each indent and then used ImageJ software to measure the indent’s distances from a more magnified image. After making several lines of indents in each sample of coral I compared the data I gathered and determined that the centers of the coral samples were consistently weaker than the edges. Examining different sections of an Acropora branch, I also found that the upper portion of the coral was weaker than the bottom portion.

From this data, I hypothesized that the weaker areas of coral were not as calcified as the harder areas and thus had lower calcium content. To test this, I used a scanning electron microscope to take energy-dispersive x-ray spectroscopy data on the coral samples. This kind of microscopy shoots a beam of electrons at a specific site on the coral. This will excite electrons in an inner electron shell allowing an electron in an outer, higher energy shell to move down. This difference in energy between the higher and lower shell is released in the form of an x-ray, whose energy can be measured and quantified to determine the elemental composition in that area of the sample. Taking data from the center and edges of coral samples, I found that weaker areas of the coral skeleton (the centers) frequently contained more calcium than areas of the skeleton that were harder (the edges). This was not what I initially had expected. Instead this suggested that there had to be another factor influencing the hardness of the structure of the coral, such as the crystal orientation and microstructure.

To look into this, I created large images of each coral sample using a polarized light microscope and examined the location of each indent. This allowed me to see gray levels and crystal orientations and compare the weaker areas of the coral to the harder areas. I found that the lowest hardness values were frequently in areas of different crystal orientations while the highest hardness values were in varying areas of crystal orientations. To further investigate this, the coral samples should be observed using electron backscatter diffraction to get clear pictures of the crystal orientations.

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

Figure 6 - Large image of an Acropora sample taken from a side branch. Horizontal lines are lines of indents. Outer lines had larger hardness values than inner lines.

Figure 7 - Histogram comparing the calcium content in the above Acropora sample in the center vs the edges. Slightly more calcium was present in the center, which was also found to be weaker than the edges.
Project Summary:

The purpose for this summer research was to replicate the study (and findings) by Green and Bavelier (2003) as well as change and add specific elements to the experiment to further the current research. Green and Bavelier concluded that the peripheral visual fields of video game players were superior to those of non-video game players and actually resembled the peripheral fields of people in the deaf population. While our study followed the same premise as the Green and Bavelier study if differed in two major ways: first, the paradigm on which we tested the participants; second, adding another group to test – athletes. The paradigm we used was Dynavision – a light board machine, usually used to test athlete reaction times, which can be found in gyms and universities throughout the country. The Dynavision machine was used because this machine is available at almost every university and therefore makes the study very easy to replicate. The athlete group was added to see if this peripheral advantage was specific to video game players or if it is also seen in other specialized groups.

Participants began by filling out three questionnaires: demographics, gaming, and athletics. Base on the subjects’ answers; they were placed in the control, gamer, or athlete category. From there they would complete a series of tasks on the Dynavision machine that tested their central and peripheral visual fields while also accounting for high and low load (the amount of options for a light to appear). Participants were also primed with instructions that were meant to try to trigger a competitive response in the gamers and athletes.

Based on the Green and Bavelier’s study, we hypothesized that the gamers would be better at these tasks and that some athletes (specifically ball sports) would follow suit. Our findings were somewhat correct. We were correct that the gamers performed better than the controls. However, the athletes showed an even more advanced peripheral visual field than gamers but only in the most difficult task. This suggests two things: first, athletes have a specific threshold that needs to be reached to tap into these extra peripheral resources and second, that simply being instructed (even on the easy tasks) that the tests were a competition had no effect on the athletes - they needed to feel challenged to tap into this competitive mode.

These exciting and unexpected findings have inspired me to continue this research throughout the semester to find out why athletes are able to tap into these extra neural resources but only when in competitive mode. Is there a way to have this advanced peripheral vision in everyday life? Can it be taught? If anything, my study has suggested a few things - the extra peripheral vision found in deaf people might not be as unique to that specific group as we previously thought; but, is actually a skill that can be learned depending on peripheral stimuli exposed to your brain on a regular basis.
Title of Project: SNPs Upstream of IGF1R Do Not Influence its Expression

Project Summary:
As far as mammalian genetics are concerned, the modern domestic dog offers a very strong system for the studying of complex traits due to the relatively simple nature of their genes. This summer (2017) I explored how the allele of a region of SNPs (single nucleotide polymorphisms) 80k basepairs upstream of IGF1R’s main coding sequence affects its expression in domestic dog tissue. In past research, it had been found that this region of SNPs as well as a non-synonymous mutation called R204H on the coding sequence of IGF1R are associated with body size variation in domestic dogs. However, it has been difficult to discern which mutation plays a causal role in the variation of body size in domestic dogs. By finding if the upstream SNPs act as a transcriptional regulatory region for the gene, I hoped to find out if it was the mutation that causes variation in domestic dog height. qPCR, a method that quantifies gene expression levels, was utilized in order to see if the upstream SNP region causes a change in gene expression.

The USCS genome browser, an annotated database of genomes, was used to find if the comparable human version of the SNP region is a regulatory region. This was done because much more data is available on the human genome in comparison to the domestic dog genome, and the SNP region probably performs the same function in both due to the large amount of conservation in the mammalian genome. The genome browser indicated that the SNP region acts as a regulatory region in humans, leading to the hypothesis that is also plays this role in domestic dogs. qPCR, a method that quantifies gene expression levels, was utilized next to explore this hypothesis.

To obtain samples to use in qPCR analysis, a variety of small domestic dogs (toys, standards, and minis) were genotyped for their IGF1R allele. Once a sufficient number of dogs had been genotyped, RNA was extracted from each specimen’s tissue and reverse transcribed into cDNA to be used in qPCR. qPCR technique was shown to be optimal by creating a dilution curve that indicated a consistent technique. qPCR was then used to measure the expression of IGF1R in dogs with the GG allele or the gene or the AA allele of the gene. 6 specimen of each allele (for a total of 12 dogs) were utilized in two trials of qPCR, and both showed that changing the allele of the upstream SNP region did not significantly change IGF1R expression levels (Figure 1). This is evidence that the upstream SNP region probably does not play a causal role in the variation of domestic dog height, while non-synonymous mutation R204H does.

Figure 1. Changing the allele of the upstream SNP region did not significantly change IGF1R expression levels. Both trials showed p-values that did not allow for rejection of the null hypothesis. In trial 1 (p-value = 0.26), dogs with the GG allele were shown to have 82.3% IGF1R expression levels compared to dogs with the AA allele when analyzed with a $2^{-\Delta \Delta Ct}$ test. In trial 2 (p-value = 0.63), dogs with the GG allele were shown to have 90.3% IGF1R expression levels compared to dogs with the AA allele when analyzed with a $2^{-\Delta \Delta Ct}$ test.

Source of Support: □ AHUM Div. □ NASC Div. □ SOSC Div. □ UNST Div. □ Other (specify): Michael J. Wolk ’60 Heart Foundation
Research Fellow: Kailey Tobin (2019)

Facility Mentor: Ana Jimenez

Title of Project: Chronic Temperature Acclimation Effects on Anoxia Tolerance in the Sheepshead Minnow

Project Summary:

In North America, sheepshead minnow, Cyprinodon variegates dominate some of the harshest aquatic habitats known. This small cyprinodontid is common to shallow saltwater swamps, sloughs, and tide pools from Cape Cod, south to the Yucatan Peninsula, Venezuela, and throughout the Gulf of Mexico. The species is well known for its ability to thrive in harsh abiotic environments that prove lethal to other fishes. Some Gulf of Mexico populations, for example, survive seasonal water temperature shifts of more than 36°C; diurnal fluctuations of up to 15°C; and, rapid, unpredictable temperature drops of up to 5°C/h. Not surprisingly, sheepshead minnow display the widest range of temperature tolerance and the highest upper thermal limit known in fish. Characteristics that no doubt contribute to their wide distribution range and successful occupation of harsh thermal habitats. Aquatic temperature fluctuations concomitantly bring along alteration in water oxygen tension, and potentially a flux in salinity concentration. Thus, the sheepshead minnow is an excellent study organism to demonstrate many of the physiological extremes that can be experienced by one species within a lifetime. In particular, we are interested in gauging the sheepshead minnow’s various physiological tolerances as a means of assessing the species’ adaptive capacities in the face of widespread ecological climate change. Additionally, we posit that our data may help to define an ‘upper limit’ in physiological adaptations for numerous other species – that is to say, that the adaptive plasticity demonstrated by sheepshead minnows under the following circumstances is unlikely to be matched or exceeded by many, if any other species assuming roughly the same ecological conditions and shifts.

We acclimated four different groups of sheepshead minnows for a mount to the following temperatures, 5°C, 15°C, 25°C, and 33°C. We asked the question, “how does chronic temperature acclimation affect anoxia tolerance?” To measure this, we had a group of control fish and a group of anoxia exposed fish from each of the acclimation temperatures. For my project, we were interested in muscle fiber diameter changes associated both with acclimation temperature and anoxia treatment. Muscle fiber size has been closely linked to whole animal metabolism in ectotherms, thus, we expected environmental stressor may dictate muscle fiber restructuring. To do this, we fixed muscle tissue from each fish in 4% paraformaldehyde. We, then, sectioned the muscle tissue to 30 µm using a cryostat. Then, sections were stained with Wheat Germ Agglutinin (WGA) AlexaFluor 488 to highlight the sarcolemma membrane and DAPI to highlight the nuclei. We imaged these fibers using a confocal microscope. We then traced muscle fibers following WGA staining using Image J. We measured 45 fibers per individual fish and then averaged across each individual. Individual averages were compared across acclimation and anoxia treatments using a two-way ANOVA.

We found no significant differences in muscle fiber diameter across temperature treatments (F = 1.728, p = 0.172) and across anoxia treatments (F = 1.956, p = 0.168), suggesting that our acclimation treatments and anoxia treatments did not alter whole animal metabolic rate for these fish. This may be a physiological adaptation of extreme temperature tolerant aquatic ectothermic species.

![Figure 1](image1)

*Figure 1* - Muscle fiber diameters measured using confocal microscopy and Image J. 45 muscle fibers were averaged across each individual fish. Bars are averages ± SEM.

