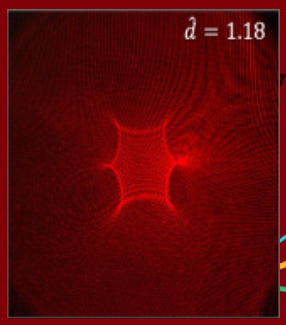

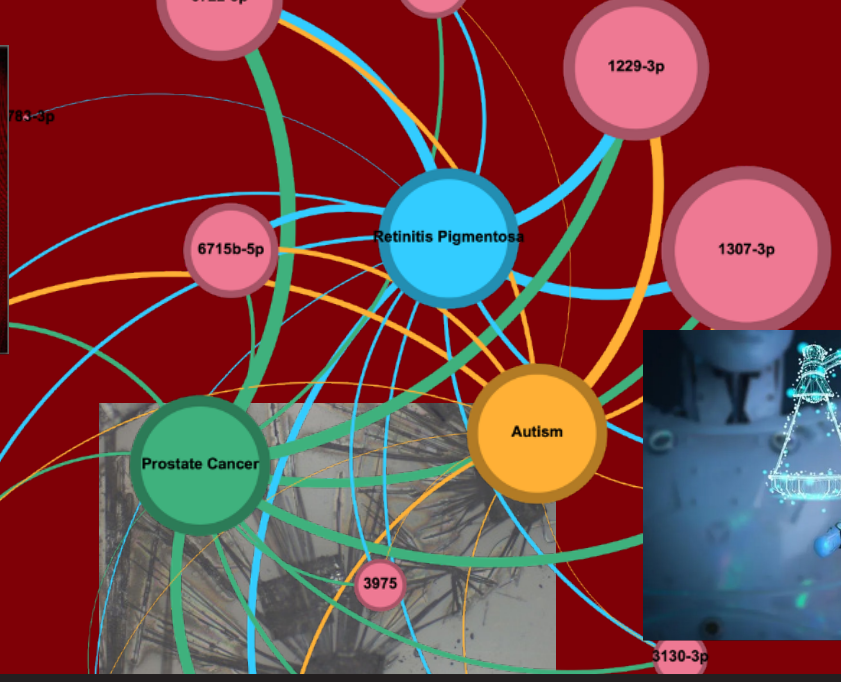

Figure 1. Image of me in the field with site 24AUAMK008 behind me

COLGATE UNIVERSITY

SUMMER UNDERGRADUATE RESEARCH DIRECTORY

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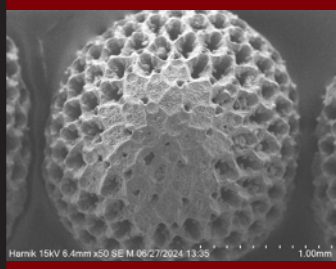
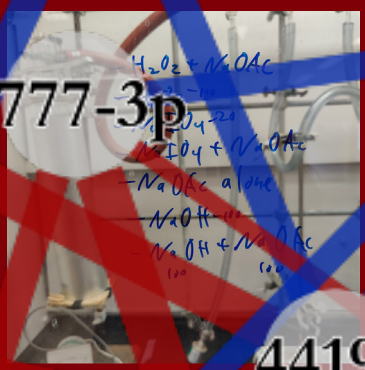
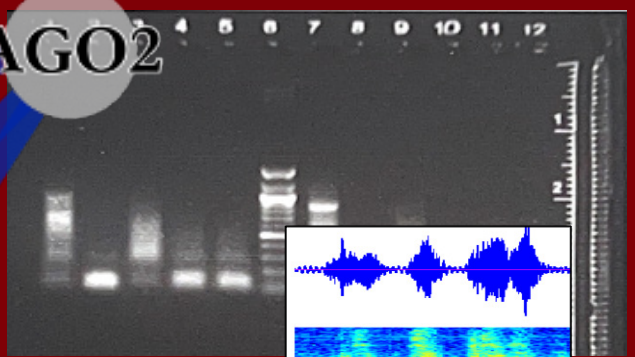
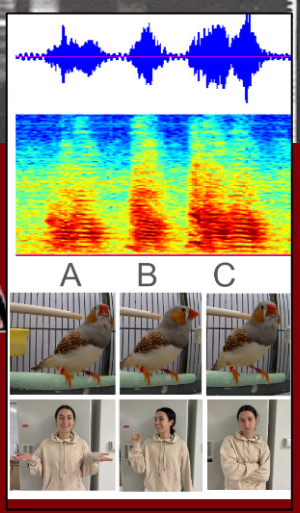
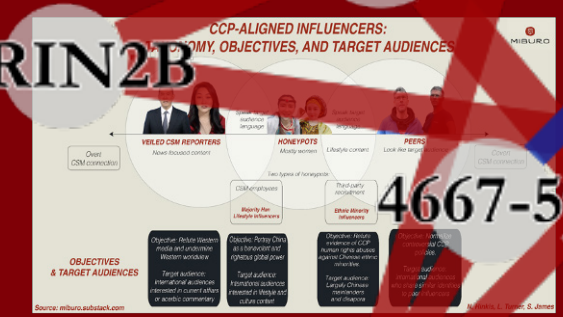
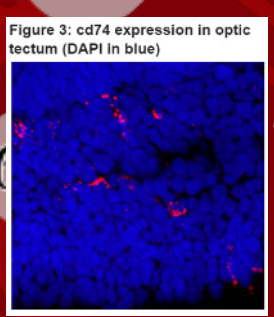












Cover photos: Each of these images was taken from student abstracts found in this 2024 Directory.
A special thanks to Mona Dunn for creating the front cover and for compiling the research directory.

Colgate University Summer Undergraduate Research Directory

Volume 31
2024

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

List of Participants

DIVISION OF ARTS AND HUMANITIES (AHUM)

Department of East Asian Languages and Literatures

Research Fellow: Evelyn Gao 2026 (Mathematical Economics)
Faculty Mentor: John Crespi (East Asian Languages & Literatures; Asian Studies)
Title of Project: *Can You Measure Satire? A Quantitative Study of Online Cartoons from China*
Funding Source: J. Curtiss Taylor ’54 Endowed Student Research Fund

Research Fellow: Moureen Gao 2025 (History)
Faculty Mentor: Jing Wang (East Asian Languages & Literatures)
Title of Project: *The Development and Decline of Female Official System in Ming China*
Funding Source: SOSC Division

Research Fellow: Jordan Shapiro 2026 (Japanese)
Faculty Mentor: Yukari Hirata (East Asian Languages & Literatures)
Title of Project: *Gesture and emotional affect: Do they play a role in L2 Japanese pitch accent acquisition?*
Funding Source: J. Curtiss Taylor ’54 Endowed Student Research Fund

Department of English

Research Fellow: Samanta Kost 2025 (English)
Faculty Mentor: Jennifer Brice (English)
Title of Project: *Living Writers*
Funding Source: AHUM Division

Research Fellow: Toby Wolfson 2025 (English; Religion)
Faculty Mentor: Jennifer Brice (English)
Title of Project: *Living Writers*
Funding Source: AHUM Division

Department of Philosophy

Research Fellow: Alexa Watson 2026 (Philosophy; Political Science)
Faculty Mentor: Hibi Pendleton (Philosophy)
Title of Project: *Uncovering the Ethical Challenges and Implications of AI to the US Judiciary and Legal Profession*
Funding Source: Center for Freedom and Western Civilization

Department of Religion

Research Fellow: Ellen Weinstock 2026 (Religion; Political Science)
Faculty Mentor: Megan Abbas (Religion)
Title of Project: *Religion and US Foreign Policy in Indonesia*
Funding Source: J. Curtiss Taylor ’54 Endowed Student Research Fund

Research Fellow: Natalie Yale 2026 (Religion)
Faculty Mentor: Megan Abbas (Religion)
Title of Project: *Religion and US Foreign Policy in Indonesia*
Funding Source: J. Curtiss Taylor ’54 Endowed Student Research Fund

DIVISION OF NATURAL SCIENCES AND MATHEMATICS (NASC)

Department of Biology

Research Fellow: Maya Albright 2026 (Biology)
Faculty Mentor: Jason Meyers (Biology; Neuroscience)
Title of Project: *Regeneration of Sensory Cells in Zebrafish is Regulated By Notch & DeltaA Signaling*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Jack Antonson 2027 (Undeclared)
Faculty Mentor: Eddie Watkins (Biology)
Title of Project: *What Factors Influence the Distribution of Three Common Temperate Northeastern Ferns?*
Funding Source: National Science Foundation Grant

Research Fellow: Jack Bennink 2025 (Environmental Studies; Biology)
Faculty Mentor: Ana Jimenez (Biology)
Title of Project: *Histological changes in muscle structure in birds*
Funding Source: NASC Division

Research Fellow: Ava Benton 2025 (Environmental Biology; Philosophy)
Faculty Mentor: Krista Ingram (Biology)
Title of Project: *SealNet: Facial Recognition and Genetic Tools for Harbor Seal Conservation*
Funding Source: Oberheim Memorial Fund

Research Fellow: Michelle Du 2025 (Environmental Biology)
Faculty Mentor: Therese Frauendorf (Biology)
Title of Project: *Why is hippo dung important to river invertebrates?*
Funding Source: NASC Division

Research Fellow: Sydney Dunn 2025 (Biology)
Faculty Mentor: Krista Ingram (Biology)
Title of Project: *SealNet: Facial Recognition and Genetic Tools for Harbor Seal Conservation*
Funding Source: NASC Division

Research Fellow: Cammy Foster 2025 (Molecular Biology)
Faculty Mentor: Geoff Holm (Biology)
Title of Project: *The interferon-stimulated gene Shiftless restricts reovirus infection*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Kevin Fuentes Gonzalez 2027 (Undeclared)
Faculty Mentor: Therese Frauendorf (Biology)
Title of Project: *Why is hippo dung important to river invertebrates?*
Funding Source: NASC Division

Research Fellow: Amanda Harragan 2025 (Biology)
Faculty Mentor: Priscilla Van Wynsberghe (Biology)
Title of Project: *Analyzing the Effect of Circadian Kinase KIN20 on Fertility in C. elegans*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Lilia Hayduchok 2026 (Molecular Biology)
Faculty Mentor: Jason Meyers (Biology; Neuroscience)
Title of Project: *Investigating the Role of Cyclin Dx in Zebrafish Neuromast Regeneration*
Funding Source: NASC Division

Research Fellow: Emmett Hintz 2025 (Economics; Computer Science)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Multi-Stage Prostate Cancer Classification Reveals Key MiRNA Biomarkers With Links To Neurodevelopmental Diseases Through Machine Learning*
Funding Source: NASC Division

Research Fellow: Max Hopkins 2026 (Biology; Psychological Science)
Faculty Mentor: Geoff Holm (Biology)
Title of Project: *The interferon-stimulated gene Shiftless restricts reovirus infection*
Funding Source: NASC Division

Research Fellow: Sia Hu 2026 (Applied Math; Computer Science)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Revealing the differential roles of DeltaC and DeltaD ligands on the segmentation clock dynamics*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Ayub Khan 2025 (Computer Science; Biology)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Machine Learning Uncovers Novel Sex-Specific Dementia Biomarkers Linked to Autism and Eye Diseases*
Funding Source: NASC Division

Research Fellow: Ayub Khan 2025 (Computer Science; Biology)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Multi-Stage Prostate Cancer Classification Reveals Key MiRNA Biomarkers With Links To Neurodevelopmental Diseases Through Machine Learning*
Funding Source: NASC Division

Research Fellow: Grace Kwitek 2026 (Molecular Biology)
Faculty Mentor: Priscilla Van Wynsberghe (Biology)
Title of Project: *External factors influence behaviors via lite-1 to lin-42 signaling pathway in C. elegans*
Funding Source: NASC Division

Research Fellow: Nancy Lei 2026 (Psychological Science; Computer Science/Mathematics)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Nuclei Alignment Detection via Deep Learning and Bioinformatics Algorithm*
Funding Source: NASC Division

Research Fellow: Matt Leopold 2026 (Molecular Biology)
Faculty Mentor: Eddie Watkins (Biology)
Title of Project: *What Factors Influence the Distribution of Three Common Temperate Northeastern Ferns?*
Funding Source: National Science Foundation Grant

Research Fellow: Zach Lightfoot 2026 (Biology)
Faculty Mentor: Ana Jimenez (Biology)
Title of Project: *Summer phenotype House Sparrows (*Passer domesticus*) demonstrate only tissue-level differences in oxidative stress when acclimated to warm, stable cold, and unpredictable cold thermal treatments*
Funding Source: NASC Division

Research Fellow: Trey McDermott 2025 (Neuroscience; Philosophy)
Faculty Mentor: Jason Meyers (Biology; Neuroscience)
Title of Project: *Top-Notch Regeneration in Zebrafish Retinas*
Funding Source: NASC Division

Research Fellow: Abigail McGuire 2026 (Biology; Native American Studies)
Faculty Mentor: Therese Frauendorf (Biology)
Title of Project: *Why is hippo dung important to river invertebrates?*
Funding Source: NASC Division

Research Fellow: Elle Monfort 2025 (Biology)
Faculty Mentor: Geoff Holm (Biology)
Title of Project: *The interferon-stimulated gene Shiftless restricts reovirus infection*
Funding Source: Oberheim Memorial Fund

Research Fellow: Eliza Podlas 2025 (Biology)
Faculty Mentor: Ana Jimenez (Biology)
Title of Project: *Summer phenotype House Sparrows (*Passer domesticus*) demonstrate only tissue-level differences in oxidative stress when acclimated to warm, stable cold, and unpredictable cold thermal treatments*
Funding Source: NASC Division

Research Fellow: Jenavieve Sherwood 2026 (Spanish; Molecular Biology)
Faculty Mentor: Engda Hagos (Biology)
Title of Project: *Investigating the role of Krüppel-like Factor 4 in Cancer Metabolism*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Megan Sullivan 2026 (Molecular Biology)
Faculty Mentor: Engda Hagos (Biology)
Title of Project: *Investigating the Role of KLF4 in Epigenetics*
Funding Source: NASC Division

Research Fellow: Vivian Viacobo 2027 (Undeclared)
Faculty Mentor: Priscilla Van Wynsberghe (Biology)
Title of Project: *Understanding the Role of LIN-42 Regions in KIN-20 Mediated Effects*
Funding Source: NASC Division

Department of Chemistry

Research Fellow: Obsidian Ammons 2026 (Biochemistry; Molecular Biology)
Faculty Mentor: Jenny Peeler (Chemistry)
Title of Project: *AMPylation Activity of SelenoproteinO Homologs*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Sydney Arlin 2026 (Biochemistry)
Faculty Mentor: Jacob Moose (Chemistry)
Title of Project: *Development of Small-Molecule Modulators of Propanediol Dehydratase*
Funding Source: NASC Division

Research Fellow: Ekaterina Balsan 2025 (Chemistry; Classical Studies)
Faculty Mentor: Anne Perring (Chemistry)
Title of Project: *Black carbon time trends as an indicator of changing particulate matter emissions in SoCAB since 2010*
Funding Source: Warren Anderson Fund

Research Fellow: Henry Burdorf 2026 (Biochemistry)
Faculty Mentor: Jenny Peeler (Chemistry)
Title of Project: *AMPylation Activity of SelenoproteinO Homologs*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Carlson Cao 2025 (Biochemistry)
Faculty Mentor: Gongfang Hu (Chemistry)
Title of Project: *Exploration of Bismuth-Palladium Bimetallic Complexes for Catalytic $C(sp^2)$-$C(sp^3)$ Cross-Coupling*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Jaydon Chalichemala 2025 (Biochemistry)
Faculty Mentor: Jason Keith (Chemistry)
Title of Project: *Examination of Fluoride Ion Affinity to Predict Lewis Acid Catalytic Activity for Diels-Alder Reactions*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Samuel Epstein 2026 (Mathematics)
Faculty Mentor: Jacob Moose (Chemistry)
Title of Project: *Development of Small-Molecule Modulators of Propanediol Dehydratase*
Funding Source: NASC Division