Organizations like Google and Facebook depend on hundreds of thousands of interconnected computers to operate efficiently and communicate with each other in a reliable fashion. However, the routing devices that connect these computers have complex and fragile configurations. If the routers are not properly configured by the network administrator, arbitrary hardware failures across the network can cause the network to fail—disabling communication between hosts, or even opening up security vulnerabilities in the network. Prior work has shown that human errors are common when modifying complex configurations [1], and it often results in non-negligible network misconfigurations. Thus, there is clearly a need for automated tools to help ensure the reliability and safety of computer networks.

As a first step, Professor Gember-Jacobson developed ARC [2]—a program that verifies the integrity of router configurations under arbitrary network failures. This research was extended with the creation of CPR [3]—a program that can repair any broken configurations. CPR achieves this by analyzing and manipulating a collection of weighted, directed graphs that model the network’s behavior. Repairs made to the model must then be translated to changes in router configurations. In this project, our goal was to implement an algorithm for converting model repairs into changes in router configuration files.

The first challenge in achieving this was properly interpreting the model repairs. To repair the model, CPR adds and removes edges of the weighted, directed graphs. By checking the class of graph modified and whether an edge was added or removed, our code determined the correct change to the router configuration. For instance, if an edge was removed between a single pair of hosts, the configuration would have to restrict the hosts from communicating with each other in the router configuration. Other, more complex distinctions were addressed too, and we introduced a filtering step to reduce unnecessary changes.

The second significant challenge was ensuring that the changes could be interpreted and applied across different router vendors. Multiple routers are available on the market, and many have their own configuration language. We leveraged the fact that routers, regardless of their configuration language, have similar capabilities. By building a configuration modification engine relative to these capabilities, the vendor-specific configuration adapter could then interpret and write the necessary changes in the vendor’s language.

The final and ongoing challenge was in creating a vendor-specific configuration modification adapter. Currently, ARC is able to interpret Cisco IOS router configurations, so we focused on building an adapter that could produce snippets of Cisco IOS language. We found it was difficult to identify exactly how to change the configuration without introducing side-effects. Our future research is focused on improving our algorithms for deciding where and how to change the configurations.

Project Summary:

This project began as a morphological study on the gametophytes of *Ceterach officinarum*, however these gametophytes proved difficult to grow quickly in a laboratory setting. Instead, we focused on studying the gametophytes of three species of fern local to the Colgate area. The first two species, *Osmundastrum cinomomea* and *Osmunda regalis* were collected from the Bewkes center, a piece of Colgate owned property that contains a small pond and surrounding swampy forest. Both *O. cinomomea* and *O. regalis* sporophytes grow in the wetter areas in this swampy forest. By contrast, *O. claytoniana* was collected from the Colgate ski hill, which was comparatively drier than the Bewkes center. Given the different habitats in which they grow, we wanted to determine if the gametophytes generations of these species showed the same preference for growth conditions as their sporophyte counterparts.

The gametophytes were grown in small petri plates in agarose growth medium that had been treated with a polyethylene glycol solution to simulate drought conditions. Initially, 4 replicates for each treatment group for each species were sown. The treatments included a control, in which no polyethylene glycol solution was added. The drought treatments were set at -0.5 mPa, -0.7 mPa, -1 mPa, and -1.5 mPa respectively. It should be noted that no spores germinated in treatments higher than -0.5, and thus measurements on these treatments was discontinued. In addition, we exposed the spores to two different CO₂ levels to see if the concentration of CO₂ influenced the germination rate or growth rate of the gametophytes. The treatments were measured for germination rate by measuring the germination rate of 2 squares on a grid placed under the plate. The same grid squares were used each day of measurements. The main measurements were done once germination had taken place. We wanted to gauge the gametophyte’s rate of growth. To this end, we used Pax-it software to take photos of the gametophytes and measure their rhizoid length, as well as the overall length and width of the gametophyte. Figure 1 below displays some of the results of this research.

![Figure 1: Average final length of the gametophytes of each of the three species studied compared based on water potential. CWP represents the control group, which was not treated with polyethylene glycol, while EWP represents the experimental treatment group that were exposed to drought conditions of -0.5 mpa though treatment with polyethylene glycol. *Osmunda regalis* was found to be significantly different from either *Osmunda claytoniana* or *Osmundastrum cinomomea* by student’s T-test.](image)

The hypothesized link between sporophyte and gametophyte water potential preferences was not supported by our data. Within species, both CO₂ concentration and water potential were shown to have a significant effect on the growth of gametophytes, though there was no cross relation. In addition, the cross-species effects were not as expected. *Osmunda regalis* was shown to be significantly different from both *Osmunda claytoniana* and *Osmundastrum cinomomea*.

Source of Support:  
- AHUM Div.  
- NASC Div.  
- SOSC Div.  
- UNST Div.  
- Other (specify):
Title of Project: Field School Fellowship with BRiDGES of Madison County

Project Summary:

I spent the summer working for BRiDGES which is a nonprofit located in Oneida, NY. Their mission “is to improve the quality of life by providing advocacy and services to our community, the workplace, families and individuals affected by addiction and the abuse of alcohol, tobacco and other substances.” They accomplish this mission through a variety of different programs, including counseling and outreach programs, that aim to tackle the different substances, or other aspects of people’s lives, that people in this area struggle with on a daily basis. During my time at BRiDGES I was working on two different projects.

The first of these projects was to revamp their assessment form that allows them to keep track of the different demographics of the people they are seeing (age, sex, etc.), and the reasons that these people are coming in, in order to understand what’s going on in the surrounding community. This information is used by BRiDGES for tasks such as writing grants to get funding for their programs. They had a previous assessment, but once they started to collect data over a longer time period, the old method began to become overwhelmed with data. Therefore, they were looking for an assessment that would be easy to input data into, as well as easy to generate data charts from, that would also be able to compile data for years’ worth of data, but they were hoping to find a way to utilize software that was free as their financial resources were limited on this project. For this reason, I looked into a variety of different options and was able to put an assessment together for them using Google Forms that did all of the things that they wanted it to do.

The other project that I began working on for them was labeled the “Hidden Mischief” project. The goal of this project was to create a mock teen bedroom (pictured below), that adults/parents would be able to explore to learn some of the sings of drug abuse that may be present in their teen’s bedrooms that they might be overlooking. In order to do this, along with typical items a teen would have, the room was strategically filled with fake drugs, drug paraphernalia, and items that showed signs of drug use, and typical hiding spots that teenagers use were utilized. First, these parents were able to look around the room to see which of the signs of drug abuse they could identify. After this period of time, they would be given more information about what to look for, and they would also be given a pamphlet listing exactly what items in the room could be a cause for concern and why this was the case. At this point they would be able to look around the room a second time to see how their perspective on seemingly normal household objects had changed after realizing that they could be used to use/sell drugs.

This image shows the mock teen bedroom that I have created in order to educate parents on what are the signs of drug use that they might be overlooking in their homes. Items signaling drug use have been dispersed throughout the room among items that would be typical to find in a teenager's bedroom.

Research Fellow: Elizabeth Vitaro (2019)  
Concentration: Biology

Faculty Mentor: Barbara Hoopes  
Department: Biology

Title of Project: Investigating Copy Number Variation at the K Locus and Unusual Color Patterns in Dogs

Project Summary:

Due to rigorous artificial selection by humans, domestic dogs have fewer genes that determine complex genes such as coat color. Because of this, they offer a valuable model to understand the complex traits of mammalian genetics. Also, with over 300 breeds, a diverse assortment of features can be observed within and between breeds. Poodles for example vary greatly in coat color and pattern, ranging from black to white, silver to red, patterned to solid.

There are seven genes involved in dog coat color, one being the K locus or beta-defensin 103. At this gene, the alleles K\(^\text{B}\) and k\(^\text{B}\) (K\(^\text{B}\) being a three-base pair deletion and dominant to k\(^\text{B}\)) can be found, where K\(^\text{B}\) leads to a solid colored dog and k\(^\text{B}\) a patterned one. Dogs can therefore be either K\(^\text{B}\)K\(^\text{B}\), K\(^\text{B}\)k\(^\text{B}\), k\(^\text{B}\)k\(^\text{B}\), however K\(^\text{B}\)k\(^\text{B}\) dogs do not always follow the reported dominance pattern, showing patterns where they should be solid. Previous research has indicated K as a copy number variant in some breeds as well. Therefore, we hypothesized that copy number variation at the K locus explains why K\(^\text{B}\) is sometimes dominant and sometimes is not.

When I sequenced K\(^\text{B}\)k\(^\text{B}\) dogs using DNA sequencing I found that different relative amounts of the K\(^\text{B}\) and k\(^\text{B}\) DNAs were visible at the mutation point. (Figure 1). As shown in Figure 1, some dogs appeared to have more copies of K\(^\text{B}\) than k\(^\text{B}\) (A and B1) because the C peak that comes from the K\(^\text{B}\) DNA has a higher peak than the A peak that comes from the k\(^\text{B}\) DNA. I then performed DNA sequencing on mixtures of purified products from K\(^\text{B}\)K\(^\text{B}\) and k\(^\text{B}\)k\(^\text{B}\) dogs to "create" heterozygous K\(^\text{B}\)k\(^\text{B}\) mixtures of defined amounts. When calibrating these against the pure forms of K\(^\text{B}\) and k\(^\text{B}\) dogs, I found that the calibrations formed a linear line with an R\(^2\) very close to one, indicating that the relative heights of the peaks in DNA sequencing were indicative of relative copy number of the alleles (Figure 2). With this information, I then began sequencing K\(^\text{B}\)k\(^\text{B}\) dogs with K\(^\text{B}\)K\(^\text{B}\) and k\(^\text{B}\)k\(^\text{B}\) dogs for calibration, in order to observe the relative copy number in the heterozygous dogs. However, I was not able to finish this part of the experiment, but the results using DNA sequencing up until this point were promising.

Other techniques, like qPCR, would have to be used to get the absolute number of copies of the K gene in individual dogs. Comparing this result to the relative number from the DNA sequencing results would give an estimate of K\(^\text{B}\) and k\(^\text{B}\) copy numbers. This could then be compared to dogs showing different dominance patterns, in order to investigate if there is a pattern between estimated copy number and unusual pattern.

(Figure 1) Using DNA sequencing to assess relative numbers of K\(^\text{B}\) and k\(^\text{B}\) copies. One way to look at relative copies is to look at DNA sequencing. Heterozygous K\(^\text{B}\)k\(^\text{B}\) dogs express varying levels of A and C at the K\(^\text{B}\) mutation point (highlighted) when sequenced. The graphs were reproducible with A performed last summer and B performed this summer. K\(^\text{B}\)k\(^\text{B}\) dogs showed either larger blue peak (A.1, B.1), a larger green peak (A.2, B.2), or equal blue and green peaks (A.3, B.3).

(Figure 2) Calibration of artificial heterozygous phenotype to purified K\(^\text{B}\) and k\(^\text{B}\) show a linear relationship as the ratio of the purified sample increases. Artificial heterozygous phenotype was created by purifying K\(^\text{B}\) and k\(^\text{B}\) samples and mixing them in ratios of 25:75, 33.3:66.7, 50:50, 66.7:33.3, and 75:25. These samples were then calibrated to both the purified K\(^\text{B}\) and the purified k\(^\text{B}\) sample. The resulting relationship is shown here with R values close to 1.

Source of Support:  
☐ AHUM Div.  ☑ NASC Div.  ☐ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
This summer I worked as a Fellow for the Chenango United Way through the Upstate Institute Summer Field School. The United Way is a global nonprofit organization that works to strengthen communities in three areas: health, income, and education. The United Way in Norwich serves townships in Chenango County, fundraising and then reallocating donations to the most robust local nonprofits and programs. Each year the Chenango United Way runs a fall campaign, visiting local businesses like Chobani and NBT Bank to collect donations and recruit donors. Most of the money is raised through payroll deductions-- workers sign up to give a small amount directly from each paycheck without taxation. In the past, the Chenango United Way sought new donors by giving presentations with tools like PowerPoint, but this method has become less successful each year.

My project was to help develop a video for the upcoming campaign season. The video will reach farther than traditional presentations as more and more employees shift from office work to working from home. Additionally, the video will be used across online platforms like Facebook and the Chenango United Way website to further spread the United Way’s message during this year’s campaign.

Chenango County is a county in need. It has the second highest rate of obesity in the state, high levels of poverty, and very few opportunities for its rural residents to access the quality health care. The narrative I created had to explain these community hardships, as well the strategies the United Way employs to address them, to perhaps reluctant potential donors. Creating an effective and believable campaign video required including a variety of footage, especially interview content from United Way partners. In order to capture both the problems United Way fights against and the various successes it enables, much of my project involved travelling to different partner sites and speaking with executive directors, staff members, volunteers and even program participants. I also had to gather recent and reliable figures from reputable sources to substantiate the video’s claims about the needs of Chenango communities. Featuring a range of voices and reliable information helped create a more thorough narrative of the United Way’s mission.

Creating a campaign video also required me to learn and hone a variety of skills. I am a creative writing major and I have taken several studio art courses, so developing a script and visual style for the video was within my comfort zone. I am also a sociology minor, and so I had some experience conducting interviews before this summer as well. However, I had never used any type of video editing software before beginning this project. A big part of my work involved learning how to use a video camera, lav microphone, and Final Cut Pro X software. By developing my technical skills, I am much more aware of the different ways video tools can be used to create meaningful and beneficial content for nonprofit organizations. I felt that I was really able to apply the knowledge I have gained through coursework at Colgate to my project. I was grateful, however, to also gain new skills and knowledge this summer while supporting nearby communities.
Concentration(s): English; ENST

Faculty Mentor: Jennifer Brice  
Department: English

Title of Project: Living Writers

Project Summary:

Living Writers is both a Colgate course (ENGL 360) and a self-paced, online literary learning experience that is free and open to all. Each fall semester, Colgate invites approximately ten authors to campus for discussion of one of their works. Students enrolled in the Colgate course read the texts, meet the authors, and participate in discussions with them. The authors, in addition to visiting the class, give talks that are open to all Colgate students, faculty, and staff as well as the surrounding community. Living Writers online provides a livestream and archives these events. Living Writers online also features video or audio discussions between Jennifer Brice and an affiliated faculty member about each text, as well as resource pages with numerous reviews of the texts, interviews with the authors, and any other pertinent sources that may enhance readers’ knowledge of the authors, texts, and content of the texts. This fall, eleven authors will come to campus, three of whom are Pulitzer Prize winners. Currently, 723 people, many of whom are Colgate alumni and parents, are participating in Living Writers online, and 48 students are enrolled in ENGL 360.

As Jennifer Brice’s research apprentice, I worked on a variety of projects to help launch Living Writers 2017. The core of my work involved research on the authors and the texts. I read each text and researched each author, compiling numerous sources for the Living Writers online resource pages. The research varied for each author, and the information I sought included but is not limited to interviews with the authors, reviews of the Living Writers texts, updated or additional research on the texts’ content, biographical information about the authors, video or audio recordings of the authors, and reviews of the authors’ other texts. Once Jennifer Brice reviewed this research, I uploaded the sources to the Living Writers site. Each week, Professor Brice and I met and discussed both my research and major themes within the texts themselves.

In addition to this research about the authors and texts themselves, I performed various tasks for the Living Writers program. When needed, I communicated with faculty partners and colleagues in IT about the Living Writers site and content needed. With Professor Brice’s oversight, I wrote summaries of each text and short biographies for each author for use on the Living Writers website and for marketing materials. I attended marketing meetings and offered feedback on effective marketing strategies and website language. For use on various social media platforms, I wrote marketing pitches tailored to different audiences. I also worked with Stephanie McClintick in proofreading designs and distributing Living Writers marketing materials such as postcards, posters, and tote bags.

My research for Living Writers did not involve a narrow, bounded project, but rather a wide variety of tasks aimed to help launch Living Writers 2017. In this apprenticeship, I gained research, marketing, analytical, and communication skills as well as proficiency in various administrative tasks, to say nothing of my enriched understanding of Living Writers’ literary content itself.

Soybeans are a major commercial crop within the United States. Farmers aim to harvest the highest yield possible by providing their soybean plants with adequate water supplies, parasite repellants, nutrient-dense soils, and the proper temperatures for growth (Pennisi E., 1995). When any of these four factors is altered, soybean yield changes. Additionally, plant chemistry also begins to deviate from the normal parameters under stress conditions. The most influential of these four limiting factors, on plant yield and structure, is thought to be drought stress. Drought is believed to induce stress by altering both metabolism and gene expression in plants (Shinozaki K. and Shinozaki K.I., 1997). These internal changes are thought to result in varying levels of fluctuating asymmetry. Fluctuating asymmetry is defined as random deviations from bilateral symmetry due to environmental or genetic factors (Sumner F.B. and Huestis R.R., 1921). Therefore, it is thought that fluctuating asymmetry is a reliable measure of individual plant fitness, which detects resistance to harmful environmental stressors (Sumner F.B. and Huestis R.R., 1921; Pennisi E., 1995; Jones J.S., 1987). Consequently, inducing drought stress upon different soybean varieties, and then measuring the resulting levels of fluctuating asymmetry, can inform the relationships among drought stress, metabolic pathways, and genetic stability.

This summer, we studied four phenotypically distinct varieties of soybeans. The different types were named Black Eyebrow, GL 2216/18, Brun Matif Rouest, and Viking 2265. Each variety was selected based on their height, expected germination time, flower color, and oil to protein composition ratio ensuring that four distinct phenotypes were chosen. Approximately 120 soybean plants were grown, with about 30 plants per variety. At day 10 after germination, each soybean was randomly selected to be part of either the experimental or control group. Then, the plants were allowed to grow until they reached full expansion of their fourth leaf without any disturbances. A photograph of each forth leaf was taken and analyzed using an image analysis program (ImageJ32). At the fourth leaf expansion time, the plants designated to endure drought stress were left to grow without any watering for eight days. The soybean plants selected for no drought stress were continuously watered. At the end of the eight days, normal watering ensued for all plants.

At the expansion of leaf number six, photographs of each plants six leaf were again captured and analyzed. Using the computer software, multiple measurements were taken for both leaf numbers four and six. First, the length of the left leaflet was compared to the length of the right leaflet. Then, the angle between the middle leaflet and left leaflet was compared to the angle between the middle leaflet and the right leaflet. Lastly, the areas of the left and right leaflets were compared, as well as the overall area of the left side of the full leaf versus the right side. These measures were integral to determining the overall symmetry levels of each plant. In addition, we calculated the deviation of the entire leaf shape from a perfect equilateral triangle using rotational symmetry analysis.

Using these five measures, we assessed whether leaf symmetry was altered between leaf 4 and 6, and whether this alteration could be attributed to the variety, the stress treatment, or an interaction between the two. We found that varieties did seem to vary in their response to the drought treatment, with some becoming much more asymmetric in the face of stress compared to others. However, there was much more among-individual variation within varieties than expected that have use cautioning the inferences that can be made from this single study. We recommend repeating this experiment with a sample size between 2-3 times what was used in this study to further clarify the response of each variety to drought stress, before investigating more closely what might be underpinning these differential responses.

Works Cited:
Project Summary:

This summer I had the opportunity to work on physical optics research in Professor Kiko Galvez’s lab thanks to the funding of the Picker Interdisciplinary Institute of Colgate University. Using optical equipment, such as lens, polarizers and crystals, I studied quantum entanglement in medical diagnosis by splitting, entangling and counting photons through the experimental setup shown in the diagram below. This was executed by shooting photons through a crystal such that the photon would exit a crystal as two identical or entangled photons. Next, the photon on the left side travels through a tissue sample, either healthy or diseased, while the photon on the right side would travel straight to the device that detects the number of coincidences, which is the number of photons that hit the detectors on both side at the exact same time. I was able to determine whether a tissue sample is healthy or diseased by calculating the change in entanglement of the entangled photon pair from the addition of the tissue sample.