Research Fellow: Eva Foketi 2026 (Biochemistry)
Faculty Mentor: Dimitar Shopov (Chemistry)
Title of Project: *Novel Pyridine-Alkoxide Ligands for Iridium Oxo Dimer Formation and Water Oxidation Catalysis*
Funding Source: NASC Division

Research Fellow: Meredith Francis 2025 (Chemistry)
Faculty Mentor: Anthony Chianese (Chemistry)
Title of Project: *Understanding the Mechanism of the Activation of Milstein’s Catalyst*
Funding Source: National Science Foundation Grant

Research Fellow: Jessica Furstein 2025 (Chemistry)
Faculty Mentor: Rick Geier (Chemistry)
Title of Project: *Towards the Development of a TLC Method for Monitoring Porphyrin Forming Reactions, and Comparison to UV-vis and HPLC Methods*
Funding Source: Warren Anderson Fund

Research Fellow: Kim Gates 2026 (Chemistry)
Faculty Mentor: Gongfang Hu (Chemistry)
Title of Project: *Synthesis of Heterobimetallic Bismuth–Nickel Complexes*
Funding Source: John C. Cochran Endowed Fund for Undergraduate Research/NASC Division

Research Fellow: Ekra Hoque 2026 (Biochemistry)
Faculty Mentor: Anthony Chianese (Chemistry)
Title of Project: *Catalytic Hydrogenation of Amide using an RuPNN imine complex*
Funding Source: John C. Cochran Endowed Fund for Undergraduate Research/NASC Division

Research Fellow: Jordan Lazaar 2026 (Chemistry)
Faculty Mentor: Rick Geier (Chemistry)
Title of Project: *Towards the Development of a TLC Method for Monitoring Porphyrin Forming Reactions, and Comparison to UV-vis and HPLC Methods*
Funding Source: John C. Cochran Endowed Fund for Undergraduate Research/NASC Division

Research Fellow: Sophia Lee-Wlodek 2025 (Biochemistry)
Faculty Mentor: Ernie Nolen (Chemistry)
Title of Project: *Studies of Oxime Cyclizations to Synthesize a Tn Antigen Mimic*
Funding Source: Miller-Cochran Fund

Research Fellow: Faye Liu 2026 (Chemistry)
Faculty Mentor: Gongfang Hu (Chemistry)
Title of Project: *Synthesis of T-Shaped Bismuth Complexes for Catalytic Applications*
Funding Source: NASC Division

Research Fellow: Liam McCarthy 2026 (Biochemistry)
Faculty Mentor: Jacob Goldberg (Chemistry)
Title of Project: *Incorporation of Fluorinated Amino Acids into Proteins*
Funding Source: Mind, Brain, and Behavior Scholars Award

Research Fellow: Jason Mrosla 2027 (Biochemistry)
Faculty Mentor: Jacob Goldberg (Chemistry)
Title of Project: *Incorporation of Fluorinated Amino Acids into Proteins*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Robert Ozerdem 2026 (Chemistry)
Faculty Mentor: Gongfang Hu (Chemistry)
Title of Project: *Synthesis of a Planar Bismuth Complex as a Potential Catalyst*
Funding Source: NASC Division

Research Fellow: Brian Pallares 2026 (Biochemistry)
Faculty Mentor: Jacob Goldberg (Chemistry)
Title of Project: *Incorporation of Fluorinated Amino Acids into Proteins*
Funding Source: NASC Division

Research Fellow: Neerusha Phuyal 2027 (Undeclared)
Faculty Mentor: Anthony Chianese (Chemistry)
Title of Project: *Finding New Epoxide Hydrogenolysis Catalysts*
Funding Source: NASC Division

Research Fellow: Barrett Regan 2025 (Philosophy)
Faculty Mentor: Jason Keith (Chemistry)
Title of Project: *Examination of Fluoride Ion Affinity to Predict Lewis Acid Catalytic Activity for Diels-Alder Reactions*
Funding Source: NASC Division

Research Fellow: Ethan Riggs 2025 (Biochemistry)
Faculty Mentor: Jenny Peeler (Chemistry)
Title of Project: *AMPylation Activity of SelenoproteinO Homologs*
Funding Source: NASC Division

Research Fellow: Ethan Riggs 2025 (Biochemistry)
Faculty Mentor: Jenny Peeler (Chemistry)
Title of Project: *Functional Analysis of SelenoproteinO*
Funding Source: NASC Division

Research Fellow: Marina Rizk 2026 (Chemistry)
Faculty Mentor: Anne Perring (Chemistry)
Title of Project: *Biological Ice Nuclei*
Funding Source: Miller-Cochran Fund

Research Fellow: Patti Rizzo 2026 (Applied Math; Chemistry)
Faculty Mentor: Eric Muller (Chemistry)
Title of Project: *Infrared Tip-Enhanced Spectroscopy and Nanoscale Imaging of Polymers*
Funding Source: NASC Division

Research Fellow: Connor Rogers 2027 (Undeclared)
Faculty Mentor: Anne Perring (Chemistry)
Title of Project: *Biological Ice Nuclei*
Funding Source: NASC Division

Research Fellow: Sabrina Srabani 2027 (Chemistry)
Faculty Mentor: Dimitar Shopov (Chemistry)
Title of Project: *Novel Pyridine-Alkoxide Ligands for Iridium Oxo Dimer Formation and Water Oxidation Catalysis*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: David Stephens 2026 (Biochemistry)
Faculty Mentor: Jason Keith (Chemistry)
Title of Project: *Examination of Fluoride Ion Affinity to Predict Lewis Acid Catalytic Activity for Diels-Alder Reactions*
Funding Source: National Science Foundation Grant

Research Fellow: Jeremy Stoll 2027 (Undeclared)
Faculty Mentor: Anne Perring (Chemistry)
Title of Project: *Biological Ice Nuclei*
Funding Source: NASC Division

Research Fellow: David Ye 2027 (Undeclared)
Faculty Mentor: Anthony Chianese (Chemistry)
Title of Project: *Identifying the Active Catalyst in Ru-PNN Complexes Catalyzed Hydrogenations and Dehydrogenations*
Funding Source: National Science Foundation Grant

Research Fellow: Grace Zhang 2027 (Undeclared)
Faculty Mentor: Jenny Peeler (Chemistry)
Title of Project: *AMPylation Activity of SelenoproteinO Homologs*
Funding Source: NASC Division

Department of Computer Science

Research Fellow: Ammar Haider 2027 (Undeclared)
Faculty Mentor: Raina Samuel (Computer Science)
Title of Project: *Analyzing Inconsistencies Across Financial Services Machine Learning Algorithms and Implementations*
Funding Source: Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science

Research Fellow: Yuliia Heleveria 2027 (Undeclared)
Faculty Mentor: Georgiana Haldeman (Computer Science)
Title of Project: *Student Reactions to a Responsive Pedagogical Model in CS1*
Funding Source: Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science

Research Fellow: Judah Robbins Bernal 2027 (Undeclared)
Faculty Mentor: Georgiana Haldeman (Computer Science)
Title of Project: *Teaching Program Decomposition in CS1: A Conceptual Framework for Improved Code Quality*
Funding Source: Holden Endowment Fund

Research Fellow: Anzi Wang 2025 (Philosophy; Computer Science)
Faculty Mentor: Grusha Prasad (Computer Science)
Title of Project: *Using (adaptation to) uncertainty expressions as a tool to study confirmation bias*
Funding Source: Mind, Brain, and Behavior Scholars Award

Research Fellow: Victor Wang 2025 (Mathematical Economics; Computer Science)
Faculty Mentor: Joel Sommers (Computer Science)
Title of Project: *Analyzing the Domain Name System Graph*
Funding Source: National Science Foundation Grant

Research Fellow: Yabesi Witinya 2026 (Computer Science)
Faculty Mentor: Joel Sommers (Computer Science)
Title of Project: *Analyzing the Domain Name System Graph*
Funding Source: National Science Foundation Grant

Research Fellow: Alec Wydra 2027 (Undeclared)
Faculty Mentor: Georgiana Haldeman (Computer Science)
Title of Project: *Teaching Program Decomposition in CS1: A Conceptual Framework for Improved Code Quality*
Funding Source: Holden Endowment Fund

Department of Earth and Environmental Geosciences

Research Fellow: Vivian Adelman 2025 (Geology)
Faculty Mentor: Paul Harnik (Earth and Environmental Geosciences)
Title of Project: *Assessing Bivalve Responses to Changing Coastal Environments through Analysis of Semelina, Nucula, and Nuculana Life History*
Funding Source: National Science Foundation Grant

Research Fellow: Sam Ash 2027 (Undeclared)
Faculty Mentor: Alison Koleszar (Earth and Environmental Geosciences)
Title of Project: *Eruptive Mechanisms and the Eruptive Personality of Augustine Volcano, Alaska*
Funding Source: Hackett-Rathmell 1968 Memorial Fund

Research Fellow: William Aspinwall 2025 (Astrogeophysics)
Faculty Mentor: William Peck (Earth and Environmental Geosciences)
Title of Project: *Investigating Proterozoic anorthosites in the northern Appalachian mountains*
Funding Source: Doug Rankin ’53 Endowment-Appalachian Research

Research Fellow: Erin Becker 2025 (Environmental Biology)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: National Science Foundation Grant

Research Fellow: Rylie Berwanger 2026 (Geology)
Faculty Mentor: Alison Koleszar (Earth and Environmental Geosciences)
Title of Project: *Eruptive Mechanisms and the Eruptive Personality of Augustine Volcano, Alaska*
Funding Source: NASC Division

Research Fellow: Madison Cammarata 2026 (Environmental Geology)
Faculty Mentor: Paul Harnik (Earth and Environmental Geosciences)
Title of Project: *Variations in Bryozoan Feeding Rates Along a Coastal Productivity Gradient*
Funding Source: National Science Foundation Grant

Research Fellow: Ryan D’Errico 2025 (Geology)
Faculty Mentor: Alison Koleszar (Earth and Environmental Geosciences)
Title of Project: *The Eruptive Personality of Augustine Volcano*
Funding Source: National Science Foundation Grant

Research Fellow: Daytona Doherty 2026 (Psychological Science; Biology)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: Norma Vergo Prize

Research Fellow: Gianna Durso
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*

Research Fellow: Fausto Flores Alvarez 2027 (Undeclared)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: NASC Division

Research Fellow: Flannery Hogan 2026 (Astrogeophysics)
Faculty Mentor: Joe Levy (Earth and Environmental Geosciences)
Title of Project: *Antarctic Biogeochemistry: Is Soil Developing?*
Funding Source: Norma Vergo Prize

Research Fellow: Sarah Jekel
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*

Research Fellow: Quentin Johnson 2027 (Undeclared)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: NASC Division

Research Fellow: Vivian Klemmer 2026 (Geology)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: Malcolm ’54 and Sylvia Boyce Endowed Fund in Geology

Research Fellow: Lindsay Kosnick 2027 (Undeclared)
Faculty Mentor: Paul Harnik (Earth and Environmental Geosciences)
Title of Project: *Assessing Bivalve Responses to Changing Coastal Environments through Analysis of Semelina, Nucula, and Nuculana Life History*
Funding Source: National Science Foundation Grant

Research Fellow: Pierce Leclerc 2025 (Geology; Applied Math)
Faculty Mentor: Aubreya Adams (Earth and Environmental Geosciences)
Title of Project: *Capturing Subsurface Structure of the Alaskan Subduction Zone using Rayleigh Wave Tomography*
Funding Source: Bob Linsley/James McLelland Fund

Research Fellow: Owen McMorrow 2026 (Geology; Environmental Geography)
Faculty Mentor: Aubreya Adams (Earth and Environmental Geosciences)
Title of Project: *Deep Earth Imaging of the Alaskan Subduction Zone*
Funding Source: Hackett-Rathmell 1968 Memorial Fund

Research Fellow: Amelia Mendez
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*

Research Fellow: Zachary O'Donnell 2027 (Undeclared)
Faculty Mentor: Amy Leventer (Earth and Environmental Geosciences)
Title of Project: *Biogeography of Ross Sea Diatoms*
Funding Source: Doug Rankin '53 Endowment - Geology Research

Research Fellow: Carolina Quirke 2027 (Undecided)
Faculty Mentor: Amy Leventer (Earth and Environmental Geosciences)
Title of Project: *Diatom-based reconstruction of the Mawson Bank, Ross Sea Antarctica*
Funding Source: Doug Rankin '53 Endowment - Geology Research

Research Fellow: Alexa Russo 2025 (Geology)
Faculty Mentor: Amy Leventer (Earth and Environmental Geosciences)
Title of Project: *Antarctic Holocene Diatoms as a Climate Proxy*
Funding Source: Malcolm '54 and Sylvia Boyce Endowed Fund in Geology

Research Fellow: Riley Taylor 2026 (Geology; Natural Sciences)
Faculty Mentor: Joe Levy (Earth and Environmental Geosciences)
Title of Project: *Antarctic Biogeochemistry: Is Soil Developing?*
Funding Source: Doug Rankin '53 Endowment - Geology Research

Research Fellow: Riley Taylor 2026 (Geology; Natural Sciences)
Faculty Mentor: Joe Levy (Earth and Environmental Geosciences)
Title of Project: *Studying the Alvord Desert as a Martian Analog*
Funding Source: Doug Rankin '53 Endowment - Geology Research

Research Fellow: Robert Vanderhoef 2027 (Environmental Studies)
Faculty Mentor: Paul Harnik (Earth and Environmental Geosciences)
Title of Project: *Marine Bivalve Shell Microstructure*
Funding Source: National Science Foundation Grant

Research Fellow: Ava Wojtaszek GR (Childhood Education MAT)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: NASC Division

Research Fellow: Jannah Zabadi 2026 (Geography)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: NASC Division

Research Fellow: Krelyn Zacarias 2025 (Computer Science)
Faculty Mentor: Karen Harpp (Earth and Environmental Geosciences; Peace and Conflict Studies)
Title of Project: *The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers*
Funding Source: NASC Division

Department of Mathematics

Research Fellow: Jiaying Bai 2025 (Applied Math)
Faculty Mentor: Silvia Jiménez Bolaños (Mathematics)
Title of Project: *Can you hide from thermal imaging?*
Funding Source: National Science Foundation Grant

Research Fellow: Dennis Belotserkovskiy 2026 (Mathematics; Astronomy/Physics)
Faculty Mentor: Joe Chen (Mathematics)
Title of Project: *Matrix Analysis of a Two-Color Particle System*
Funding Source: NASC Division

Research Fellow: Jackson Carter 2025 (Computer Science; Applied Math)
Faculty Mentor: Joe Chen (Mathematics)
Title of Project: *Matrix Analysis of a Two-Color Particle System*
Funding Source: NASC Division

Research Fellow: Andy Gong 2026 (Physics)
Faculty Mentor: Silvia Jimenez Bolanos (Mathematics)
Title of Project: *Can you hide from thermal imaging?*
Funding Source: National Science Foundation Grant

Research Fellow: Emmett Hintz 2025 (Economics; Computer Science)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Multi-Stage Prostate Cancer Classification Reveals Key MiRNA Biomarkers With Links To Neurodevelopmental Diseases Through Machine Learning*
Funding Source: NASC Division