The goal of my research was to use entangled photons to distinguish healthy and diseased tissue by analyzing the entanglement, scatter and linear entropy of the photon pair after one photon traverses the sample. First, I produced the entangled photons by performing a spontaneous parametric down-conversion setup by using a laser to shoot a photon that is transmuted into two photons travelling at 3° from the axis. The photon pairs were then entangled in the polarization HH+VV, such that this state is undefined and unrealistic because it is both horizontal and both vertical at the same time. Thus, I could use the principle of “spooky action at a distance” that states that if the polarization of one photon is measured then the polarization of the other photon can be determined. I took 16 projective measurements of both photons passing through different optical configurations and using the recorded coincidences of each measurement to construct a density matrix to calculate the degree of entanglement. It was hypothesized that the diseased tissue would alter the state of the entangled photon pair, thus reducing the degree of entanglement and this is what I spent my time proving.

We were interested in the cellular mechanism that may allow for small breeds to age slower compared with large breeds in the context of cellular metabolism and oxidative stress. Primary dermal fibroblasts were grown in tissue culture from small and large breed dogs as puppies and seniors. We measured basal oxygen consumption (OCR), proton leak, and glycolysis using a Seahorse XF96 oxygen flux analyzer. Additionally, we measured rates of RS (reactive species) production, reduced glutathione, mitochondrial content, lipid peroxidation (LPO) damage and DNA damage. Our preliminary data suggested that as large breeds age, glycolytic rates tend to increase ($F = 4.82, p = 0.030$). For small dogs LPO damage increases with age, whereas LPO damage decreases with age in large dogs (age*size class: $F = 4.610, p = 0.035$). In both small and large breeds of dogs, oxidative damage to DNA increases with age. Additionally, small breeds of dogs have lower levels of oxidative DNA damage than large breeds of dogs throughout their lives ($F = 0.056, p = 0.056$). Thus, large breed dogs may also have a higher glycolytic rates, LPO and DNA damage, thus, demarcating a potential mechanism for their decreased lifespan compared with small breed dogs.
Title of Project: Breaking Glass: Breaking Down the Barrier between the Arts and Social Responsibility

Project Summary:

Opera is often perceived as an old-fashioned, elitist, and inaccessible form of culture. In order to step away from these stereotypes, Glimmerglass Festival, a non-profit opera company in Cooperstown, NY, is asking what social responsibilities arts organizations have outside of their artistic missions. For Glimmerglass, creating a space for public dialogue is a crucial part of this notion of social responsibility. This seems especially important to the organization in the politically-charged social climate of our current society. While the organization is exploring a variety of means to increase its social responsibility, one major project it has adopted is a five episode podcast entitled Breaking Glass, that aims to connect opera with relevant social issues and will be released in the spring of 2018. Each episode will focus on a production that Glimmerglass has recently shown or plans to show and connect the themes of the performance to current events and debates. In addition to the podcast, Glimmerglass is also planning to hold a series of community forums in major cities across the country to allow for discussion of local concerns and the issues touched upon in their productions and podcast.

This summer, I had the opportunity to work alongside Glimmerglass Festival’s Artistic Director and co-executive producer of Breaking Glass, Chris Powell, to help facilitate the making of the first two episodes of the podcast. The first episode of the podcast will focus on the opera The Siege of Calais by Gaetano Donizetti, which tells the story of citizens depending and ultimately being forced to leave their city. The episode will connect the opera’s storyline and its themes of home, family, and sacrifice with the stories of local refugees. This production was selected for the podcast due to the timely nature of its plot, given the current refugee and migrants crises, along with the decisive rhetoric over immigration. To provide material for the episode, I conducted interviews with both the cast members of the production and members of the local refugee population in Utica. With cast members, we discussed their preparation for their roles, their thoughts on the opera’s themes, and their takes on the significance of performing this production in the current political climate. Members of the local refugee population shared their personal experiences in regards to migrating to the United States and beginning their lives in a new country, along with their thoughts on current anti-immigration rhetoric. The episode will aim to intertwine these stories and highlight how opera can explore the issues touched upon.

The second episode of the podcast will feature a hip-hop opera, Stomping Grounds, a production by Paige Hernandez and Victor Simonson that premiered at Glimmerglass Festival this summer. The show is a unique blend of genres that focuses on issues of race, gentrification, ancestry, and legacies of slavery. As with The Siege of Calais, this production also has clear social relevance and I also interviewed its cast members to get their views for the podcast. In addition to its themes, Stomping Grounds also shows its socially responsible mission through its characters and casting, as most of the characters were written specifically for performers of color, which is quite rare in the opera world and allows for greater representation of diversity on Glimmerglass’s stage.

The steps that Glimmerglass Opera is taking towards becoming a more socially responsible organization set it apart among other opera companies. Breaking Glass will be the first opera podcast that primarily explores social issues rather than focusing on the musical aspect. Glimmerglass hopes the podcast will serve as a model and inspiration for other opera companies, helping to bring opera to the forefront of social issues and relevance within the arts.
Title of Project: Resource Consumption of Residential Areas in the Suburb of a Medium-Sized Indonesian City, Palu: An Exploratory Study

Project Summary:

In this study, I explore the current phenomenon of suburbanization in a mid-sized Indonesian city in Indonesia, Palu, and how it affects the level of gasoline and land resource consumption. Suburbanization or urban sprawl is a population shift from the city centers to the suburban area in the city peripheries. It is occurring in cities around the world. Much has been written about the negative environmental consequences of low-density suburban settlements in developed countries, especially the United States. Many scholars describe the suburban lifestyle as “resource intensive” and, thus, highly unsustainable. Suburbanites typically consume more gasoline than their city-counterparts because of their tendency to drive long distances and not to walk or use public transportation to go to places. In term of land resource consumption, instead of living in row houses or apartment buildings like those in the city center, families in suburban areas often live in fully detached houses that are surrounded by large ornamental yards. Matthew Kahn, a leading American environmental economist, claimed that American suburbanites drive 31% more and consume 100% more land than their city counterparts.

On the other hand, few researchers have investigated the relationship between suburban developments and resource consumption levels of cities in developing countries, like Indonesia. Since urban centers and suburbs in other parts of the world may have different characteristics, we should not base our perception about the environmental impact of suburbanization solely according to the American and other developed countries cases since there are differences in national development conditions and the context of planning in different countries. Using data and information from the literature, local government agencies, interviews, surveys, and personal observation, I characterize the housing development pattern in Palu and the degree of suburbanization. I also compare resource consumption levels between residential areas in the suburbs of Palu and of the United States.

I discovered that the city of Palu is sprawling rapidly, and new housing developments are highly responsible for it. Residential area developments by private developers are flourishing in the fringe of Palu, and many are taking the form of a leapfrog development pattern. The majority of them provide affordable family houses for lower-middle income households. As a result, many households have decided to move out of the city center in order to become homeowners. While the development of the first gated-community (CitraLand Waterfront City) in the city periphery may be an indication of the future housing pattern of high-income families in Palu, the current degree of suburbanization among high-income families seems to be relatively low based on my survey.

Although residential areas with detached family houses for both middle and high-income households are flourishing in suburban Palu, overall, they are not as resource intensive as those in the United States. Suburbanites in Palu consume less gasoline than those in the United States because most of them travel by scooters or motorcycles and have smaller activity spaces. Government regulations in Palu that limit lot sizes and the higher demand for small, affordable family houses are responsible for the lower degree of land consumption and sprawl. The table shows the levels of land and gasoline consumption of households of four different residential areas in Palu.

<table>
<thead>
<tr>
<th>Residential area</th>
<th>Lot Size (sq meters)</th>
<th>Gasoline Consumption per week (liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CitraLand Waterfront City</td>
<td>135 to 324 sq meters</td>
<td>40 to 58.5 liters/household</td>
</tr>
<tr>
<td>BTN Agape</td>
<td>60 to 120 sq meters</td>
<td>3.5 to 50 liters/household</td>
</tr>
<tr>
<td>BTN Gara Petobo Permai</td>
<td>96 sq meters</td>
<td>6.5 to 54.5 liters/household</td>
</tr>
<tr>
<td>BTN Bokot Sinta</td>
<td>54 to 210 sq meters</td>
<td>6.5 to 27.5 liters/household</td>
</tr>
</tbody>
</table>

Research Fellow: Chenglu Wu (2019)  
Concentration: Astronomy/Physics  
Faculty Mentor: Jeffrey “Jeff” Bary  
Department: Physics and Astronomy  
Title of Project: Spectrum Analysis of DQ TAU Binary  

Project Summary:

This summer I worked for professor Bary under his project: The spectral analysis of DQ Tau system, together with Alina and Megan. DQ Tau Binary is comprised of two T Tauri stars. T Tauri stars are pre-main-sequence which are still contracting and preparing for hydrogen fusion. Before a star enters its T Tauri phase, the star is usually too dim and its surrounding materials are too dense, making the star invisible to us. Thus T Tauri stars are stars that are on the earliest stage of evolution which we could observe; this special trait of T Tauri star makes such celestial object particularly significant since it could reveal to us the secrets of formation of stars and planets.

The goal of this project is to analyze spectrum images professor Bary took and try to figure out different kinds of activities within DQ Tau system. However, we can’t just use the raw images taken by professor Bary since they contained too much noise and errors. To get rid of those noises and produce good images, we used iraf to run a code called apered. The image reduction process includes flat and dark correction, cosmic radiation correctness and etc. After we have good images in our hands, we have to fit a continuum (a continuum is a spectrum line of a perfect black body, which has no emission or absorption features and etc.) to our spectrum. This step took most of our time during the summer. After we subtract the continuum from the original spectrum, we can easily see all the spectral features of this Binary system and these features are good to be analyzed.

Our analysis gives us lots of interesting hypothesis. For instance, we saw a strong OI forbidden line in our spectrum, indicating possible existence of hot oxygen moving within the system (those oxygen elements might eventually fall into star as part of accretion process) since forbidden transmission only occurs at low density environment. Also, other lines such as Ca II and Na I might also prove the mass outflow and inflow of the star since blue shifted line implies the material is moving towards us and redshifted line implies the material is moving away from us.