Research Fellow: Sia Hu 2026 (Applied Math; Computer Science)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Revealing the differential roles of DeltaC and DeltaD ligands on the segmentation clock dynamics*
Funding Source: Michael J. Wolk ’60 Heart Foundation

Research Fellow: Ayub Khan 2025 (Computer Science; Biology)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Machine Learning Uncovers Novel Sex-Specific Dementia Biomarkers Linked to Autism and Eye Diseases*
Funding Source: NASC Division

Research Fellow: Ayub Khan 2025 (Computer Science; Biology)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Multi-Stage Prostate Cancer Classification Reveals Key MiRNA Biomarkers With Links To Neurodevelopmental Diseases Through Machine Learning*
Funding Source: NASC Division

Research Fellow: Thomas Lanuza 2026 (Mathematics; Computer Science)
Faculty Mentor: Gabe Sosa Castillo (Mathematics)
Title of Project: *The polynomials for the Hilbert series of special monomial sets*
Funding Source: NASC Division

Research Fellow: Nancy Lei 2026 (Psychological Science; Computer Science/Mathematics)
Faculty Mentor: Ahmet Ay (Biology; Mathematics)
Title of Project: *Nuclei Alignment Detection via Deep Learning and Bioinformatics Algorithm*
Funding Source: NASC Division

Research Fellow: Ariza Meza 2027 (Undeclared)
Faculty Mentor: Will Cipolli (Mathematics)
Title of Project: *Data Science Collaboratory Project*
Funding Source: NASC Division

Research Fellow: Edmond Nzivugira 2027 (Undeclared)
Faculty Mentor: Gabe Sosa Castillo (Mathematics)
Title of Project: *The polynomials for the Hilbert series of special monomial sets*
Funding Source: NASC Division

Research Fellow: Ethan Rackleff 2025 (Computer Science/Mathematics)
Faculty Mentor: Gabe Sosa Castillo (Mathematics)
Title of Project: *The polynomials for the Hilbert series of special monomial sets*
Funding Source: NASC Division

Research Fellow: Sahana Savarkar 2026 (Applied Math)
Faculty Mentor: Will Cipolli (Mathematics)
Title of Project: *Data Science Collaboratory Project*
Funding Source: NASC Division

Department of Physics and Astronomy

Research Fellow: Thomas Brew 2025 (Physics)
Faculty Mentor: Rebecca Metzler (Physics and Astronomy)
Title of Project: *Identifying the type of Biomineralization in Barnacles*
Funding Source: National Science Foundation Grant

Research Fellow: Tori Broadnax 2027 (Undeclared)
Faculty Mentor: Cosmin Ilie (Physics and Astronomy)
Title of Project: *Search for Super Massive Dark Star*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Jerry Cao 2026 (Physics)
Faculty Mentor: Beth Parks (Physics and Astronomy)
Title of Project: *Modeling heat transport in insulation measurements*
Funding Source: NASC Division

Research Fellow: Lance Chen 2025 (Physics)
Faculty Mentor: Cosmin Ilie (Physics and Astronomy)
Title of Project: *Nebular Emission from Super Massive Dark Star*
Funding Source: NASC Division

Research Fellow: Jared Diks 2025 (Astronomy/Physics)
Faculty Mentor: Cosmin Ilie (Physics and Astronomy)
Title of Project: *Probing for Asymmetric Dark Matter in Neutron Stars via Black Hole Formation*
Funding Source: NASC Division

Research Fellow: Leia Francis 2025 (Physics)
Faculty Mentor: Rebecca Metzler (Physics and Astronomy)
Title of Project: *Crystalline Guanine and Polarized Light*
Funding Source: NASC Division

Research Fellow: Chris Gross 2026 (Physics)
Faculty Mentor: Rebecca Metzler (Physics and Astronomy)
Title of Project: *Exploring the Growth Rates of the Balanus amphitrite in Relation to Temperature*
Funding Source: NASC Division

Research Fellow: Ben Horner 2025 (Japanese; Astronomy/Physics)
Faculty Mentor: Jeff Bary (Physics and Astronomy)
Title of Project: *Modeling Spots on Young Stellar Objects*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Kwakye Kendja 2025 (Physics)
Faculty Mentor: Kiko Galvez (Physics and Astronomy)
Title of Project: *Gravitational Lensing Diffraction in Binary Systems*
Funding Source: National Science Foundation Grant

Research Fellow: Jackson Kustell 2025 (Physics)
Faculty Mentor: Ken Segall (Physics and Astronomy)
Title of Project: *Developing Superconducting Neural Networks*
Funding Source: NASC Division

Research Fellow: Emma Lewis 2025 (Biology; French)
Faculty Mentor: Rebecca Metzler (Physics and Astronomy)
Title of Project: *Marine Bivalve Shell Microstructure*
Funding Source: National Science Foundation Grant

Research Fellow: Bill Luo 2026 (Physics; Applied Math)
Faculty Mentor: Kiko Galvez (Physics and Astronomy)
Title of Project: *A New Quantum Eraser*
Funding Source: National Science Foundation Grant

Research Fellow: Sayed Shafaat Mahmud 2026 (Astronomy/Physics)
Faculty Mentor: Cosmin Ilie (Physics and Astronomy)
Title of Project: *Using Monte Carlo Methods to Detect Dark Star Candidates Based on JWST Spectra*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Jai Mangal 2027 (Undeclared)
Faculty Mentor: Ramesh Adhikari (Physics and Astronomy)
Title of Project: *Leaves as a Bio-based Substrate for Electrochemical Sensing*
Funding Source: National Science Foundation Grant/NASC Division

Research Fellow: Aurora Markwell 2025 (Astronomy/Physics; Music)
Faculty Mentor: Thomas Balonek (Physics and Astronomy)
Title of Project: *ASAS-SN as a Replacement for ATLAS for Studying Quasars*
Funding Source: NASC Division; NASA New York Space Grant

Research Fellow: Eli Mayes 2026 (Physics)
Faculty Mentor: Kiko Galvez (Physics and Astronomy)
Title of Project: *Free Space Communications With Rotating Beams*
Funding Source: National Science Foundation Grant

Research Fellow: Flynn McGrath 2026 (Physics)
Faculty Mentor: Jonathan Levine (Physics and Astronomy)
Title of Project: *Investigations of Fano Resonances in Atomic, Mechanical, and Electrical Systems*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Olivia Miller 2027 (Undeclared)
Faculty Mentor: Rebecca Metzler (Physics and Astronomy)
Title of Project: *Marine Bivalve Shell Microstructure*
Funding Source: Justus ’43 and Jayne Schlichting Student Research Fund

Research Fellow: Shadana Nepal 2026 (Physics)
Faculty Mentor: Cosmin Ilie (Physics and Astronomy)
Title of Project: *Dark Stars: Searching for Dark Star candidates using Nelder Mead Algorithm*
Funding Source: NASC Division

Research Fellow: Chris O'Connell 2025 (Astrogeophysics)
Faculty Mentor: Thomas Balonek (Physics and Astronomy)
Title of Project: *ASAS-SN as a Replacement for ATLAS for Studying Quasars*
Funding Source: NASC Division; NASA New York Space Grant

Research Fellow: Andrew Savage 2026 (Computer Science; Physics)
Faculty Mentor: Ramesh Adhikari (Physics and Astronomy)
Title of Project: *Development of Leaf and Tryptophan Based Memristors*
Funding Source: Justus '43 and Jayne Schlichting Student Research Fund

Research Fellow: Sherlyn Shi 2027 (Undeclared)
Faculty Mentor: Beth Parks (Physics and Astronomy)
Title of Project: *Modeling heat transport in insulation measurements*
Funding Source: NASC Division

Research Fellow: Mia Toribio Lantigua 2026 (Physics)
Faculty Mentor: Ramesh Adhikari (Physics and Astronomy)
Title of Project: *Leaf-Based Triboelectric Nanogenerators*
Funding Source: National Science Foundation Grant

Research Fellow: Jonathan Van Magness 2026 (Physics)
Faculty Mentor: Ramesh Adhikari (Physics and Astronomy)
Title of Project: *Morphological and Electrical Properties of L-Phenylalanine Doped PEDOT:PSS Thin Films*
Funding Source: NASC Division

Research Fellow: Neha Viradia 2025 (Physics)
Faculty Mentor: Ramesh Adhikari (Physics and Astronomy)
Title of Project: *Development of Leaf-based Hydro-voltaic Devices*
Funding Source: National Science Foundation Grant

Department of Psychological and Brain Sciences

Research Fellow: George Adamson 2025 (Psychological Science)
Faculty Mentor: Ewa Galaj (Psychological and Brain Sciences)
Title of Project: *Fentanyl exposure alters rat CB1 receptor expression in the insula, nucleus accumbens and substantia nigra*
Funding Source: National Science Foundation Grant

Research Fellow: Fiona Barber 2025 (Psychological Science)
Faculty Mentor: Erin Cooley (Psychological and Brain Sciences)
Title of Project: *The Pain of Falling Behind: Exploring How Race-Class Stereotypes Inform Subjective Perceptions of Status, Emotional Experiences, and, thus, Health*
Funding Source: NASC Division

Research Fellow: Claudia Coolidge 2025 (Psychological Science; Sociology)
Faculty Mentor: Jennifer Tomlinson (Psychological and Brain Sciences)
Title of Project: *Sleep and Relationships in Adulthood*
Funding Source: NASC Division

Research Fellow: Chloe Dorris 2025 (Psychological Science; Political Science)
Faculty Mentor: Allison Zengilowski (Psychological and Brain Sciences)
Title of Project: *Profiles of Confusion: How Motivation and Self-Regulation Inform Students' Perceptions of Confusion in Online*
Funding Source: NASC Division

Research Fellow: Matthew Freund 2026 (Neuroscience)
Faculty Mentor: Ewa Galaj (Psychological and Brain Sciences)
Title of Project: *Neuroscience Lab of Addiction*
Funding Source: NASC Division

Research Fellow: Zuzu Gacso 2025 (Neuroscience)
Faculty Mentor: Ewa Galaj (Psychological and Brain Sciences)
Title of Project: *Addiction Lab Projects*
Funding Source: National Science Foundation Grant

Research Fellow: Cailen Geller 2026 (Neuroscience)
Faculty Mentor: Wan-chun Liu (Psychological and Brain Sciences)
Title of Project: *Exploring Context Dependent Co-song Gestures in Zebra Finch Birds*
Funding Source: NASC Division

Research Fellow: Ashley Graegin GR (English MAT)
Faculty Mentor: Jessica Murray (Psychological and Brain Sciences)
Title of Project: *The Effects of Ecologically Relevant Teaching Practices on Stress-adapted Students' Engagement in High School English Classes*
Funding Source: NASC Division

Research Fellow: Dylan Gutterman 2025 (Psychological Science)
Faculty Mentor: Lauren Philbrook (Psychological and Brain Sciences)
Title of Project: *Children's Sleep, Stress, and Learning Study*
Funding Source: NASC Division

Research Fellow: Jillian Herbst 2025 (Psychological Science)
Faculty Mentor: Erin Cooley (Psychological and Brain Sciences)
Title of Project: *The Pain of Falling Behind: Exploring How Race-Class Stereotypes Inform Subjective Perceptions of Status, Emotional Experiences, and, thus, Health*
Funding Source: NASC Division

Research Fellow: Lindsay Hess 2026 (Art & Art History; Psychological Science)
Faculty Mentor: Lauren Philbrook (Psychological and Brain Sciences)
Title of Project: *Children's Sleep, Stress, and Learning Study*
Funding Source: NASC Division

Research Fellow: Brady Johnson 2027 (Undeclared)
Faculty Mentor: Anzela Niraula (Psychological and Brain Sciences)
Title of Project: *Is Microglia Number and Distribution Altered During Metamorphosis?*
Funding Source: NASC Division

Research Fellow: Audrey Kris 2026 (Neuroscience)
Faculty Mentor: Bruce Hansen (Psychological and Brain Sciences)
Title of Project: *Developing a brain-guided artificial neural network to gain insight into how the brain represents behaviorally relevant information*
Funding Source: Mind, Brain, and Behavior Summer Grant

Research Fellow: Avalian Rios 2025 (Psychological Science; Sociology)
Faculty Mentor: Erin Cooley (Psychological and Brain Sciences)
Title of Project: *The Pain of Falling Behind: Exploring How Race-Class Stereotypes Inform Subjective Perceptions of Status, Emotional Experiences, and, thus, Health*
Funding Source: NASC Division

Research Fellow: Rediet Shiferahu 2025 (Psychological Science)
Faculty Mentor: Jennifer Tomlinson (Psychological and Brain Sciences)
Title of Project: *Sleep and Relationships in Adulthood*
Funding Source: NASC Division

Research Fellow: Joseph Slama 2027 (Undeclared)
Faculty Mentor: Ewa Galaj (Psychological and Brain Sciences)
Title of Project: *Neuroscience of Addictions Lab*
Funding Source: NASC Division

Research Fellow: Emma Slupik 2026 (Neuroscience)
Faculty Mentor: Wan-chun Liu (Psychological and Brain Sciences)
Title of Project: *Exploring Context Dependent Co-song Gestures in Zebra Finch Birds*
Funding Source: NASC Division

Research Fellow: Charlotte Smith 2026 (Psychological Science)
Faculty Mentor: Allison Zengilowski (Psychological and Brain Sciences)
Title of Project: *The Effects of Play-Based Learning on Achievement Emotions and Outcomes*
Funding Source: NASC Division

Research Fellow: Sophie Smyth 2025 (Mathematics; Neuroscience)
Faculty Mentor: Bruce Hansen (Psychological and Brain Sciences)
Title of Project: *Developing a brain-guided artificial neural network to gain insight into how the brain represents behaviorally relevant information*
Funding Source: NASC Division

Research Fellow: Felicite Tien 2025 (Neuroscience)
Faculty Mentor: Anzela Niraula (Psychological and Brain Sciences)
Title of Project: *The Role of Microglia in Metamorphic Remodeling of the Brain*
Funding Source: NASC Division

Research Fellow: Teagan Williams 2025 (Neuroscience; Molecular Biology)
Faculty Mentor: Wan-chun Liu (Psychological and Brain Sciences)
Title of Project: *Investigating the effect of chronic light pollution on adult neurogenesis in the vocal learning circuit of male zebra finches*
Funding Source: NASC Division

Research Fellow: Leyi Zhang 2026 (Educational Studies)
Faculty Mentor: Allison Zengilowski (Psychological and Brain Sciences)
Title of Project: *International Undergraduates' Responses to Academic Confusion: How Culture Homophily and Discipline Culture Inform Academic Help-Seeking Behaviors*
Funding Source: NASC Division

DIVISION OF SOCIAL SCIENCES (SOSC)

Department of Economics

Research Fellow: Sylvia Guo 2026 (Computer Science; Economics)
Faculty Mentor: Mike Mei (Economics)
Title of Project: *Housing Markets and Heterogenous Households: leveraging linked migration microdata to define housing markets and household types*
Funding Source: SOSC Division

Research Fellow: Jessie Han 2026 (Economics)
Faculty Mentor: Yang Song (Economics; Asian Studies)
Title of Project: *Human vs. Machine: Exploring the Accuracy of ChatGPT in Data Collection*
Funding Source: SOSC Division

Research Fellow: Siddhant Jhawar 2027 (Undeclared)
Faculty Mentor: Takao Kato (Economics)
Title of Project: *Wages that Work – Experimental Evidence for Gift Exchange*
Funding Source: SOSC Division

Research Fellow: Michelle Li 2025 (Mathematical Economics)
Faculty Mentor: Mike Mei (Economics)
Title of Project: *Housing Markets and Heterogenous Households: leveraging linked migration microdata to define housing markets and household types*
Funding Source: SOSC Division