This is still an ongoing study and there’re more mysteries than known facts about T Tauri star and the early stage of stellar evolution and planet formation. However, I do believe that scientific observation from earth and interstellar travel (maybe?) will one day give us answers of all the questions we have about stars and universe.

This is what our final spectrum looks like.

□ Other (specify):
Project Summary:

During this summer, I worked with Prof. Galvez on the optical polarization of Gaussian Beams. Gaussian beam is one kind of light beam that follows Gaussian Distribution. The center of the beam is the brightest, and the intensity (brightness) decreases when it goes further from the center. Light essentially is electromagnetic wave that has oscillating magnetic and electric fields, which point in certain directions, perpendicular to the propagation direction. In our lab, we used half-wave plate, polarizers and other optical equipment to manipulate the direction of the propagating field. Then we tried to combine the lights beams to make interference pattern, from which one can see fringes of light in the images taken by a highly sensitive camera. By analyzing the data taken by the camera, we finally got the Mobius polarization of light in 3-D. What we saw from the camera is its surface projection. At the beginning we built up a setup with a better Spatial Light Modulator (SLM). The complete graph (not to is shown in fig.1. First, we a set of lenses to expand beam by 2 times. Then we the beam into two with a splitter. The beams are diffracted by the SLM to become two doughnut-shaped beams. The SLM was programmed by a MATLAB script to manipulate the incoming light and to change its mode. Then we used another beam splitter to make the two beams meet each other at the camera. The beams are circularly polarized with different chirality. We took groups of images by changing various $\ell$ combinations.

Two graphs, fig.2 (1) and fig.2 (2), to the right were taken by the camera with different $\ell$ combinations. The index $\ell$ represents the azimuthal order. The larger the absolute value of $\ell$ is, the bigger the donuts diffracted from the SLM appears. Our camera took images of the interference of donut shaped light beams with different $\ell_1$ and $\ell_2$ that exhibited the shape of a fork with fringes around the center of the image. The number of the branches on the fork images is determined by the absolute value of $\ell = |\ell_1 - \ell_2|$. A program was written to analyze the images taken by the camera. The resulting images were compared to the images generated by our simulation program. Based on the theory of interference, we could simulate two Laguerre Gaussian beam to superimpose on each other to create fringes and forks. We extracted the Mobius strip from the images. The number of the twists is determined by the parity of $\ell = |\ell_1 - \ell_2|$. From the graph fig.2 (1), $(1, 0)$ has an odd number of twists while, in fig.2 (2), $(1, -1)$ has an even number of twists, which is consistent with our prediction.

Concentration(s): Mathematics; Economics

Faculty Mentor: Takao Kato  
Department: Economics

Title of Project: Labor Turnover and Ability: Four Case Studies of Manufacturing Factories in China and the U.S.

Project Summary:

The relationship between ability and turnover decisions has long been considered an important issue in labor economics, and different types of labor turnover could lead to a positive impact or negative consequences for firms. Positive labor turnover eliminates inept workers while creating more opportunities for high-ability workers to get promoted within the firm and hence motivating them to remain in the firm and work harder and more smartly. It follows that the overall efficiency of the firm will improve. On the other hand, negative labor turnover causes the organization to lose its high-ability workers and brings down the overall average workforce ability in the long-term. To distinguish between these two types of turnover requires a deep understanding of how people with different ability levels make their decisions to quit. My study of the relationship between ability and turnover can help practitioners of human resource management formulate better-targeted incentive programs, recruit better-fitted new workers, and then increase the firm’s overall productivity and profitability.

The econometric case study method was adopted for this research. It is an emerging research method in labor economics that employs econometric methods and focuses on a single organization. The unit of analysis is individual workers within the same organization. Unlike most economics research, the case study method is based on field work and analyzes internal data obtained through interactions between researchers and their research subjects. Previous empirical studies of the effects of worker productivity on turnover have been restricted by the lack of match-specific productivity data. The econometric case study enables researchers to access such data and hence test theories of turnover with rigor.

In this study, I analyzed individual-level panel data of the daily productivity of workers. This summer, I mainly focused on a light manufacturing firm in central New York. Workers’ performance was measured by their average success rates: non-defective output divided by total output. My major findings are the following. In a firm where good performance is not rewarded and bad performance is not punished, higher-quality workers are more likely to voluntarily separate from the firm. A one-percent increase in average success rates can increase the propensity to quit by 8.8 percent; moreover, having a college education amplifies the degree of adverse selection in this firm. Then, we investigated if productivity has differential effects on people holding opposite subjective opinions towards their jobs. The results are significant among workers who disagree with each of the following two statements: "my effort affects my wages" and "I feel stress at work." Adverse selection (high-productivity workers are more likely to quit than low-productivity workers, all other things being equal) is less apt to happen among workers who believe that their efforts affect wages are less affected by being a high-performance worker and feel stress at work. Other meaningful findings include male workers have a higher proportion of people who quit and aging reduces the propensity of quitting.

In conclusion, the worker's propensity to quit is positively correlated with his productivity, and the productivity effect is shown to be stronger among workers who are highly educated, feel less stress, and believe that their efforts are not rewarded properly. Future research in other contexts is needed to enhance my study’s external validity.

Source of Support:  
☐ AHUM Div.  ☐ NASC Div.  ☒ SOSC Div.  ☐ UNST Div.  
☐ Other (specify):
Research Fellow: Ryan Zoellner (2020) Concentration(s): Philosophy and Religion; Political Science
Faculty Mentor: Robert Kraynak Department(s): POSC; Center for Freedom and Western Civilization
Title of Project: Leo Strauss and the Revival of Classical Political Philosophy

Project Summary:
My summer research project for the Colgate Center for Freedom and Western Civilization centered around an intensive study of the life, intellectual influences, and philosophy of Leo Strauss. My day-to-day work consisted of reading eight texts by Strauss, two about his life and influence in the modern world, as well as a number of works from the Classical world. This examination of Classical texts was necessary to understand the style of scholarship Strauss endorsed—a revival of intensive, esoteric reading—and to have experience with some of the texts that Strauss devoted so much intellectual energy to understanding. I met to discuss my research with my faculty advisor, Professor Kraynak, once a week and ultimately wrote a thesis paper entitled “Modern Malaise and Classical Revival in Leo Strauss, or Vegetarianism and Cannibalism: Beyond a Matter of Taste”. The focus of this paper is Strauss’ attempts to address the problem of modern relativism via his reexamination of Classical texts. The paper provides an intellectual background of Strauss, explications of some of his seminal theories and subjects of study, as well as my own personal response to Strauss’ solution to modernity. At the end of July, I attended a conference at the CEVRO Institute in Prague, Czech Republic where I participated in discussions concerning some of Strauss’ work (particularly regarding modern political science) as well as broader topics in political science.

Leo Strauss was a German Jewish political philosopher who lived from 1899 - 1973). While he spent his younger years in German academia, he left Germany for France and later the United States in the 1930's. He later earned tenure as a professor at the University of Chicago—the intellectual home for his school of thought to this day. Throughout his career, Leo Strauss sought to address the “theologico-political problem” (in other words, is reason or revelation the basis for politics and natural rights?), as well as issues in Classical cosmology, fact/value distinction, ancient esotericism, medieval Platonism, and the genesis and history of political philosophy. My paper addresses each of these endeavors individually. The Straussian school of thought is defined by its highly comprehensive examination of the Greek Classics, zetetic (non-doctrinaire) Platonism, belief in classical natural right, and rejection of modern subjectivism. The ranks of the Straussians include: Allan Bloom, Leon Kass, Thomas Pangle, and Harvey Mansfield.

In my view, Strauss’ life and work was dedicated to finding a response to relativism—what I mean in my paper by “the modern malaise”. In doing so, Strauss consulted a number of authorities ranging from medieval Jewish and Islamic philosophy, to the Bible of Christianity, to the Ancients of Classical Greece. While he spent much time deliberating on the conflict between “Athens and Jerusalem” (the mutually exclusive clash between philosophy and religion), Strauss ultimately arrived at the conclusion that the solution to modern relativism—by which he means to indict historicism, and nihilism as well—is a recovery of Classical knowledge. This revival in the Classics was Strauss’ main intellectual project and continues to be a central fixture of the Straussian intellectual school.

While it is difficult to pin down an exact account of morality in Strauss’ work—some argue there is no such account—one of the primary hallmarks of Strauss’ moral thought is Natural Right (the notion that there are certain immutable principles of right and wrong grounded in human nature that apply universally). The ancients derived these principles from their investigation of first things and thought of them as the basis of justice and virtue universally. Strauss saw natural right as the only means of turning the tide of moral relativism and guiding humanity to virtue.

In my analysis, I take issue with the fundamentally aristocratic and inegalitarian elements of the Classical solution. Thinkers like Aristotle and Plato saw democracy as an affront to their most perfect system of government, a regime of virtue, and would certainly balk at modern attempts to enfranchise less virtuous and educated citizens. While I agree with Strauss that relativism is pernicious to modern man, I also feel that the classical solution is in tension with modern liberal democracy. I conclude my paper by defending the 20th century notion of fusionism (the idea that the individual rights of liberal democracy and virtue can check one another to produce the most effective political order) as the most suitable solution for modern politics. By the end of my summer research I came to the conclusion that an objectively and thus naturally virtuous society can exist, so long as all of its constituents have the ability to choose virtue.