Research Fellow: Lily Schoonmaker 2025 (English; Economics)
Faculty Mentor: Yang Song (Economics; Asian Studies)
Title of Project: *Human vs. Machine: Exploring the Accuracy of ChatGPT in Data Collection*
Funding Source: SOSC Division

Department of Educational Studies

Research Fellow: Yuki Yuan 2025 (Educational Studies)
Faculty Mentor: Meg Gardner (Educational Studies)
Title of Project: *Fostering STEM Teacher Identities Through Engagement in the Virtual Galápagos (VG) Program*
Funding Source: SOSC Division

Research Fellow: Joyce Zheng 2026 (English; Psychological Science)
Faculty Mentor: Meg Gardner (Educational Studies)
Title of Project: *Exploring Group Consensus During STEM Curriculum Content Selection: A Case Study of the Virtual Galápagos (VG) Program*
Funding Source: SOSC Division

Department of Geography

Research Fellow: Declan Huddleston 2026 (Geography)
Faculty Mentor: William Meyer (Geography)
Title of Project: *State, Local, and City Parks and the Worthless Lands Thesis*
Funding Source: SOSC Division

Research Fellow: Maddox Miller 2027 (Undeclared)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Beaver Dam Presence Before and After Fires in Alaska's Boreal Forest Streams*
Funding Source: National Science Foundation Grant

Research Fellow: Sara Tabibian 2026 (Environmental Geography)
Faculty Mentor: Adam Burnett (Geography; Environmental Studies)
Title of Project: *Analyzing the Isotopic Composition of Winter Precipitation in Central New York State*
Funding Source: SOSC Division

Research Fellow: Matt Walinski 2026 (Environmental Biology)
Faculty Mentor: Myongsun Kong (Geography)
Title of Project: *Creation of a Pathway Database for ITS Using GIS*
Funding Source: Information Technology Services; SOSC Division

Research Fellow: Katrina Wright 2026 (Environmental Geography)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Uncertainty in Beaver Dam Identification from High Resolution Satellite Imagery*
Funding Source: SOSC Division

Research Fellow: Elaine Zhou 2025 (Biology; Geography)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Do Beaver Dams have Buffering Effects in streams in Interior Alaska?*
Funding Source: Walter Broughton ’63 Research Fund

Department of History

Research Fellow: Oscar Brown 2026 (History)
Faculty Mentor: Monica Mercado (History)
Title of Project: *Campus Places and Queer Spaces: Gay and Lesbian Visibility at Colgate University, 1965-1985*
Funding Source: Walter Broughton ’63 Research Fund

Research Fellow: Zachary Brown 2025 (Music; History)
Faculty Mentor: Graham Hodges (History; Africana & Latin American Studies)
Title of Project: *Henry Highland Garnet In Central New York*
Funding Source: SOSC Division

Research Fellow: Amanda DeSantis 2025 (Psychological Science)
Faculty Mentor: Dionne Bailey (History)
Title of Project: *“Daughters of Jim Crow’s Injustice”: African American Women, Mass Incarceration, and the Business of Black Women’s Bodies at Parchman Penal*
Funding Source: SOSC Division

Research Fellow: Sophia Fossati 2025 (History)
Faculty Mentor: Graham Hodges (History; Africana & Latin American Studies)
Title of Project: *Henry Highland Garnet In Central New York*
Funding Source: SOSC Division

Research Fellow: Bailey Misken 2024 (History)
Faculty Mentor: Dionne Bailey (History)
Title of Project: *“Daughters of Jim Crow’s Injustice”: African American Women, Mass Incarceration, and the Business of Black Women’s Bodies at Parchman Penal Farm*
Funding Source: SOSC Division

Department of Political Science

Research Fellow: Abby Call 2026 (Peace and Conflict Studies)
Faculty Mentor: Frances Wang (Political Science)
Title of Project: *Buying Influence: Analyzing Chinese Outsourced Foreign Propaganda in Asia*
Funding Source: SOSC Division

Research Fellow: Mavric Crotty 2025 (Asian Studies; Political Science)
Faculty Mentor: Frances Wang (Political Science)
Title of Project: *Buying Influence: Analyzing Chinese Outsourced Foreign Propaganda in Asia*
Funding Source: SOSC Division

Research Fellow: Ned Meisel 2026 (Political Science)
Faculty Mentor: Danielle Lupton (Political Science)
Title of Project: *Threat Construction During Crises: How Leaders Justify Coercion*
Funding Source: SOSC Division

Research Fellow: Robert Payne 2027 (Political Science)
Faculty Mentor: Danielle Lupton (Political Science)
Title of Project: *Threat Construction During Crises: How Leaders Justify Coercion*
Funding Source: SOSC Division

Research Fellow: Talia Troy 2025 (English; Philosophy)
Faculty Mentor: Valerie Morkevičius (Political Science)
Title of Project: *Just War Theory and Practice in Eastern Orthodox Christianity*
Funding Source: Center for Freedom and Western Civilization

Department of Sociology and Anthropology

Research Fellow: Georgia Banner 2026 (Anthropology)
Faculty Mentor: Kristin De Lucia (Sociology & Anthropology)
Title of Project: *Poolville: Preserving the History of a Small Rural Community*
Funding Source: SOSC Division

Research Fellow: Emily Falk 2025 (Anthropology; French)
Faculty Mentor: Kristin De Lucia (Sociology & Anthropology)
Title of Project: *Poolville: Preserving the History of a Small Rural Community*
Funding Source: SOSC Division

Research Fellow: Tiffany Liu 2025 (Sociology)
Faculty Mentor: Carolyn Hsu (Sociology & Anthropology)
Title of Project: *The Chinese Social Credit System: Analysis of State Media*
Funding Source: SOSC Division

Research Fellow: Leila Ribeiro 2025 (Sociology)
Faculty Mentor: Janel Benson (Sociology & Anthropology)
Title of Project: *Career Development at Selective Liberal Arts Colleges*
Funding Source: SOSC Division

Research Fellow: Madison Steele 2026 (Computer Science)
Faculty Mentor: Janel Benson (Sociology & Anthropology)
Title of Project: *Integrating Career Development into the Classroom and Examining Questbridge Satisfaction*
Funding Source: SOSC Division

DIVISION OF UNIVERSITY STUDIES (UNST)

Africana and Latin American Studies Program

Research Fellow: Zachary Brown 2025 (Music; History)
Faculty Mentor: Graham Hodges (History; Africana & Latin American Studies)
Title of Project: *Henry Highland Garnet In Central New York*
Funding Source: SOSC Division

Research Fellow: Sophia Fossati 2025 (History)
Faculty Mentor: Graham Hodges (History; Africana & Latin American Studies)
Title of Project: *Henry Highland Garnet In Central New York*
Funding Source: SOSC Division

Asian Studies Program

Research Fellow: Evelyn Gao 2026 (Mathematical Economics)
Faculty Mentor: John Crespi (East Asian Languages & Literatures; Asian Studies)
Title of Project: *Can You Measure Satire? A Quantitative Study of Online Cartoons from China*
Funding Source: J. Curtiss Taylor ’54 Endowed Student Research Fund

Research Fellow: Jessie Han 2026 (Economics)
Faculty Mentor: Yang Song (Economics; Asian Studies)
Title of Project: *Human vs. Machine: Exploring the Accuracy of ChatGPT in Data Collection*
Funding Source: SOSC Division

Research Fellow: Lily Schoonmaker 2025 (English; Economics)
Faculty Mentor: Yang Song (Economics; Asian Studies)
Title of Project: *Human vs. Machine: Exploring the Accuracy of ChatGPT in Data Collection*
Funding Source: SOSC Division

Environmental Studies Program

Research Fellow: Maddox Miller 2027 (Undeclared)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Beaver Dam Presence Before and After Fires in Alaska’s Boreal Forest Streams*
Funding Source: National Science Foundation Grant

Research Fellow: Sara Tabibian 2026 (Environmental Geography)
Faculty Mentor: Adam Burnett (Geography; Environmental Studies)
Title of Project: *Analyzing the Isotopic Composition of Winter Precipitation in Central New York State*
Funding Source: SOSC Division

Research Fellow: Katrina Wright 2026 (Environmental Geography)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Uncertainty in Beaver Dam Identification from High Resolution Satellite Imagery*
Funding Source: SOSC Division

Research Fellow: Elaine Zhou 2025 (Biology; Geography)
Faculty Mentor: Mike Loranty (Geography; Environmental Studies)
Title of Project: *Do Beaver Dams have Buffering Effects in streams in Interior Alaska?*
Funding Source: Walter Broughton ’63 Research Fund

Peace and Conflict Studies Program

Research Fellow: Ernie Nelson 2025 (Peace and Conflict Studies)
Faculty Mentor: Teo Ballvé (Geography; Peace and Conflict Studies)
Title of Project: *The Anti-Trans Regime: An Apparatus of Queer Hate in Texas*
Funding Source: UNST Division

Russian and Eurasian Studies Program

Research Fellow: Jebbie Bauer 2026 (Russian & Eurasian Studies; International Relations)
Faculty Mentor: Jessica Graybill (Russian & Eurasian Studies)
Title of Project: *From the Okhrana to the FSB: The Evolution of Russian Security Services*
Funding Source: UNST Division

Research Fellow: Sophie Karbstein 2026 (Russian & Eurasian Studies)
Faculty Mentor: Jessica Graybill (Russian & Eurasian Studies)
Title of Project: *Caviar: Culture, Commodity, Catastrophe*
Funding Source: UNST Division

LAMPERT INSTITUTE FOR CIVIC AND GLOBAL AFFAIRS

Research Fellow: Sawyer Brown 2025 (International Relations)
Faculty Mentor: Dominika Koter (Political Science)
Title of Project: *World Vision International (Department of Preparedness and Field Readiness) Internship*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Daniel Garcia Andrade 2025 (Economics)
Title of Project: *Alton Aviation Consultancy Internship*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Camille Goodhart 2025 (Political Science)
Faculty Mentor: Juan Fernando Ibarra Del Cueto (Political Science)
Title of Project: *Research/ Internship at John Mannion’s Campaign*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Jack Hyams 2025 (International Relations)
Title of Project: *Simon Wiesenthal Center (Government Advocacy) Internship*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Simon Khairallah 2025 (Middle East and Islamic Studies)
Title of Project: *Intern Senator Murphy's DC Office Internship/IRIS (Integrated Refugee and Immigrant Services)*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Paul Lynch 2025 (German; International Relations)
Faculty Mentor: Edward (Ed) Fogarty (Political Science)
Title of Project: *Migration Integration and the Rise of Germany's Far Right: Failed Policy or Unfortunate Circumstances*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Bryan Pham 2025 (Asian Studies; Chinese)
Title of Project: *Attend the Public Policy & International Affairs Program Junior Summer Institute (Princeton University)*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: Danielle Silverman 2025 (Economics; English)
Title of Project: *Client Coverage Internship at MSCI*
Funding Source: Lampert Institute for Civic and Global Affairs

Research Fellow: George Wilson 2025 (International Relations; French)
Faculty Mentor: Jill Harsin (History)
Title of Project: *Voilà L'Ennemi: A Legal and Political Analysis of Laïcité*
Project affiliation: Lampert Institute for Civic and Global Affairs

UPSTATE INSTITUTE

Research Fellow: Lily Armstrong 2025 (Environmental Studies)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Oneida Adventure Quest*
Funding Source: Upstate Institute

Research Fellow: Peter Biss 2026 (English)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *A Cost-Benefit Analysis of Champlain Area Trails Mitigation Efforts of European Buckthorn Within The Essex Quarry Nature Preserve*
Funding Source: Upstate Institute

Research Fellow: Endré Cattouse 2026 (Educational Studies; International Relations)
Faculty Mentor: Bruce Moseley (Upstate Institute)
Title of Project: *Bridging Barriers: English as a Second Language (ESL) Education at Midtown Utica Community Center (MUCC)*
Funding Source: Upstate Institute

Research Fellow: Brigid Clive 2027 (Undeclared)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *Identifying and Mitigating Barriers to Student Participation in Saranac Lake Community School's 21st CCLC Programs*
Funding Source: Upstate Institute

Research Fellow: Annabelle Daley 2025 (Women's Studies)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Keeping Adirondack Businesses Alive by Connecting Aspiring Entrepreneurs with Retiring Business Owners*
Funding Source: Upstate Institute

Research Fellow: Owen Fahey 2025 (Environmental Studies)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *How Can Local Museums Better Serve Their Communities?*
Funding Source: Upstate Institute

Research Fellow: Richelle Gao 2027 (Undeclared)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Uncovering the Book Magic: Lifelong Benefits and Positive Community Impacts of Early Literacy Education*
Funding Source: Upstate Institute

Research Fellow: Rylee Hatch 2026 (English)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Preserving Madison County's Agricultural History through Digitizing and Sharing Archival Records*
Funding Source: Upstate Institute

Research Fellow: Emma Herwig 2025 (French; History)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Demystifying Deaccessioning: The Not-So-Secret Ways Museums Process, Preserve, and Protect Their Collections Held in Public Trust*
Funding Source: Upstate Institute

Research Fellow: Vuong Hoang 2024 (Economics; Film and Media Studies)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Nowhere to Go: Maternal Health in New York*
Funding Source: Upstate Institute

Research Fellow: Joan Jatto 2025 (Biology)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Raising Suicide Prevention Awareness in Madison County, New York*
Funding Source: Upstate Institute

Research Fellow: Grace Klag 2026 (Biology)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *What is the Current Status and Availability of Low-Income Housing in Madison County?*
Funding Source: Upstate Institute

Research Fellow: Robyn Landes 2024 (Chinese)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Public Libraries in Rural Areas: Community Perception of the Long Lake Public Library*
Funding Source: Upstate Institute

Research Fellow: Priya Martin 2024 (Psychology; Philosophy)
Faculty Mentor: Bruce Moseley (Upstate Institute)
Title of Project: *Telling the Story of the Earlville Opera House*
Funding Source: Upstate Institute

Research Fellow: Corey McLaughlin 2024 (Environmental Economics)
Faculty Mentor: Bruce Moseley (Upstate Institute)
Title of Project: *Capacity-Building and Strategic Planning for The Bell Tree*
Funding Source: Upstate Institute

Research Fellow: Aby Metellus 2025 (Women's Studies; English)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *My Summer with Young Scholars*
Funding Source: Upstate Institute

Research Fellow: Chidinma Okafor 2025 (Neuroscience)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *Tackling Youth Substance Use: Data Compilation with BRiDGES*
Funding Source: Upstate Institute

Research Fellow: Mary Thomas Powell 2026 (Biology; Environmental Studies)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *How do different soybean varieties perform in New York?*
Funding Source: Upstate Institute

Research Fellow: Ayden Simpson 2025 (Environmental Geography)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Picturing the Chenango Heritage Rail Trail*
Funding Source: Upstate Institute

Research Fellow: Salem Sokpoli 2026 (Africana and Latin American Studies)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *The Importance of Historical Preservation for Community Building*
Funding Source: Upstate Institute

Research Fellow: Joy Tang 2026 (Sociology; Biology)
Faculty Mentor: Rachel Amann-Burns (Upstate Institute)
Title of Project: *Developing Interactive Learning Modules For Students At The National Abolition Hall of Fame (NAHOF)*
Funding Source: Upstate Institute

Research Fellow: K'Cyee Toma 2026 (History)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Archiving the Legacy of the Lake Moraine Association*
Funding Source: Upstate Institute

Research Fellow: Charlie Tourbaf 2025 (Environmental Economics)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Upstate Institute Summer Fellowship: The B-Team*
Funding Source: Upstate Institute

Research Fellow: Natalie Woodson 2026 (Psychological Science)
Faculty Mentor: Julie Dudrick (Upstate Institute)
Title of Project: *Empowering Voices: Self Advocacy at Pathfinder Village*
Funding Source: Upstate Institute

Research Fellow: Marisa Zarcone 2025 (Mathematics)
Faculty Mentor: Bruce Moseley (Upstate Institute)
Title of Project: *United Way of Mid Rural New York*
Funding Source: Upstate Institute

Research Fellow: Angie Zhu 2026 (Applied Math)
Faculty Mentor: Catherine Cardelús (Upstate Institute)
Title of Project: *Visualizing the Impact of Road Salt Application on Stream Conductivity in the Adirondacks*
Funding Source: Upstate Institute

Research Summaries

Research Fellow: George Adamson (2025) **Concentration:** Psychological Science

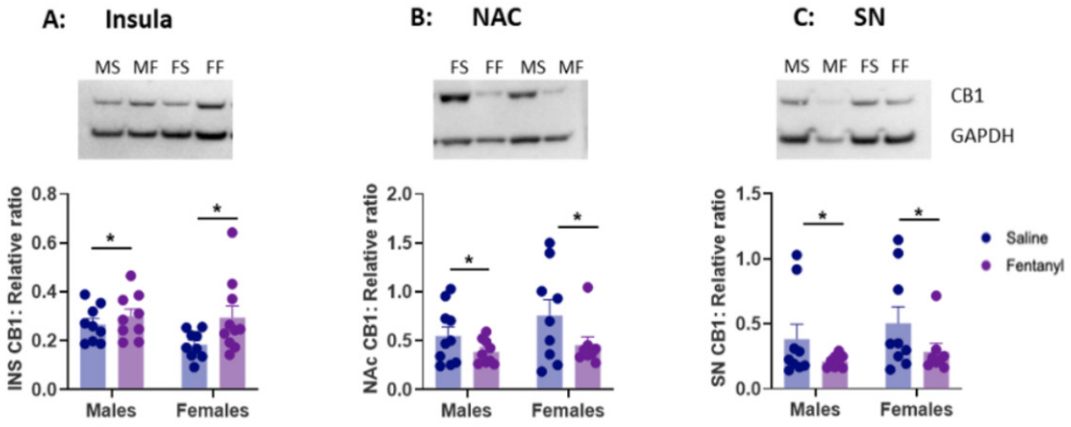
Faculty Mentor: Ewa Galaj **Department:** Psychological and Brain Sciences

Title of Project: Fentanyl exposure alters rat CB1 receptor expression in the insula, nucleus accumbens and substantia nigra

Funding Source: National Science Foundation Grant

Project Summary:

This summer, I worked as a research assistant in Dr. Galaj's addiction lab. At the beginning of the summer, a lab assistant and I learned how to write the manuscript for a project (i.e. the fentanyl project) that we completed the semester before. In this experiment, rats were administered fentanyl and we performed multiple assays (e.g. western blots) to determine how chronic fentanyl treatment may cause neuroadaptations to CB1 receptors (attached below is a graph of one of the brain regions in which there were significant differences in CB1 receptor expression). Following this, I learned how to use multiple different experimental techniques and assays that are a part of multiple projects. For example, our lab learned how to gavage rats with alcohol. Additionally, we prepared and ran a plethora of samples for our current project covering heroin effects on ghrelin receptors in rats in enriched vs non-enriched environments. Moreover, I was introduced to a new assay, immunohistochemistry, and began practicing this technique in preparation for my senior thesis this fall and spring. Lastly, some projects that we will be working on in the semester require the confocal microscope and I have recently started my training on this imaging device.



Research Fellows: Vivian Adelman (2025) **Concentration:** Geology
Lindsay Kosnick (2027) **Concentration:** Undeclared
Faculty Mentor: Paul Harnik **Department:** Earth and Environmental Geosciences

Title of Project: Assessing Bivalve Responses to Changing Coastal Environments through Analysis of Semelina, Nucula, and Nuculana Life History

Funding Source: National Science Foundation Grant

Project Summary:

The chemistry of coastal systems around the world is rapidly changing due to anthropogenic nutrient-loading and rising temperatures. Recent literature has hypothesized that these global-scale processes impact the larval shells of bivalves.

Bivalves begin their life cycle as larvae floating in the water column, obtaining energy from the yolk of their egg. This life stage is preserved in a small, ovate feature on the adult shell called "Prodissoconch I" (P1), the size of which is correlated with egg size. Because of this correlation, we can observe how bivalves respond to changing conditions by measuring their P1s. When nutrient levels are low and temperatures are cool, bivalves developing from larger P1s are expected to have the best chance of survival. When nutrient levels and temperatures are high, bivalves spawning from smaller P1s may be able to live to adulthood because of the lack of competition for resources. It is currently unknown how the P1s of bivalves living in cool, nutrient-rich environments and warm, nutrient-poor environments are impacted by those conditions. Our research aims to clarify whether nutrient availability and temperature independently affect P1 size, or always work in tandem, by sampling organisms from a diversity of coastal environments.

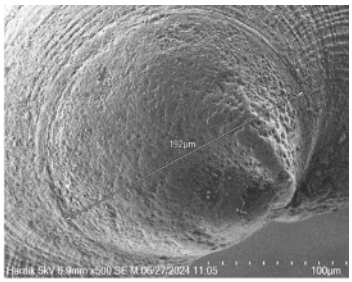
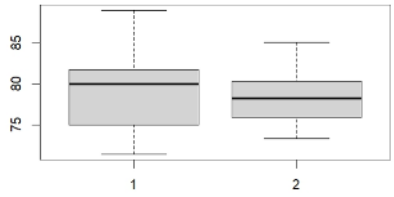


Figure 2: Well-preserved P1 of a *Nucula hawaiensis* collected off the coast of Easter Island

Our first object of study was *Semelina* nuculoides, a bivalve that members of the Paleo Lab collected previously from seafloor sediments off the coast of Florida, a marine environment that is warming but which has not experienced a stark increase in nutrient fluxes. We measured the P1s of *Semelina nuculoides* using a scanning electron microscope and found no statistically significant difference between the P1 sizes of live and dead specimens (Figure 1). These results indicate that nutrient-concentration, rather than temperature, may be the principal variable affecting larval shell size.



We are also in the process of measuring the P1 size of *Nucula* and *Nuculana* specimens sent to us by contributors from around the world. Our preliminary data suggest that *Nuculana* living in higher, cooler latitudes have larger P1s whereas specimens from warm, equatorial waters tend to have smaller P1s. This points towards temperature potentially wielding a strong influence on the P1 size of *Nuculana*; the relative contribution of surface productivity will be assessed in the future using data for our collection sites being generated by a collaborator. At this time, our lab has not observed a statistically significant correlation between sea-temperature and *Nuculidae* P1 size, which may be due to interspecific variation.

Future work will increase the geographic coverage of specimens in order to assess whether the lack of correlation in *Nuculidae* is due to interspecific differences or other environmental variables. We also plan to compare our P1 measurements against sea-surface temperature, pH level, and primary productivity in order to see which factors most affect these species. Our aim is that this work will contribute to our understanding of how marine life reacts to each of the concurrently changing environmental variables in our oceans.

Research Fellow: **Maya Albright (2026)** **Concentration: Biology**
Faculty Mentor: **Jason Meyers** **Departments: Biology; Neuroscience**
Title of Project: **Regeneration of Sensory Cells in Zebrafish is Regulated By Notch & DeltaA Signaling**
Funding Source: **Michael J. Wolk '60 Heart Foundation**

Project Summary:

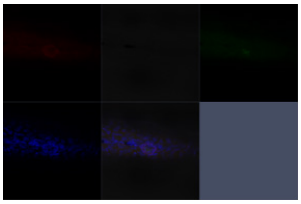
Zebrafish (Danio rerio) provide a highly effective model for studying vertebrate development and sensory systems; their regenerative capabilities allow them to repopulate damaged cells, and in some cases entire organs. The neuromast is one of several sensory organs established during embryonic development, and is composed of four distinct cell types, including sensory hair cells which are homologous to those found in the human inner ear. Hair cells in humans and zebrafish have similar functions based in mechanotransduction; however, while zebrafish hair cells can regenerate after extensive damage, human hair cells cannot. Studying the zebrafish lateral line and its component neuromasts therefore provides valuable insights into sensory development and restoration.

A zebrafish's capacity for hair cell regeneration is contingent upon a variety of environmental and molecular factors. The role of each distinct neuromast cell has proven to be a lucrative area of study–particularly the function of support cells (which surround a central hair cell population) and mantle cells (which enclose the support cells and form the outermost layer of a neuromast). Our initial experimentation involved the targeted bleaching of hair cells and surrounding support cells, leaving only the mantle and interneuromast cells intact, and allowing us to study their behavior in response to injury. 24 hours post laser-induced injury, mantle cells were observed collapsing upon the now lesioned neuromast, forming an ill-distinguished pile. At 72 hpi, mantle cells had organized in an interneuromast-like pattern across the lesioned space. No hair or support cell regeneration was observed within that time frame.

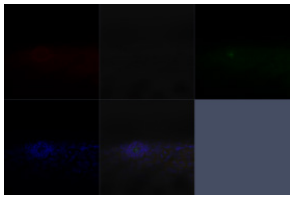
Notch and DeltaA cell signals involve receptor ligands which extend through the cell membrane and, when stimulated, activate and coordinate molecular pathways related to growth and development. Initial experiments using chemical inhibition of Notch showed significantly higher levels of hair cell regeneration than wild-type neuromasts after ablation of hair and support cells, implicating the pathway's role in regulating proliferation and regeneration. Notch-mediated division therefore likely involves the dedifferentiation of mantle cells into an intermediary progenitor cell type, before proliferating and repopulating hair cells. The role of Notch in mediating each step of this complex pathway remains a promising area of further study.

Later experiments examined Notch signaling in conjunction with that of DeltaA via a method of whole-mount hybridization chain reaction. Zebrafish larvae possessing the desired transgene were fixed and stained so as to fluoresce green in the presence of Notch or DeltaA proteins. Degrees of Notch and DeltaA fluorescence were analyzed after ablation of hair and support cells to determine how mantle cell expression varied across neuromast cells in response to injury. In zebrafish expressing the Notch-specific probe, faint green fluorescence was observed centrally within an injured neuromast, at the point of expected hair cell regeneration. Similar results were observed in the DeltaA-specific zebrafish, although with less green fluorescence (suggesting lower levels of expression). Although uninjured hair cells fluoresce green, and so are not obviously distinct from regenerating mantle cells expressing green (due to Notch or DeltaA), the patterns of expression were sufficiently different so as to suggest that green expression post-injury was not merely due to remaining hair cell debris (i.e. pinpricks vs. cell bodies).

These results suggest that hair cell regeneration and proliferation may be stimulated via manipulation of Notch signaling in mantle cells. Notch's central expression within a recovering neuromast suggests a mechanism of regulation which enables collapsed mantle cells to repopulate hair cells, while also maintaining the integrity of the organ's general structure. Conceptually, some ideal level of Notch and DeltaA expression promotes dedifferentiation of mantle cells after injury, and guides hair cell replacement without depleting the source of their proliferation (mantle cells).



Neuromast Post-Ablation (expressing Notch)



Neuromast Post-Ablation (expressing DeltaA)

Research Fellows: **Obsidian Ammons (2026)** **Concentrations:** **Biochemistry; Molecular Biology**
Henry Burdorf (2026) **Concentration:** **Biochemistry**
Ethan Riggs (2025) **Concentration:** **Biochemistry**
Grace Zhang (2027) **Concentration:** **Undeclared**
Faculty Mentor: **Jenny Peeler** **Department:** **Chemistry**
Title of Project: **AMPylation Activity of SelenoproteinO Homologs**
Funding Source: **NASC Division; Justus '43 and Jayne Schlichting Student Research Fund; Michael J. Wolk '60 Heart Foundation**

Project Summary:

Selenocysteine (Sec) is the 21st naturally occurring amino acid found in all domains of life. Selenoproteins are characterized by the incorporation of Sec into a protein's polypeptide chain. Selenoproteins have been found to be involved with redox homeostasis. A loss of redox homeostasis is associated with various abnormal cellular responses and diseases. Our lab is utilizing chemical biology techniques to study the recently characterized Selenoprotein O (SelenoO).

SelenoO is capable of catalyzing protein AMPylation, the covalent attachment of adenosine monophosphate (AMP) to a target protein. The Sec residue is not in the active site of the protein. However, we hypothesize that the Sec residue plays an allosteric role in the regulation of AMPylation activity. Our goal is to study the functional importance of the Sec residue in SelenoO. To accomplish this, we are working towards cloning a plasmid that encodes for human SelenoO. The plasmid will then be transfected into mammalian cells for further study of the human selenoprotein.

Additionally, we are expressing the Cys-containing SelenoO homolog in Escherichia coli (E. coli). This is followed by protein purification and AMPylation assays. To confirm the AMPylation activity of SelenoO, a biotinylated ATP-based AMPylation assay is performed on purified SelenoO. Furthermore, the mass of the purified SelenoO homologs is then analyzed by Matrix Assisted Laser Desorption/Ionization Time of Flight Mass Spectrometry (MALDI-TOF MS). We aim to use MALDI-TOF MS to detect AMPylation via peptide mass differences as well as utilizing Tandem Mass Spectrometry (MS/MS) analysis to confirm which residues are auto-AMPylated.

Fig. 1

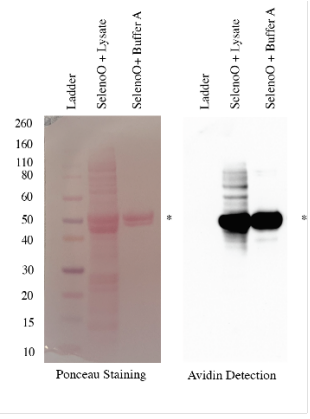


Fig. 2

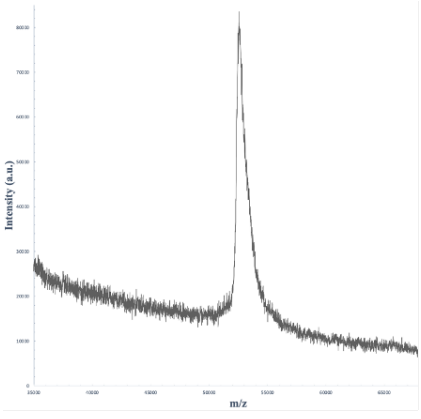


Figure 1: Ponceau Stain confirmed the presence of SelenoO for an AMPylation assay. Avidin detection detected AMPylation activity between SelenoO and lysate substrates as well as auto-AMPylation activity.
Figure 2: MALDI-TOF MS detected SelenoO with a peak at about 54000 m/z signifying a peptide with a mass of 54000 Da.

Research Fellows: **Jack Antonson (2027)** **Concentration: Undeclared**
Matt Leopold (2026) **Concentration: Molecular Biology**
Faculty Mentor: **Eddie Watkins** **Department: Biology**
Title of Project: **What Factors Influence the Distribution of Three Common Temperate Northeastern Ferns?**
Funding Source: **National Science Foundation Grant**
Project Summary:

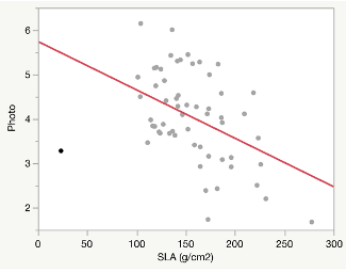
The goal of our project is to understand factors that influence niche partitioning in ferns. Species rely on unique multidimensional spaces (the niche) to ensure ecological success. Understanding the mechanisms by which plants manipulate functional traits can help understand why species grow where we find them. Specific leaf area (SLA) is perhaps one of the most important and integrated plant traits related to species distribution.