Source of Support: ☑ AHUM Div. ☑ NASC Div. ☑ SOSC Div. ☑ UNST Div. ☑ Other (specify): Center for Freedom and Western Civilization (Stone Summer Research Fund)
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: 177

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

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africana and Latin American Studies</td>
<td>1</td>
</tr>
<tr>
<td>Anthropology</td>
<td>2</td>
</tr>
<tr>
<td>Applied Math</td>
<td>2</td>
</tr>
<tr>
<td>Art and Art History</td>
<td>3</td>
</tr>
<tr>
<td>Asian Studies</td>
<td>1</td>
</tr>
<tr>
<td>Astrogeophysics</td>
<td>2</td>
</tr>
<tr>
<td>Astronomy/Physics</td>
<td>6</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>1</td>
</tr>
<tr>
<td>Biology</td>
<td>17</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Chinese</td>
<td>1</td>
</tr>
<tr>
<td>Classical Studies</td>
<td>1</td>
</tr>
<tr>
<td>Computer Science</td>
<td>15</td>
</tr>
<tr>
<td>Computer Science/Mathematics</td>
<td>1</td>
</tr>
<tr>
<td>Economics</td>
<td>7</td>
</tr>
<tr>
<td>Educational Studies</td>
<td>6</td>
</tr>
<tr>
<td>English</td>
<td>5</td>
</tr>
<tr>
<td>Environmental Biology</td>
<td>2</td>
</tr>
<tr>
<td>Environmental Economics</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Geography</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>8</td>
</tr>
<tr>
<td>French</td>
<td>1</td>
</tr>
<tr>
<td>Geography</td>
<td>10</td>
</tr>
<tr>
<td>Geology</td>
<td>7</td>
</tr>
<tr>
<td>History</td>
<td>6</td>
</tr>
<tr>
<td>International Relations</td>
<td>4</td>
</tr>
<tr>
<td>Japanese</td>
<td>1</td>
</tr>
<tr>
<td>Mathematical Economics</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10</td>
</tr>
<tr>
<td>Molecular Biology</td>
<td>11</td>
</tr>
<tr>
<td>Music</td>
<td>3</td>
</tr>
<tr>
<td>Native American Studies</td>
<td>1</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>16</td>
</tr>
<tr>
<td>Peace and Conflict Studies</td>
<td>5</td>
</tr>
<tr>
<td>Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy and Religion</td>
<td>2</td>
</tr>
<tr>
<td>Physics</td>
<td>15</td>
</tr>
<tr>
<td>Political Science</td>
<td>6</td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Religion</td>
<td>1</td>
</tr>
<tr>
<td>Russian and Eurasian Studies</td>
<td>2</td>
</tr>
<tr>
<td>Sociology</td>
<td>3</td>
</tr>
<tr>
<td>Spanish</td>
<td>1</td>
</tr>
<tr>
<td>Undeclared</td>
<td>11</td>
</tr>
<tr>
<td>Women’s Studies</td>
<td>3</td>
</tr>
<tr>
<td>Category</td>
<td>Count</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Arts and Humanities</strong></td>
<td>22</td>
</tr>
<tr>
<td>Art and Art History</td>
<td>3</td>
</tr>
<tr>
<td>Chinese</td>
<td>1</td>
</tr>
<tr>
<td>Classical Studies</td>
<td>1</td>
</tr>
<tr>
<td>English</td>
<td>5</td>
</tr>
<tr>
<td>French</td>
<td>1</td>
</tr>
<tr>
<td>Japanese</td>
<td>1</td>
</tr>
<tr>
<td>Music</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy and Religion</td>
<td>2</td>
</tr>
<tr>
<td>Religion</td>
<td>1</td>
</tr>
<tr>
<td>Spanish</td>
<td>1</td>
</tr>
<tr>
<td><strong>Natural Sciences and Mathematics</strong></td>
<td>113</td>
</tr>
<tr>
<td>Applied Math</td>
<td>2</td>
</tr>
<tr>
<td>Astrogeophysics</td>
<td>2</td>
</tr>
<tr>
<td>Astronomy/Physics</td>
<td>6</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>1</td>
</tr>
<tr>
<td>Biology</td>
<td>17</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>Computer Science</td>
<td>15</td>
</tr>
<tr>
<td>Computer Science/Mathematics</td>
<td>1</td>
</tr>
<tr>
<td>Geology</td>
<td>7</td>
</tr>
<tr>
<td>Mathematical Economics</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10</td>
</tr>
<tr>
<td>Molecular Biology</td>
<td>11</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>16</td>
</tr>
<tr>
<td>Physics</td>
<td>15</td>
</tr>
<tr>
<td>Psychology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Social Sciences</strong></td>
<td>44</td>
</tr>
<tr>
<td>Anthropology</td>
<td>2</td>
</tr>
<tr>
<td>Economics</td>
<td>7</td>
</tr>
<tr>
<td>Educational Studies</td>
<td>6</td>
</tr>
<tr>
<td>Geography</td>
<td>10</td>
</tr>
<tr>
<td>History</td>
<td>6</td>
</tr>
<tr>
<td>International Relations</td>
<td>4</td>
</tr>
<tr>
<td>Political Science</td>
<td>6</td>
</tr>
<tr>
<td>Sociology</td>
<td>3</td>
</tr>
<tr>
<td><strong>University Studies</strong></td>
<td>25</td>
</tr>
<tr>
<td>Africana and Latin American Studies</td>
<td>1</td>
</tr>
<tr>
<td>Asian Studies</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Biology</td>
<td>2</td>
</tr>
<tr>
<td>Environmental Economics</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Geography</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>8</td>
</tr>
<tr>
<td>Native American Studies</td>
<td>1</td>
</tr>
<tr>
<td>Peace and Conflict Studies</td>
<td>5</td>
</tr>
<tr>
<td>Russian and Eurasian Studies</td>
<td>2</td>
</tr>
<tr>
<td>Women’s Studies</td>
<td>3</td>
</tr>
<tr>
<td><strong>Undeclared</strong></td>
<td>11</td>
</tr>
</tbody>
</table>
Distribution of Students by Faculty Division and Department:

(Number is greater than total number of participating students due to jointly supervised projects)

<table>
<thead>
<tr>
<th>Faculty Division</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arts and Humanities</strong></td>
<td>6</td>
</tr>
<tr>
<td>Art and Art History</td>
<td>2</td>
</tr>
<tr>
<td>East Asian Languages and Literatures</td>
<td>2</td>
</tr>
<tr>
<td>English</td>
<td>1</td>
</tr>
<tr>
<td>Religion</td>
<td>1</td>
</tr>
<tr>
<td><strong>Natural Sciences and Mathematics</strong></td>
<td>105</td>
</tr>
<tr>
<td>Biology</td>
<td>27</td>
</tr>
<tr>
<td>Chemistry</td>
<td>6</td>
</tr>
<tr>
<td>Computer Science</td>
<td>17</td>
</tr>
<tr>
<td>Geology</td>
<td>11</td>
</tr>
<tr>
<td>Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>Neuroscience</td>
<td>7</td>
</tr>
<tr>
<td>Physics</td>
<td>2</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>23</td>
</tr>
<tr>
<td>Psychology</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social Sciences</strong></td>
<td>29</td>
</tr>
<tr>
<td>Anthropology</td>
<td>2</td>
</tr>
<tr>
<td>Economics</td>
<td>2</td>
</tr>
<tr>
<td>Educational Studies</td>
<td>5</td>
</tr>
<tr>
<td>Geography</td>
<td>7</td>
</tr>
<tr>
<td>History</td>
<td>4</td>
</tr>
<tr>
<td>Political Science</td>
<td>7</td>
</tr>
<tr>
<td>Sociology</td>
<td>2</td>
</tr>
<tr>
<td><strong>University Studies</strong></td>
<td>11</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>4</td>
</tr>
<tr>
<td>Film and Media Studies</td>
<td>2</td>
</tr>
<tr>
<td>Native American Studies</td>
<td>1</td>
</tr>
<tr>
<td>Peace and Conflict Studies</td>
<td>2</td>
</tr>
<tr>
<td>Writing and Rhetoric</td>
<td>2</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>45</td>
</tr>
<tr>
<td>Center for Freedom and Western Civilization</td>
<td>4</td>
</tr>
<tr>
<td>Lampert Institute for Civic and Global Affairs</td>
<td>10</td>
</tr>
<tr>
<td>New York Six Liberal Arts Consortium</td>
<td>2</td>
</tr>
<tr>
<td>Research Council</td>
<td>2</td>
</tr>
<tr>
<td>Upstate Institute</td>
<td>27</td>
</tr>
</tbody>
</table>
## Distribution of Students by Funding Source

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal</strong></td>
<td>122</td>
</tr>
<tr>
<td>Center for Freedom and Western Civilization</td>
<td>4</td>
</tr>
<tr>
<td>Division of the Arts and Humanities</td>
<td>4</td>
</tr>
<tr>
<td>Division of Natural Sciences and Mathematics</td>
<td>52</td>
</tr>
<tr>
<td>Division of Social Sciences</td>
<td>14</td>
</tr>
<tr>
<td>Division of University Studies</td>
<td>7</td>
</tr>
<tr>
<td>Lampert Institute for Civic and Global Affairs</td>
<td>10</td>
</tr>
<tr>
<td>New York Six Liberal Arts Consortium</td>
<td>2</td>
</tr>
<tr>
<td>Research Council</td>
<td>2</td>
</tr>
<tr>
<td>Upstate Institute</td>
<td>27</td>
</tr>
<tr>
<td><strong>Endowed</strong></td>
<td>52</td>
</tr>
<tr>
<td>Bob Linsley/James McLelland Fund</td>
<td>2</td>
</tr>
<tr>
<td>Doug Rankin '53 Endowment-Appalachian Research</td>
<td>2</td>
</tr>
<tr>
<td>Doug Rankin '53 Endowment-Geology Research</td>
<td>3</td>
</tr>
<tr>
<td>Hackett-Rathmell 1968 Memorial Fund</td>
<td>3</td>
</tr>
<tr>
<td>Holden Endowment Fund</td>
<td>2</td>
</tr>
<tr>
<td>J. Curtiss Taylor '54 Endowed Student Research Fund</td>
<td>2</td>
</tr>
<tr>
<td>Justus '43 and Jayne Schlichting Student Research Fund</td>
<td>13</td>
</tr>
<tr>
<td>Michael J. Wolk '60 Heart Foundation</td>
<td>8</td>
</tr>
<tr>
<td>Miller-Cochran Fund</td>
<td>3</td>
</tr>
<tr>
<td>Norma Vergo Prize</td>
<td>4</td>
</tr>
<tr>
<td>Oberheim Memorial Fund</td>
<td>2</td>
</tr>
<tr>
<td>Picker Interdisciplinary Science Institute</td>
<td>4</td>
</tr>
<tr>
<td>Walter Broughton '63 Research Fund</td>
<td>1</td>
</tr>
<tr>
<td>Warren Anderson Fund</td>
<td>3</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td>12</td>
</tr>
<tr>
<td>American Chemical Society Petroleum Research Fund</td>
<td>1</td>
</tr>
<tr>
<td>Beckman Scholar Program</td>
<td>2</td>
</tr>
<tr>
<td>NASA / New York Space Grant</td>
<td>1</td>
</tr>
<tr>
<td>National Institutes of Health (NIH) Area Grant</td>
<td>2</td>
</tr>
<tr>
<td>National Science Foundation Grant</td>
<td>6</td>
</tr>
</tbody>
</table>
Total Number of Participating Faculty: 72