Our work specifically explored the plasticity of SLA to determine if this trait could help explain the distribution of three common NE ferns: *Dryopteris intermedia* (DryInt), *Osmunda claytoniana* (OsmClay), and *Onocleasensibilis* (OnoSen). While they overlap, these three taxa primarily occupy different light environments. We hypothesized that maximum photosynthetic rate would be linked to a species light environment and that high plasticity in SLA would be linked to distribution.

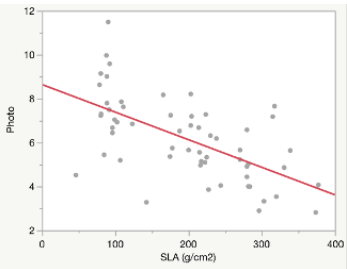
Specimens were collected from three different light sites throughout Charles Baker State Forest in Brookfield, NY. Each location was chosen for the level of light exposure to ensure that we could explore a wide range of light environments. We also ensured that all three desired species were present at each site across the light gradient. We measured 20 plants per species per transect for a total of 180 individuals. For each tested individual, we measured the maximum photosynthetic and respiration rates, light levels, solid moisture, and SLA. SLA of each plant was made with 40mm2 of dried biopsy punches. We then ran a series of ANOVAs and post hoc Tukey tests using JMP 15.

Dryopteris intermedia exhibited reduced plasticity in response to different light gradients compared to the other species. This species is perhaps one of the most common in our flora but is typically limited to lower light environments. It may be that the lack of plasticity in this species limits its photosynthetic capacity and its ability to grow in higher light (Fig. 1). *Onoclea sensibilis* is more frequent in higher light settings. This species exhibited a near identical photosynthetic rate and SLA compared to osmunda claytoniana, a species with a more intermediate light habitat. This indicates that there may be other factors beyond SLA that more strongly influence the distribution of these species. Future work will involve recording density and precise measurements of light intensity for each individual measured. This will better allow us to fine-tune some of our results.

Photosynthesis vs. SLA in DryInt



Photosynthesis vs. SLA in OnoSen



Photosynthesis vs. SLA in OsmClay

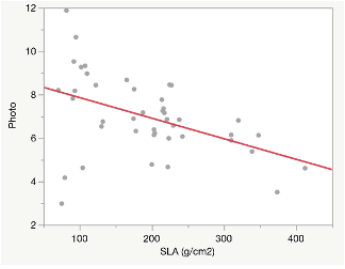


Figure 1. graph of relationship between SLA and photosynthetic rate

Research Fellows: **Sydney Arlin (2026)** **Concentration: Biochemistry**
Samuel Epstein (2026) **Concentration: Mathematics**
Faculty Mentor: **Jacob Moose** **Department: Chemistry**
Title of Project: **Development of Small-Molecule Modulators of Propanediol Dehydratase**
Funding Source: **NASC Division**
Project Summary:

Our project's aim is to find molecules that could be used to treat Crohn's disease. We focused on propanediol dehydratase (PD), an important enzyme in an alternate E. coli metabolic pathway that results in gastrointestinal inflammation. PD converts propanediol to propionaldehyde, and is not currently inhibited by any known small chemical modulators. We are looking for potential inhibitors of PD that could therapeutically treat Crohn's disease through this pathway. Our research included computational chemistry, assay development, and attempted organic synthesis of potential PD modulators.

We used MTiOpenScreen to screen molecules' potential interactions with PD and read the screen with Pymol. Through the virtual screen, a database was assembled of potential small molecule inhibitors and their interactions and binding sites. Molecule JM203 stood out due to its core adamantane ring (Fig 1). Additionally, we developed an assay to determine the potency of molecules of interest. Current literature uses an MBTH coupled assay for PD to detect the enzymatic product, propionaldehyde. We are developing the assay to be used in a 96-well plate for efficient screening and better accuracy. The reaction of MBTH and aldehydes produces a slightly yellow color that absorbs at 300 nm using a UV-Vis spectrometer. We experimented with both incubation times and varying concentrations of MBTH and propionaldehyde to determine acceptable assay parameters and detection limits. After receiving consistently low absorbance for the reaction, we added Fe (III) as a spectral indicator of the reaction of interest, changing the color to a dark blue, which we processed at 610 nm. The MBTH and Fe (III) assay was effectively optimized for the UV-vis, decreasing processing time from 30 minutes to 7 (Fig 2).

We began the synthesis of molecule JM203, but were unable to complete the synthesis before the end of this time period. After a successful synthesis, the next steps of this project are to adapt the optimized assay to the 96-well plate format and express PD to allow testing of the hit molecules from the screen. Molecules with the highest potency against PD would further be studied to test their use as potential modulators of PD in the treatment of Crohn's disease.

Research Fellow: Lily Armstrong (2025) **Concentration:** Environmental Studies
Faculty Mentor: Julie Dudrick **Department:** Upstate Institute
Title of Project: Oneida Adventure Quest
Funding Source: Upstate Institute
Project Summary:

The Oneida Community Mansion House originates from the Oneida Community, a perfectionist religious community founded by John Humphrey Noyes in 1848. After the community dissolved in 1881, the Mansion House was preserved and designated a National Historic Landmark in 1965. Today, the Oneida Community Mansion House (OCMH) is a non-profit organization chartered by the State of New York. Their mission is to use the historic site and collection to share the story of the Oneida Community by preserving, collecting, and interpreting the material and non-material culture of the Oneida Community. The Mansion House also houses residential apartments, overnight guest rooms, and meeting spaces.

I spent this summer as an Upstate Institute Field School Fellow creating the Oneida Adventure Quest, which is a scavenger hunt based in the town of Oneida that is intended to increase tourism in the area. My project aimed to promote these sites and draw people to the area by including local businesses, parks, and natural landmarks in Oneida. This would allow the businesses and local sites to connect and expand with tourists who may come back to enjoy Oneida's interesting features, uplifting the region's culture. I interviewed multiple community partners, business owners, and community planners in order to better understand what was needed in the community. I created an adventure quest that could be used as a template or adapted for future events in Oneida to increase interaction with the city's features.

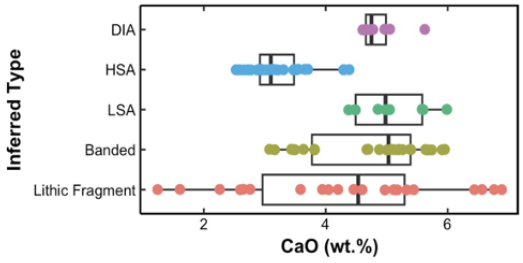
During my time at the Mansion House over the summer, I was able to explore and discover the town of Oneida in great depth. Being from Maryland, I was unaware of the important historical and cultural roles that rural towns in Upstate New York play. Due to the decline in usage of the railroads and canals in this region, many towns experienced a population migration and economic decline due to the disinvestment in the area. This disinvestment threatens the preservation of the rich history and natural resources that Upstate New York has to offer. Groups such as the Oneida Community Mansion House work to combat this loss by highlighting important and interesting historical aspects of these small rural towns. By preserving the region's history, we make an effort to revive and sustain the culture that Upstate New York holds.

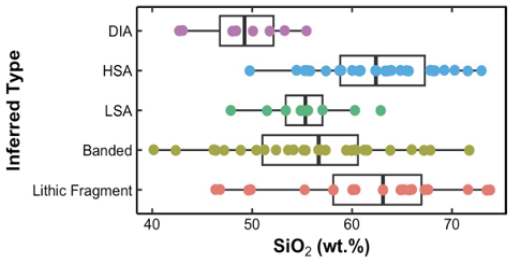
As an architecture minor, I decided to theme the scavenger hunt around historical buildings in Oneida. I researched and studied the history of sites, how they are preserved, or how they were reinvented. I hope that in the future I can work within the sustainable architecture field where I have heard that 'the most sustainable building is one that has been already built'. Historical preservation is key to what I am studying at Colgate, so when I was given the opportunity to intimately research a historically significant community, I knew it was a chance I could not pass. I used my experience in previous community-based research I had done for my Environmental Studies major to push me even further into the history behind Upstate New York. I'm extremely grateful for the opportunity to learn more about the region that I have been lucky to call home during my college years.

Research Fellow: Sam Ash (2027) **Concentration:** Undeclared
Faculty Mentor: Alison Koleszar **Department:** Earth and Environmental Geosciences
Title of Project: Eruptive Mechanisms and the Eruptive Personality of Augustine Volcano, Alaska
Funding Source: Hackett-Rathmell 1968 Memorial Fund
Project Summary:

Augustine Volcano, one of Alaska's most active volcanoes, sits within the northeastern portion of the Aleutian Arc. It is considered a "high threat" as its recent eruptive history includes regional tsunamis and widespread aviation hazards. Augustine is therefore an important research target to understand how it may erupt in the future, and how volcanic threats can change through time. This summer, my research included a two week field campaign to five sites on the south side of Augustine, where we exposed deposits of Tephra C ~1100 ybp) and Tephra M (~750 ybp). We described stratigraphy and collected samples of tephra and soil for geochemistry, componentry, grain size analysis, and carbon dating. Our observations confirm that a particularly thick tephra fall on the south coast is Tephra M (not Tephra C, as it was described in the literature), suggesting that the eruption that produced Tephra M was the most explosive Holocene eruption at Augustine. Lab work has included visual and compositional componentry, and my work has focused on using portable X-Ray Fluorescence (pXRF) to investigate the componentry of clasts that are difficult to visually categorize.

Clasts that are compositionally between high silica andesite (HSA) and low silica andesite (LSA) are difficult to identify and classify, but componentry of a tephra fall is needed to understand changes in magma composition that can affect the explosivity of an eruption. I used pXRF to analyze ambiguous clasts for elements such as Si, K, Ca, and Fe. Although pXRF analyses are less precise than benchtop XRF, I found that the pXRF can determine componentry quickly and without lengthy sample prep. I confirmed that pumiceous HSA can be correctly identifiable by eye, however many dense clasts previously classified as lithic fragments are geochemically similar to HSA. Similarly, some previously unidentifiable clasts are geochemically consistent with Dense Intermediate Andesite (DIA). Although HSA and LSA are defined by their Si concentrations, I found that Ca is a better compositional identifier than Si. LSA clasts are more texturally variable than HSA clasts, making LSA more difficult to correctly identify. My pXRF data shows that lithic fragments vary widely in composition and could represent magma that degassed prior to eruption or dome rocks from older eruptions. This implies that lithic fragments should not be considered in componentry. Moreover, my results suggest that DIA is fairly ubiquitous across samples, and future componentry for Augustine tephras should include DIA as an additional component type.





Research Fellow: **William Aspinwall (2025)** **Concentration:** **Astrogeophysics**
Faculty Mentor: **William Peck** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Investigating Proterozoic anorthosites in the northern Appalachian mountains**
Funding Source: **Doug Rankin ’53 Endowment-Appalachian Research**
Project Summary:

Anorthosite is an unusual rock consisting primarily of plagioclase (<90%). Other minerals in the rock are mostly mafic and commonly include olivine, pyroxene, and Fe-Ti oxides. In the eastern United States, anorthosites are seen in the Proterozoic Grenville Province and in the old Appalachian Mountain crust. These rocks have been studied in Virginia, the Adirondacks, southern Ontario, and Quebec, but there are also anorthosite bodies in Honey Brook Uplands, PA and the New Jersey Highlands for which the literature is sparse. The goal of this project is to compare these anorthosite bodies and their associated granitoids primarily to the better-studied Adirondack anorthosite suite, and also to similar rocks in Virginia.

The samples I analyzed during this project were collected in the field from Mase Mountain and Minnisink Road in NJ; from Icedale, Glenmore, and East Nantmeal, PA; and from various locales in the Adirondacks. Analysis was done primarily by comparing whole rock geochemical data, zircon U-Pb ages, and mineral inclusions within those zircons.

Geochemical data was determined by X-ray fluorescence analysis. I ground select samples from the New Jersey Highlands and the Honey Brook Uplands to flour-like powder. At Hamilton Analytic Laboratory, I fused the powder into glass disks. To ensure homogeneity, these glass disks were again ground and fused, before being polished and analyzed using an X-ray fluorescence spectrometer. I combined the geochemical data from these samples with other analyses, published and unpublished, to create a large data set of whole rock chemical compositions.

To obtain crystallization ages, I extracted zircon crystals from samples by crushing the rocks to a medium sand, performing magnetic separation to exclude ferric minerals, and then heavy liquid separation to concentrate heavy grains (specific gravity ≥ 3). I hand-picked zircons using tweezers and a binocular microscope from the resulting grains, which were sent to Arizona Laserchron Laboratory for geochronology in September. Analytical spots were selected to representatively sample cathodoluminescence zircon textures.

Zircons were also examined using the scanning electron microscope to survey mineral inclusions within the zircon grains. When observed, inclusions were identified using energy-dispersive X-ray spectroscopy. Knowledge of which minerals belong to which zircon growth zones will help identify the environments in which the anorthosites and associated granitoids have formed. Within the New Jersey granitic sample, I found substantial feldspars and quartz, and minor sulfides, phosphates, and oxides. Mafic minerals, mostly Fe-rich biotite, fayalite, and pyroxenes were also found in small amounts.

The geochemical data indicates that, in many respects, the Adirondack, New Jersey, and Pennsylvania anorthosites are very similar. Their trace and rare earth element compositions, however, can vary substantially for each anorthosite body. For example, each locality could be distinguished by its quantities of Ba, Sr, and Rb. This suggests different source magmas for each body, with each source magma having a distinct composition.

Research Fellows: **Jiaying Bai (2025)** **Concentration: Applied Math**
Andy Gong (2026) **Concentration: Physics**
Faculty Mentor: **Silvia Jiménez Bolaños** **Department: Mathematics**
Title of Project: **Can you hide from thermal imaging?**
Funding Source: **National Science Foundation Grant**
Project Summary:

To a thermal camera, which measures infrared radiation, the heat that we can feel is visible, like the heat of a traveler in an airport with a fever or the cold of a leaky window or door in the winter. In this project, 2D-cloaking against thermal measurements is considered. In the paper titled "Impedance Imaging, Inverse Problems, and Harry Potter's Cloak" published in SIAM Review 52, no. 2 (2010), the authors, Kurt Bryan and Tanya Leise, described how to cloak an object from impedance tomography, which measures the electromagnetic waves on the boundary of the region containing the object. The goal of this project is to show that the ideas and techniques presented in that paper can be applied to heat imaging. That is, to render the heat of an object undetectable by heat detectors.

The main purpose of this project is to prove that the idea of thermal cloaking is possible to realize. To proceed, we need to know how a heat sensor works. To check if there is a certain heat source hiding inside a given region (which we consider to be a disk, for ease of calculations), an option is to apply a heat flux on the boundary of that region and measure the output. If the measurement is different from the solution when there is nothing inside, then we know that some heat source is hiding there.

The next step is creating the cloak. What the cloak does is to make the "big hole" inside the region where we want to hide a heat source to look small enough so that it is impossible to hide any object inside. Our goal is to show that there is only a tiny difference between the outputs of the cloaked and uncloaked region. We first worked with the heat equation for both regions in polar coordinates, since the region is a disk. Then, we defined the difference between their solutions using the L2-norm. Our task was to show that the difference is smaller than (bounded by) a positive power of the radius of the small hole, which goes to 0, obtaining that way that the difference between the solutions of the problems to the cloaked and uncloaked regions also goes to 0 and therefore the cloaking works!

The proof was quite long and exquisite. We used many mathematical tools, theorems and lemmas, like the Divergence Theorem, Jensen's inequality, the concept of Sobolev space, Holder's inequality and so on. The best part of all for us would be the inequality that we proved completely on our own needed to obtain the final result!

Finally, we proved that thermal cloaking is mathematically possible, although with one lemma that remains to be completely proved, which we will continue to work on. Overall, we would say that we had a really amazing experience during the summer. We learned many things that we didn't know and we did something new from what we have learned in math classes, and we especially appreciated the guidance and support provided by our faculty adviser.

Research Fellow: Ekaterina Balsan (2025) **Concentrations:** Chemistry; Classical Studies

Faculty Mentor: Anne Perring **Department:** Chemistry

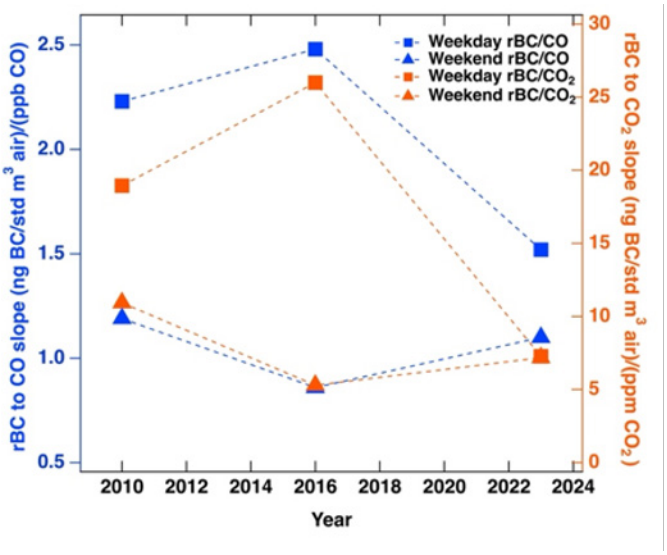
Title of Project: Black carbon time trends as an indicator of changing particulate matter emissions in SoCAB since 2010

Funding Source: Warren Anderson Fund

Project Summary:

The Perring lab focuses on projects measuring atmospheric aerosols, including refractory black carbon (rBC). rBC is a type of particulate matter (PM) sourced from incomplete combustion, produced by sources ranging from forest fires or other biomass burning as well as on road emissions such as cars and trucks. rBC has been associated with a variety of health concerns and also has been noted to absorb sunlight, and therefore states have often implemented legislation to reduce PM emissions. Prior to 2023, California passed laws regulating diesel vehicles as part of the goal to decrease PM emitted from the on road fleet. Data collected from the NOAA and NASA Atmospheric Emissions and Reactions Observed from Megacities to Marine Areas 2023 field campaign allows for updated measurements of rBC as a metric of PM emissions in the Southern California air basin (SoCAB) in order to better understand the efficiency of such regulations.

The NOAA Single Particle Soot Photometer (SP2) was used to measure particle counts of rBC as well as microphysics such as mass and optical properties. The field campaign included three flight periods in the SoCab area on August 23, 25, and 26th of 2023. Data from similar field campaigns in 2010 (NOAA CalNex) and 2016 (Student Airborne Research Program associated with KORUS-AQ project) were used to provide long term benchmarks of rBC from years prior to the full installation of emission regulations being active in the SoCAB. As rBC is the product of incomplete combustion (oxygen deprived environments), correlations between rBC and CO and CO2 have been used in previous literature to understand the nature of rBC emissions as they relate to other combustion products. Moreover, we investigated the difference in slopes between those species on both weekends and weekdays as they typically have differing traffic patterns.



Our results suggest that weekend correlations, which would be associated with lower commercial road traffic, have a relationship between rBC and CO consistent around 1 (ng BC/m3)/(ppbv CO). However, weekday correlations, which would have higher road traffic, demonstrated a decrease from about 2.2 (ng BC/m^3)/(ppbv CO) to 1.5 (ng BC/m^3)/(ppbv CO) spanning from 2010 to 2023. This trend is consistent with trends in rBC and CO_2 slopes as well. These results suggest that regulations were effective in decreasing PM emissions after their implementation. Future research will evaluate how this may have affected mass distribution and particle sizes across the SoCAB, providing insight into the aging and lifetime of such particles in the atmosphere.

Research Fellows: Georgia Banner (2026) — **Concentration:** Anthropology
Emily Falk (2025) — **Concentrations:** Anthropology; French
Faculty Mentor: Kristin De Lucia — **Department:** Sociology & Anthropology
Title of Project: Poolville: Preserving the History of a Small Rural Community
Funding Source: SOSC Division
Project Summary:

Our research in Poolville began in Fall 2023 when we participated in the Archaeological Field Methods class and completed the excavation of a homestead dating back to the 1800s. We expanded on that research this summer by collecting oral histories from Poolville residents to develop context for the archaeological site and to better understand what life was like in the mid-19th to early 20th century in Poolville. Over eight weeks we conducted interviews to document Poolville's history and ensure that stories from this small town are not forgotten.

The project was conducted in three phases. We began with background research, reviewing all material relevant to Poolville using Colgate's Special Collections and University Archives. Through archival research, we developed key topics to focus on in our interviews based on informational gaps in the archives and subjects that would trigger conversation from interviewees. From this research, we created an interview guide and moved on to the second phase of the project: conducting interviews. The interview guide focused on participants' experience growing up in Poolville, their memory of historic buildings, and their reflections on how Poolville has changed over time. We contacted over fifteen current or former Poolville residents and conducted eight interviews, two being coupled. Once the interviews were recorded, we transcribed them using Otter.ai software and edited them according to linguistic anthropological conventions, which focus on the transcription denoting contextual information. We plan to store the audio recordings along with their transcripts on NYHeritage so that they can be utilized by the Poolville community and anyone else who is interested.

From our interviews we learned that Poolville's residents cherish the experience of living in a small tight-knit community. Especially in Poolville's past, there was a strong sense of belonging amongst community members. However, long-term residents feel as if this sense of community has declined over the years. Events such as the loss of economy and community spaces have made it difficult for residents to come together. In response to this loss of community, passionate community members are looking for new ways to reinvigorate Poolville. The hamlet was recently awarded the Restore New York grant to rebuild six properties and bring new families to Poolville. Additionally, the Poolville Community Center is striving to host original events. The community is working hard to adapt to the changes which have befallen them and restore that sense of pride and belonging in Poolville.

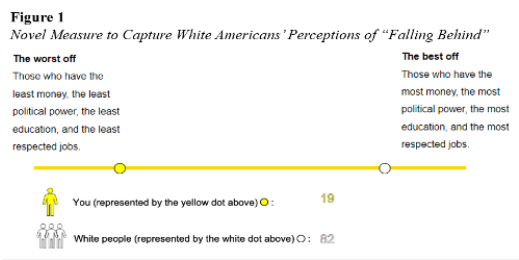
Research Fellows: **Fiona Barber (2025)** **Concentration: Psychological Science**
Jillian Herbst (2025) **Concentration: Psychological Science**
Avalian Rios (2025) **Concentrations: Psychological Science; Sociology**
Faculty Mentor: **Erin Cooley** **Department: Psychological and Brain Sciences**
Title of Project: **The Pain of Falling Behind: Exploring How Race-Class Stereotypes Inform Subjective Perceptions of Status, Emotional Experiences, and, thus, Health**
Funding Source: **NASC Division**

Project Summary:

Racial economic inequality is rising in the United States, such that a typical White American household now possesses 9.2 times the amount of wealth as the typical Black American household (Pew Research Center). Despite this reality, or perhaps because of it, our lab finds that the average White American reports feeling as though they are "falling behind" their racial group when it comes to perceived societal status (Caluori, Cooley, et al., 2024; Cooley et al., 2021). Why does this paradox exist? Our summer research explored this question and developed a new study to examine the effects of these subjective feelings of falling behind on health.

Prior work from our lab has found that White people in the U.S. tend to hold race-class stereotypes that White people are "wealthy" and that Black people are "poor" (Brown-Iannuzzi et al., 2019). And, it is these stereotypes that White = wealth that seem to lead many White people to feel as if they are "falling behind" the perceived high status of their racial group (Cooley et al., 2021). Moreover, in nationally representative samples of White Americans, our lab finds that White people's feelings of falling behind (controlling for their objective status) at time 1 predict the experience of fewer positive emotions at time 2, which then predicts worse self-reported mental and physical health at time 3 (Caluori, Cooley et al., 2024). While informative, these prior findings are limited by their use of self-reported/indirect health measures.

Figure 1
Novel Measure to Capture White Americans' Perceptions of "Falling Behind"



In the study we developed and piloted this summer, we are examining the relationship between feelings of "falling behind" (measured using the novel scale our lab developed in Figure 1) on direct measures of health. To measure health directly we are assessing respiratory sinus arrhythmia (RSA) and cortisol (i.e., a stress hormone) both at baseline and in response to an in-lab stressor. We are also asking participants to collect a week of at-home data to assess daily status comparisons (via daily online surveys), diurnal cortisol (assessed via 4 times daily saliva samples), and sleep duration/quality (measured via an actigraphy watch). This will allow us to better test whether daily status comparisons have predictable downstream consequences for physiological stress and sleep via a longitudinal design.

Due to the time-intensive nature of developing the elaborate methodology for this study, and the time-intensive nature of data collection, we do not yet have the results of this multi-year study. However, we anticipate that our results will replicate previous findings indicating that White people, on average, tend to feel that they are falling behind "most White people" in status (Cooley et al., 2021). We also predict that larger perceived disparities between the self and "most White people" (i.e., greater feelings of falling behind) will be predictive of poorer physiological health markers such as worse sleep, less adaptive diurnal cortisol patterns, delayed cortisol recovery in response to an in-lab social stressor, and lower baseline RSA. Finally, we predict that greater feelings of falling behind may be linked to more daily status comparisons which may mediate worse health outcomes.

While we are focusing on the psychology of these processes for White people throughout our study, it is important to understand the harmful impact of racial economic inequality, and resulting race-class stereotypes, on other racial/ethnic groups in the U.S. We should note that this study is focused specifically on the U.S., so it is important to test these processes in other countries that may have unique race-class stereotypes. In sum, our study aims to deepen our understanding of how racial economic inequality affects people's perception of their status, and thus their health in the United States. We also hope to highlight the broader need to address and mitigate the effects of racial economic equality along with prevalent racial stereotypes that link race with social class.

Research Fellow: Jebbie Bauer (2026) **Concentrations:** Russian & Eurasian Studies; International Relations

Faculty Mentor: Jessica Graybill **Department:** Russian & Eurasian Studies

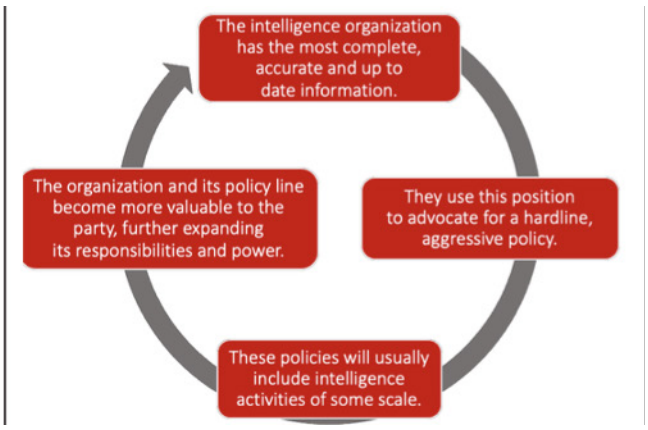
Title of Project: From the Okhrana to the FSB: The Evolution of Russian Security Services

Funding Source: UNST Division

Project Summary:

For well over a century, Russia has been marred by the presence of a repressive intelligence service dealing with internal dissent and external threats. Intelligence in Russia grew from a small protective service into an all-encompassing organization integral to the function of the state. Studying the evolution of these organizations provides insight into how they may function in the future. These intelligence services, most notably the KGB and FSB, have long held more power than any other Russian government organ, maintaining the strongest voice in Russia's ever-shrinking circles of power due to their near-monopoly on domestic and international information. This has allowed the organizations and their members to increasingly advocate for policies that benefit or expand an organ of state security.

Furthermore, the KGB enlarged its influence in the Kremlin through involvement in leadership transitions. Since the death of Joseph Stalin, intelligence services have played the role of a kingmaker, backing hardline general secretaries who supported the KGB and removing weak reformers who inhibited KGB activities. Liberalizing Soviet leaders such as Nikita Khrushchev and Mikhail Gorbachev were removed by KGB-led coups, while conservative Soviet leaders such as Leonid Brezhnev and Yuri Andropov came to power as a result of the KGB's hand. By ingraining itself within the processes of state function, the KGB grew larger and larger until the fall of the Soviet Union, after which it quickly transitioned into the FSB. This present iteration of Russian intelligence maintains the same level of influence that the KGB held in the USSR. The FSB is under the direct control of Putin and his inner circle is composed primarily of figures with FSB or KGB experience. With intelligence services maintaining their influence in the Kremlin, understanding how they have accrued this power and how they use it provides insights into how Putin's government operates and in which direction it may be heading.



Research Fellows:	**Erin Becker (2025)**	**Concentration: Environmental Biology**
	Daytona Doherty (2026)	**Concentrations: Psychological Science; Biology**
	Gianna Durso	
	Fausto Flores Alvarez (2027)	**Concentration: Undeclared**
	Sarah Jekel	
	Quentin Johnson (2027)	**Concentration: Undeclared**
	Vivian Klemmer (2026)	**Concentration: Geology**
	Amelia Mendez	
	Ava Wojtaszek (GR)	**Concentration: Childhood Education (MAT)**
	Jannah Zabadi (2026)	**Concentration: Geography**
	Krelyn Zacarias (2025)	**Concentration: Computer Science**
Faculty Mentor:	**Karen Harpp**	**Departments: Earth and Environmental Geoscience; Peace and Conflict Studies**
	Meg Gardner	**Department: Educational Studies**
Title of Project:	**The Virtual Galápagos: Building an Interactive and Interdisciplinary STEM-Learning Website for Elementary and Middle Schoolers**	
Funding Source:	**National Science Foundation Grant; Norma Vergo Prize; NASC Division; Malcolm ’54 and Sylvia Boyce Endowed Fund in Geology**	

Project Summary:

From May until August, we worked for ten weeks to produce the 2024 Virtual Galápagos curriculum. Our curriculum encompasses the efforts of undergraduate and graduate students who teamed up to create four units of lesson plans. These lesson plans are designed to teach 5th and 6th-grade students about biology, geography, and geology. The program encouraged future teachers to use creative outlets such as videos and storytelling to effectively teach these topics.

Our program developers came from diverse backgrounds, bringing exceptional perspectives that collaborated to produce a unique program. We aligned our curriculum with state and national science standards, applying them to the unique context of the Galápagos Archipelago, located almost 1000 km off the coast of Ecuador. We chose the Galápagos because it exhibits extraordinary scientific phenomena; scientists are still investigating why these islands have flora and fauna that display peculiar behaviors. This year’s focus was on the famous Galápagos finches, particularly the vampire finch, which has been observed drinking the blood of marine birds when food is scarce.

The focus of the Virtual Galápagos curriculum exploration is a central mystery that can be answered by collecting scientific evidence and making a claim. This year focuses on an endemic Galápagos finch species, colloquially known as the Vampire Finch. They exist only on two isolated islands to the north of the main archipelago: Wolf and Darwin Islands. Students in 5th and 6th grade will work through a murder mystery story to collect evidence and answer the central scientific questions: Why do Vampire Finches drink blood? Why do they exist only on Wolf and Darwin Islands? As they collect evidence for the story as a detective and for the mystery as a scientist, they work through units that cover Earth Science processes, adaptations and natural selection, ancestry and DNA, and ecosystems. Throughout these units there is consistent content on human impact, climate change and pollution.