Distribution of Faculty by Division and Department:

**Arts and Humanities**
- Art and Art History: 2
- East Asian Languages and Literatures: 2
- English: 1
- Religion: 1

**Natural Sciences and Mathematics**
- Biology: 10
- Chemistry: 2
- Computer Science: 7
- Geology: 4
- Mathematics: 2
- Neuroscience: 3
- Physics: 1
- Physics and Astronomy: 7
- Psychology: 6

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

**University Studies**
- Environmental Studies: 2
- Film and Media Studies: 1
- Native American Studies: 1
- Peace and Conflict Studies: 2
- Writing and Rhetoric: 1

**Other**
- Center for Freedom and Western Civilization: 1
- Lampert Institute for Civic and Global Affairs: 9
- New York Six Liberal Arts Consortium: 1
- Research Council: 2
- Upstate Institute: 1
Distribution of Faculty by Funding Source

(Faculty with more than one funding source are counted multiple times)

<table>
<thead>
<tr>
<th>Internal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for Freedom and Western Civilization</td>
<td>1</td>
</tr>
<tr>
<td>Division of the Arts and Humanities</td>
<td>4</td>
</tr>
<tr>
<td>Division of Natural Sciences and Mathematics</td>
<td>28</td>
</tr>
<tr>
<td>Division of Social Sciences</td>
<td>11</td>
</tr>
<tr>
<td>Division of University Studies</td>
<td>5</td>
</tr>
<tr>
<td>Lampert Institute for Civic and Global Affairs</td>
<td>9</td>
</tr>
<tr>
<td>New York Six Liberal Arts Consortium</td>
<td>1</td>
</tr>
<tr>
<td>Research Council</td>
<td>2</td>
</tr>
<tr>
<td>Upstate Institute</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Endowed</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob Linsley/James McLelland Fund</td>
<td>2</td>
</tr>
<tr>
<td>Doug Rankin ’53 Endowment-Appalachian Research</td>
<td>2</td>
</tr>
<tr>
<td>Doug Rankin ’53 Endowment-Geology Research</td>
<td>3</td>
</tr>
<tr>
<td>Hackett-Rathmell 1968 Memorial Fund</td>
<td>3</td>
</tr>
<tr>
<td>Holden Endowment Fund</td>
<td>1</td>
</tr>
<tr>
<td>J. Curtiss Taylor ’54 Endowed Student Research Fund</td>
<td>2</td>
</tr>
<tr>
<td>Justus ’43 and Jayne Schlichting Student Research Fund</td>
<td>6</td>
</tr>
<tr>
<td>Michael J. Wolk ’60 Heart Foundation</td>
<td>5</td>
</tr>
<tr>
<td>Miller-Cochran Fund</td>
<td>1</td>
</tr>
<tr>
<td>Norma Vergo Prize</td>
<td>3</td>
</tr>
<tr>
<td>Oberheim Memorial Fund</td>
<td>2</td>
</tr>
<tr>
<td>Picker Interdisciplinary Science Institute</td>
<td>3</td>
</tr>
<tr>
<td>Walter Broughton ’63 Research Fund</td>
<td>1</td>
</tr>
<tr>
<td>Warren Anderson Fund</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Chemical Society Petroleum Research Fund</td>
<td>1</td>
</tr>
<tr>
<td>Beckman Scholar Program</td>
<td>2</td>
</tr>
<tr>
<td>NASA / New York Space Grant</td>
<td>1</td>
</tr>
<tr>
<td>National Institutes of Health (NIH) Area Grant</td>
<td>1</td>
</tr>
<tr>
<td>National Science Foundation Grant</td>
<td>5</td>
</tr>
</tbody>
</table>
## Index

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Page(s)</th>
<th>Student Name</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrams, Kaitlin</td>
<td>19, 24</td>
<td>Dimas, Monica</td>
<td>7, 60</td>
</tr>
<tr>
<td>Ackerman, Ethan</td>
<td>19, 25</td>
<td>Doby, Brandon</td>
<td>2, 61</td>
</tr>
<tr>
<td>Adams, Jacob</td>
<td>19, 26</td>
<td>Donlan, Colleen</td>
<td>20, 62</td>
</tr>
<tr>
<td>Apple, Benjamin “Ben”</td>
<td>2, 27</td>
<td>Dove, Isabel</td>
<td>7, 63</td>
</tr>
<tr>
<td>Arlin, Hayley</td>
<td>19</td>
<td>Duffy, Meghan</td>
<td>8, 64</td>
</tr>
<tr>
<td>Armstrong, George</td>
<td>8, 28</td>
<td>Dumas, Taylor</td>
<td>20, 65</td>
</tr>
<tr>
<td>Ascenzi, Leonardo “Leo”</td>
<td>6, 29</td>
<td>Dutta, Ishir</td>
<td>10</td>
</tr>
<tr>
<td>Barcello, Julia</td>
<td>7, 30</td>
<td>Eckart, Kaitlyn</td>
<td>10, 66</td>
</tr>
<tr>
<td>Becic, Dzenela</td>
<td>19</td>
<td>Eldridge, Jessica “Jess”</td>
<td>20, 67</td>
</tr>
<tr>
<td>Bensky, Jake</td>
<td>8, 31</td>
<td>Emch, Megan</td>
<td>10, 68</td>
</tr>
<tr>
<td>Berardi, Skyler</td>
<td>2, 32</td>
<td>Englehart, Timothy</td>
<td>15, 69</td>
</tr>
<tr>
<td>Bianchi, Gabriella “Gaby”</td>
<td>19, 33</td>
<td>Escobar Acosta, Vanessa</td>
<td>13, 70</td>
</tr>
<tr>
<td>Biggar, Erin</td>
<td>3, 34</td>
<td>Farmer, Sabrina</td>
<td>14, 19, 71</td>
</tr>
<tr>
<td>Bista, Aayam</td>
<td>9, 35</td>
<td>Filer, Hunter</td>
<td>15, 17, 72</td>
</tr>
<tr>
<td>Bousquet, Matthew</td>
<td>5, 36</td>
<td>Gallate, Zachary</td>
<td>16, 51</td>
</tr>
<tr>
<td>Brown, Kaine</td>
<td>12, 37</td>
<td>Geranen, Holly</td>
<td>13, 18, 73</td>
</tr>
<tr>
<td>Brown, Karl</td>
<td>3, 38</td>
<td>Gill, Tanner</td>
<td>3, 74</td>
</tr>
<tr>
<td>Burke, Erin</td>
<td>19, 39</td>
<td>Greco, Angelica</td>
<td>14, 18, 75</td>
</tr>
<tr>
<td>Campbell, Noah</td>
<td>10, 40</td>
<td>Halitjaha, Lambardh “Lumi”</td>
<td>3, 76</td>
</tr>
<tr>
<td>Carney, Megan</td>
<td>19, 41</td>
<td>Handa, Suyash</td>
<td>10, 77</td>
</tr>
<tr>
<td>Castillo, Tiffany</td>
<td>12, 17, 42</td>
<td>Harris, Oliver</td>
<td>5, 36</td>
</tr>
<tr>
<td>Castro, Olivia “Liv”</td>
<td>20, 43</td>
<td>He, Tianyi “Mike”</td>
<td>5, 78</td>
</tr>
<tr>
<td>Cealie, MaKenna</td>
<td>12, 44</td>
<td>Herrick, John “Jack”</td>
<td>10, 79</td>
</tr>
<tr>
<td>Chas, Jacob</td>
<td>13</td>
<td>Holmes, Brianna</td>
<td>10, 80</td>
</tr>
<tr>
<td>Chakrani, Zakaria</td>
<td>20</td>
<td>Horn, Christine</td>
<td>3, 81</td>
</tr>
<tr>
<td>Chapagain, Sandesh</td>
<td>9, 45</td>
<td>Hourbi, Nadia</td>
<td>3, 56</td>
</tr>
<tr>
<td>Chaudhari, Rohan</td>
<td>6, 46</td>
<td>Howie, Robert “Bobbie”</td>
<td>20, 82</td>
</tr>
<tr>
<td>Chen, Harrison</td>
<td>5, 36</td>
<td>Huh, Jin Won “Jin”</td>
<td>10, 83</td>
</tr>
<tr>
<td>Cole, Peyton</td>
<td>3, 47</td>
<td>Hurst, James</td>
<td>2</td>
</tr>
<tr>
<td>Conran, Logan “Cooper”</td>
<td>10, 48</td>
<td>Imessaoudene, Zakaria</td>
<td>16, 84</td>
</tr>
<tr>
<td>Corrigan, Sean</td>
<td>10</td>
<td>Israelit, Max</td>
<td>3</td>
</tr>
<tr>
<td>Coyle, Rosalie “Rosie”</td>
<td>6, 49</td>
<td>Jamil, Asad</td>
<td>6, 85</td>
</tr>
<tr>
<td>Cricillow, Emily</td>
<td>2, 50</td>
<td>Jin, Yinuo “Tayshaun”</td>
<td>8, 86</td>
</tr>
<tr>
<td>Cusick, Maggie</td>
<td>20</td>
<td>Johnson, Lindsey</td>
<td>20, 87</td>
</tr>
<tr>
<td>Danetiu, Julian</td>
<td>16, 51</td>
<td>Kato, Matthew</td>
<td>14, 18, 88</td>
</tr>
<tr>
<td>DeBouter, Alden</td>
<td>16, 52</td>
<td>Kelsey, Benjamin “Ben”</td>
<td>17, 89</td>
</tr>
<tr>
<td>De Leo, Matthew “Matt”</td>
<td>15, 17, 53</td>
<td>Kidd, Jourdan</td>
<td>3, 90</td>
</tr>
<tr>
<td>Derbyshire, Lindsey</td>
<td>6, 54</td>
<td>Kim, Woohee</td>
<td>13, 18, 91</td>
</tr>
<tr>
<td>Derrenbacker, Andrew “Drew”</td>
<td>15, 17, 55</td>
<td>King, Christopher “Chris”</td>
<td>6, 92</td>
</tr>
<tr>
<td>de Silva, Ryan</td>
<td>10</td>
<td>Klare, Molly</td>
<td>3, 90</td>
</tr>
<tr>
<td>Dexter, Sony</td>
<td>3, 56</td>
<td>Kong, Carmen</td>
<td>2, 93</td>
</tr>
<tr>
<td>Dhanraj, Ravendra</td>
<td>9, 57</td>
<td>Kozlowski, Natalie</td>
<td>8, 63</td>
</tr>
<tr>
<td>Dhawka, Priyadarshinee “Priya”</td>
<td>17, 18, 58</td>
<td>Langenderfer, Abigail “Abbey”</td>
<td>16, 94</td>
</tr>
<tr>
<td>Dillon, Kyle</td>
<td>15, 17, 59</td>
<td>LaPan, Mark</td>
<td>8, 95</td>
</tr>
<tr>
<td>Student Name</td>
<td>Page(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li, Peishan “Lillian”</td>
<td>14, 96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li, Xiaohan</td>
<td>9, 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberman, Amanda</td>
<td>4, 76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin, Jack</td>
<td>6, 97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin, Yimei</td>
<td>4, 98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu, Jichen “Ed”</td>
<td>5, 99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobban, Romario</td>
<td>11, 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mahmood, Ahsan</td>
<td>6, 54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marr, Jeffrey</td>
<td>20, 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matulka, Patrick</td>
<td>11, 102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McCann, MaryKathryn</td>
<td>4, 34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McLaughlin, Dylann</td>
<td>20, 87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mehanna, Nezar</td>
<td>4, 103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melendez, Cynthia</td>
<td>13, 104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mikus, Aleksandra “Sasha”</td>
<td>14, 105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miranda, Markus</td>
<td>5, 106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitchell, Rebecca “Bec”</td>
<td>6, 107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mohamed, Nader</td>
<td>4, 108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moroney, Erin</td>
<td>9, 109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray, Kathleen “Katie”</td>
<td>12, 110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needham, Revée</td>
<td>20, 111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nelsen, Margaret</td>
<td>12, 112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newmann, Emma</td>
<td>14, 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nguyen, Anh “Julie”</td>
<td>13, 114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nguyen, Phuong “Alicia”</td>
<td>2, 115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nie, Can “Alexandra”</td>
<td>6, 116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olson, Cassady</td>
<td>9, 45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ormel, Shannon</td>
<td>21, 117</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padula, Allegra</td>
<td>4, 118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paolini, Stephen</td>
<td>11, 119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patel, Dhara</td>
<td>8, 120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patrina, Jolene</td>
<td>13, 70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paynter, Danielle</td>
<td>9, 121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilawa, Jacob</td>
<td>11, 122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pluff, Annina “Anna”</td>
<td>15, 123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qin, Yingsi “Tiffany”</td>
<td>7, 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raemer, Ashlea</td>
<td>21, 124</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raphitis, Sotirios “Soto”</td>
<td>15, 125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reed, Michael</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhodehouse, Kyle</td>
<td>4, 126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ringel, Benjamin “Ben”</td>
<td>15, 18, 127</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rios, Ryan</td>
<td>7, 116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rodrigues Faria Brighenti, Caio</td>
<td>8, 128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roundy, Renee</td>
<td>13, 129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruff, Tessa</td>
<td>9, 130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rykaczewski, Victoria</td>
<td>21, 131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sabyr, Alina</td>
<td>11, 132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sale, Zoe</td>
<td>8, 128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santiago, Jonathan</td>
<td>11, 133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherry, Derek</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrestha, Ruchit</td>
<td>7, 54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sia, Tiong Hua “Andy”</td>
<td>21, 135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sim, Ho Jun “Paul”</td>
<td>12, 136</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smalley, Paige</td>
<td>16, 137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stahlin, Ryan</td>
<td>11, 138</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong, Catharine</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunshine, Sierra</td>
<td>16, 139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vassolas, Michael “Mike”</td>
<td>5, 145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violette, Alicia</td>
<td>21, 146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitaro, Elizabeth</td>
<td>5, 147</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vu, Ha</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waltz, Susan</td>
<td>21, 148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wang, Zhanling “Annie”</td>
<td>17, 18, 58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wasserman, Jacob</td>
<td>14, 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watkins, Emerson “Emmy”</td>
<td>2, 149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaver, Emily</td>
<td>8, 128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wellington, Emma</td>
<td>5, 150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetsman, Ryan</td>
<td>7, 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Williams, Faith</td>
<td>11, 151</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winward, Joshua “Josh”</td>
<td>5, 152</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wong, Emily</td>
<td>21, 153</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wongso, Samto</td>
<td>14, 18, 154</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu, Chenglu</td>
<td>12, 155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yang, Seung-Ah</td>
<td>14, 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yates, Gabrielle “Gabby”</td>
<td>14, 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yefipanova, Yekaterina “Katya”</td>
<td>15, 105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yu, Ryan</td>
<td>7, 97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zhang, Saiyang “Sylvan”</td>
<td>12, 156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zhou, Baiyu “Bonnie”</td>
<td>13, 157</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinyama, Tinotenda “Tino”</td>
<td>7, 92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoellner, Ryan</td>
<td>15, 17, 158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty Name</td>
<td>Page(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adams, Aubreya</td>
<td>7, 8, 60, 86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albert, Neil</td>
<td>12, 112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anderson, Benjamin</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ay, Ashmet</td>
<td>3, 4, 8, 9, 28, 76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balonek, Thomas</td>
<td>10, 11, 66, 122, 138</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bary, Jeffrey “Jeff”</td>
<td>10, 11, 12, 68, 132, 155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benson, Janel</td>
<td>15, 17, 69, 72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brice, Jennifer</td>
<td>2, 149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardelús, Catherine</td>
<td>3, 56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chianese, Anthony</td>
<td>5, 78, 99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cipolli, William</td>
<td>8, 9, 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooley, Erin</td>
<td>12, 37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crespi, John</td>
<td>2, 93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyer, Rebecca</td>
<td>12, 37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourquet, Elodie</td>
<td>6, 7, 49, 92, 107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frey, Frank</td>
<td>3, 5, 81, 150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvez, Enrique “Kiko”</td>
<td>9, 10, 11, 12, 35, 48, 151, 156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gember-Jacobson, Aaron</td>
<td>6, 7, 19, 54, 144</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hansen, Bruce C.</td>
<td>9, 45, 121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harpp, Karen</td>
<td>8, 17, 89, 128</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay, Michael</td>
<td>6, 85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holm, Geoffrey “Geoff”</td>
<td>2, 3, 27, 74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hoopes, Barbara</td>
<td>3, 4, 5, 47, 98, 142, 147</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jimenez, Ana</td>
<td>3, 4, 5, 34, 38, 143, 152</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kato, Takao</td>
<td>13, 157</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keith, Jason</td>
<td>5, 36, 106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kraly, Ellen</td>
<td>14, 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kraly, Scott</td>
<td>12, 17, 42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kraynak, Robert</td>
<td>15, 17, 53, 55, 59, 158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane, Penny</td>
<td>2, 61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leventer, Amy</td>
<td>7, 8, 63, 64, 95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levine, Jonathan</td>
<td>10, 77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liu, Wan-chun</td>
<td>12, 44, 110, 136</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loranty, Michael</td>
<td>14, 19, 71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorenz, Carol Ann</td>
<td>16, 139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lupton, Danielle</td>
<td>15, 18, 127</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McCay, Timothy “Tim”</td>
<td>16, 51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McVaugh, Robert “Bob”</td>
<td>2, 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metzler, Rebecca</td>
<td>10, 11, 79, 80, 133, 140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meyer, William</td>
<td>14, 18, 154</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meyers, Jason</td>
<td>3, 8, 57, 90, 109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morkevicius, Valerie</td>
<td>15, 125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mundy, Jacob</td>
<td>16, 84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nemes, Robert</td>
<td>14, 18, 88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palmer, John</td>
<td>13, 129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parks, Beth</td>
<td>10, 11, 83, 102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peck, William</td>
<td>7, 8, 30, 120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramachandran, Vijay</td>
<td>6, 7, 97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rios-Rojas, Anne “Anna”</td>
<td>13, 18, 91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robinson, David</td>
<td>14, 96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scull, Peter</td>
<td>14, 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segall, Kenneth “Ken”</td>
<td>11, 100, 119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seymour, Jenessa</td>
<td>12, 141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shain, Barry</td>
<td>15, 123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shever, Elana</td>
<td>13, 70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simonson, Mary</td>
<td>16, 52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smith, Madeline E.</td>
<td>6, 7, 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sommers, Joel</td>
<td>6, 7, 116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring, Suzanne</td>
<td>17, 18, 58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stahlberg, Ben</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stern, Mark</td>
<td>13, 104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stevens, Kira</td>
<td>14, 15, 105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strash, Darren</td>
<td>6, 46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taye, Bineym</td>
<td>4, 103, 108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taylor, Ashley</td>
<td>13, 18, 73, 114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tseng, Linda</td>
<td>10, 16, 40, 94, 137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Van Wynsberghe, Priscilla</td>
<td>2, 4, 32, 118, 126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wang, Jing</td>
<td>2, 115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watkins, James “Eddie”</td>
<td>3, 4, 5, 145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yamamoto, Daisaku “Dai”</td>
<td>14, 18, 75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yoshino, Jun</td>
<td>9, 130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>