The main technology sources utilized throughout the program were Google Docs, Google Slides, iMovie, Canva, 3DVista, and AfterEffects. Google Docs were used to write our scripts and ideas for each unit, and Google Slides were used to organize our thoughts in an easy-to-access way. We used Canva, iMovie, and AfterEffects for video making and storyboarding, while 3DVista is being utilized for children to use for the main parts of the curriculum and storyline. At first, all of the participants in the program were not completely aware of how to use Canva and the different templates. Still, after some trial and error, all the participants could effectively use the platforms for the videos. As for implementation processes,

As we reach the end of this program, we have completed so much and plan to improve it way more. Each unit is ending at different places. As a result, the next steps are on improving each unit's worksheet materials which are the guided worksheets, teacher copies, and rubrics. While the materials get improved, the next step is to transfer all of the materials unto the software 3D Vista so this can be implemented and used at elementary and middle schools across the country.

Research Fellows: **Dennis Belotserkovskiy (2026)** **Concentrations: Mathematics; Astronomy/Physics**

Jackson Carter (2025) **Concentrations: Computer Science; Applied Math**

Faculty Mentor: **Joe Chen** **Department: Mathematics**

Title of Project: **Matrix Analysis of a Two-Color Particle System**

Funding Source: **NASC Division**

Project Summary:

We studied an interacting particle system of random walkers with two different particle species on a connected weighted graph. These particles are subject to an "exclusion rule," where no two particles can occupy the same site. This model simulates a simplified traffic flow; each particle behaves like a car traveling along a series of sites connected by roads. We assume particles are indistinguishable outside their type or "color". Then, we introduce movement; a particle can either move to an adjacent empty site or swap sites with a neighboring particle of the opposite type. If a particle has multiple options for movement, it picks between them randomly, depending on the graph's weights. Figure 1 illustrates two examples of our model and its rules.

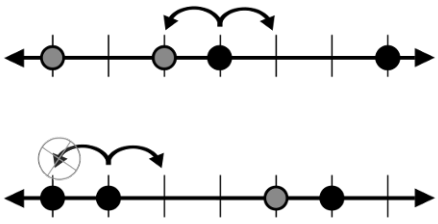


Figure 1: Example graphs and configurations with legal moves shown

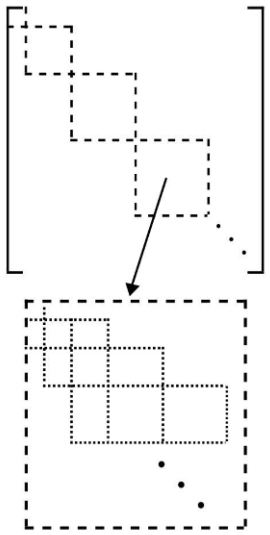


Figure 2: Block/Sub-block Structure of L

To capture the evolution of this model on a connected n-vertex graph, we define the infinitesimal generator of the system as a $3^n \times 3^n$ matrix, L, where the size comes from all possible states of the graph. This generator encodes the model's properties and is crucial in its analysis. The brunt of our research was studying this matrix, which is extremely difficult to parse without choosing an attractive presentation. With a clever choice of basis, we have found structural results for L and an explicit representation of its null space. L is dramatically cleaner when presented in a Boolean-Fourier basis. The normal inclination is to use a standard basis, where each possible configuration indexes a row and column; the resulting L, however, is not straightforward to analyze. If we impose perfect symmetry with swaps between opposite particle types, the Boolean-Fourier basis yields a block diagonal L, whose blocks are sub-block tridiagonal (See Figure 2). More generally, we decompose the matrix into $L = A + B$, where A and B are the contributions from the system's perfectly symmetric and asymmetric dynamics, respectively.

There are several key properties of L. The perfectly symmetric component, A, is negative semidefinite, symmetric, and block diagonal, with blocks that are themselves block-diagonal. The asymmetric component, B, is skew symmetric if and only if the graph is divergence-free. Furthermore, each sub-block column sum of L, A, and B equals zero. Combining this observation with the Perron-Frobenius Theorem lets us prove that the null space of L is completely spanned by constant sub-block vectors. We also have strong numerical evidence—and wrote down a partial proof— that the second-eigenspace of A is completely characterized on any connected weighted graph.

Research Fellow: **Jack Bennink (2025)** **Concentrations:** **Environmental Studies; Biology**
Faculty Mentor: **Ana Jimenez** **Department:** **Biology**
Title of Project: **Muscle structure does not change in summer phenotype House Sparrows (*Passer domesticus*) acclimated to room temperature, stable cold, and unpredictable cold thermal treatments**
Funding Source: **NASC Division**
Project Summary:

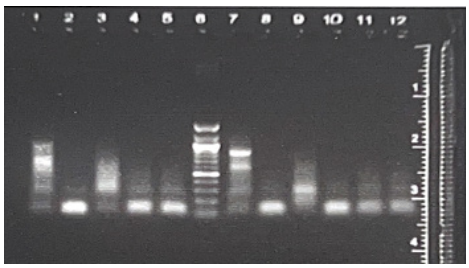
Increasing thermal variability is one of the predicted effects of global climate change, including sudden cold snaps, which will require rapid and flexible adjustments of physiology to match environmental conditions. Such requirements for rapid physiological adjustment could lead to physiology-environment mismatches, which may be metabolically costly for organisms. Organismal-level phenotypic differences commonly occur in birds across seasons. Cell-level changes linked to these seasonal phenotypes, however, are less well understood. At the ultrastructural level, trade-offs may manifest in the size of functional tissues like the pectoralis muscle. Fiber diameter changes may be closely tied to other ultrastructural changes in muscle tissue itself, such as myonuclear domain (MND), which is important to muscle remodelling because muscle hypertrophy or atrophy are often accompanied by changes in myonuclei content. Here, we acclimated summer-phenotype house sparrows (*Passer domesticus*) to three different six-week acclimation treatments: a stable warm, a stable cold treatment and a fluctuating cold treatment. Following acclimation, we measured fiber diameter, number of nuclei per mm of fiber and MND from pectoralis muscle of birds from each treatment. We found no differences in pectoralis muscle ultrastructure for any variable across thermal acclimation treatments, highlighting that summer phenotype house sparrows may be properly equipped to withstand variable thermal conditions. However, we did find ultrastructural differences between winter-phenotype (previous study) and summer phenotype muscle ultrastructural changes. Surprisingly, summer phenotype fiber diameter was larger, number of nuclei per fiber was lower and MND was higher compared with winter phenotype.

Research Fellows: Ava Benton (2025) **Concentrations:** Environmental Biology; Philosophy
Sydney Dunn (2025) **Concentration:** Biology
Faculty Mentor: Krista Ingram **Department:** Biology
Title of Project: SealNet: Facial Recognition and Genetic Tools for Harbor Seal Conservation
Funding Source: Oberheim Memorial Fund; NASC Division
Project Summary:

Harbor Seal (*Phoca vitulina*) populations in the Gulf of Maine are a model system for studying population dynamics of elusive marine mammals. Not only do they have large, stable populations but they are also a key organism in marine ecosystems. Studying their behavior can allow us to collect systematic data and perfect non-invasive techniques that can be applied to less robust populations in a conservation-minded manner. The core goal in our study is to develop non-invasive marine monitoring methods that rely on photographs and eDNA collected from water samples to assess population dynamics. These two efforts, in conjunction, help to create a larger picture of day to day and year to year seal behavior and diversity in Casco Bay.

This summer, we worked on all facets of this project.We began with processing photographs from the summer of 2022 using the facial recognition program, SealNet, developed in the lab. This process begins by isolating individual seal faces from images in a process we call "chipping." From there these chips are run against our larger database of named seals from other days and other years since the project began. SealNet produces a similarity score based on biometric landmarks on the seal's faces (distance between eyes, mouth, nose, etc). Five seals with the highest facial similarities to the chipped seal are produced. Then, we can manually make a call on whether or not the chipped seal is a match with any other seal. Once we make a match, the images of the seals can be consolidated into a folder that is just, say, the seal "Annie." This allows us to create folders of the same seals across sites, days, and years. In order to ascertain the kind of data we are able to get from these data sets we analyzed a previously processed 2021 data set. For example, we found over 36 matches between the 2021 and other years, meaning seals that showed up in 2021 also showed up many times in 2019, 2020, and 2023. We are currently working on the datafor 2022 photographs.The other facet of this project is the environmental DNA (eDNA) collection using the underwater drone, Chasing M2. From the boat, we were able to launch the drone at the haul out sites while still being the regulated 50 yards away from the seals,collecting water samples without disturbing the seals. Wwe collected eDNA in transects at five different sites that had varying numbers of seals, ranging from ~10 to ~80 individuals at the time of sampling. We hope to identify a pattern in the number of haplotypes found in water samples and number of seals on the haul out sites.

Back in the lab, we began processing water samples to identify and isolate pure seal DNA which we could then send off to NextGen sequencing for haplotypes analysis. We had a few very strong bands that looked to be Harbor Seal DNA, one of which is pictured to the right in wells 1 & 7.



These methods combined give us a larger and more complete understanding of population dynamics of Harbor Seals in the Casco Bay while prioritizing non-disruptive and non-invasive techniques.

Research Fellow: **Rylie Berwanger (2026)** **Concentration:** **Geology**
Faculty Mentor: **Alison Koleszar** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Eruptive Mechanisms and the Eruptive Personality of Augustine Volcano, Alaska**
Funding Source: **NASC Division**
Project Summary:

Augustine Volcano is a young intermediate stratovolcano located in southern Cook Inlet, about 290 km southwest of Anchorage. Augustine is one of the 50 active volcanoes in the Aleutian Arc and is among the most active. It has a history of large explosive eruptions at ~1150 ybp (Tephra C), ~750 ybp (Tephra M), and ~450 ybp (Tephra B), with smaller eruptions in between. However, all eruptions in the past ~450 years have been smaller and less explosive. Understanding Augustine's past eruptions can help us better predict the risks associated with future eruptions, not only at Augustine but also at other high-threat intermediate arc volcanoes. Some key questions are: Is Augustine becoming less explosive, or is it in a lull period? How does Tephra M compare in explosivity to past volcanic events?

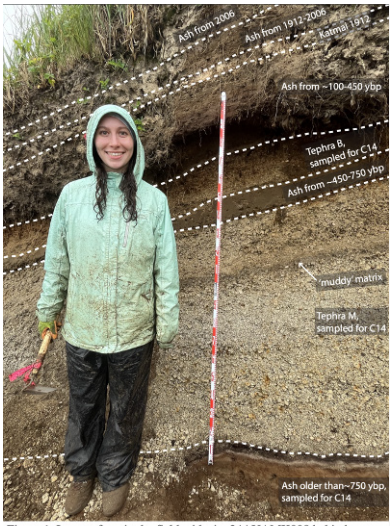


Figure 1. Image of me in the field with site 24AUAMK008 behind me

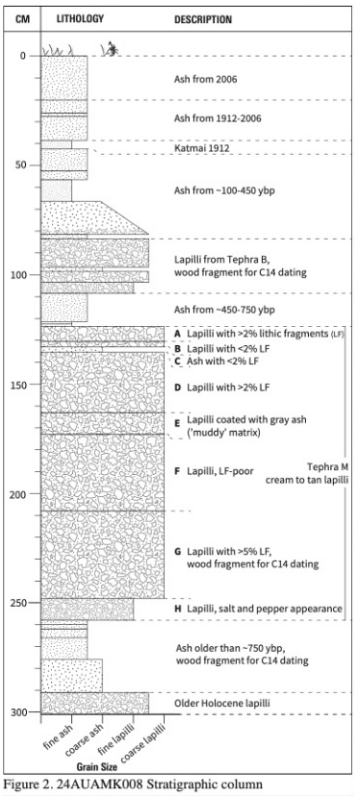


Figure 2. 24AUAMK008 Stratigraphic column

This summer, we conducted fieldwork at Augustine with research partners from Western Washington University. We traveled by float plane from Homer, Alaska, to Augustine, then hiked from the Northwest Lagoon to the south coast of the island and set up camp. We then hiked to different field sites, revisiting some locations from the 2022 field campaign and locating new ones based on tephra dispersal maps in the literature. Our field tasks involved exposing, describing, and sampling tephra from the eruptions that produced Tephras B, M, and C (Fig. 1). We recorded detailed stratigraphic observations and collected samples for geochemistry, grain size analysis, componentry, and carbon dating.

Back at Colgate, we used portable XRF to correlate between composition and visual componentry in 2022 samples. We prepared the 2024 samples for grain size and geochemical analysis. My focus was on compiling and digitizing field observations, including site descriptions, tephra stratigraphy, and sample data. I cross-referenced field notes, StraboSpot2 data, and photos, then created stratigraphic sections in R and Adobe Illustrator for comparison with previous studies (Fig. 2).

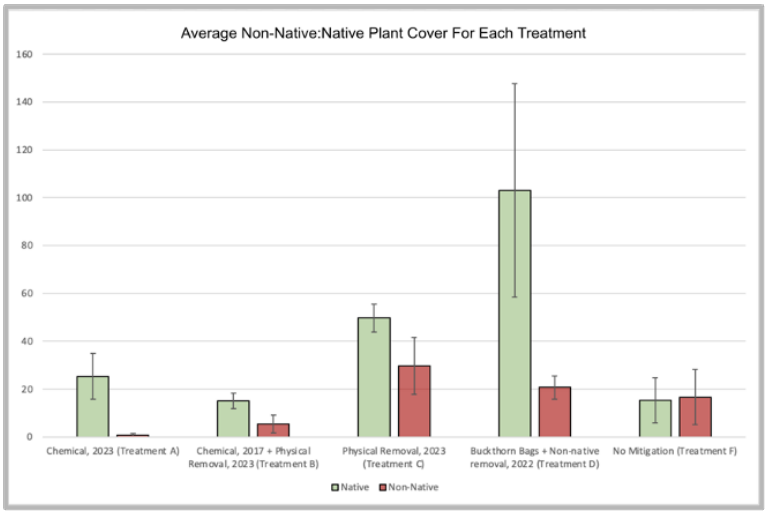
Although the tephra deposit at site 24AUAMK008 was described as Tephra C by Waitt & Beget (2009), our field observations and my stratigraphic section suggest it aligns more closely with Tephra M. Tephra C is characterized by a dark band formed by an increase in banded pumice, LSA, and lithic fragments. In contrast, my stratigraphic column reveals that the dark band in this deposit (the "muddy matrix" in Figs. 1 and 2) is due to gray ash coating the clasts—something absent in Tephra C. Correctly identifying these deposits is crucial, as past misidentifications could affect our understanding of eruption dynamics and the dispersal patterns of tephra plumes.

Research Fellow: **Peter Biss (2026)** **Concentration: English**
Faculty Mentor: **Catherine Cardelús** **Department: Upstate Institute**
Title of Project: **A Cost-Benefit Analysis of Champlain Area Trails Mitigation Efforts of European Buckthorn Within The Essex Quarry Nature Preserve**
Funding Source: **Upstate Institute**
Project Summary:

The Champlain Area Trails Service (CATS) is a non-profit organization and accredited land trust that promotes tourism and protects biologically rich ecosystems through the acquisition and maintenance of a trail network that now spans almost 100 miles. It was my job this summer to maintain and expand this trail network, in addition to conducting a research project on the mitigation of the invasive species European Buckthorn within one of CATS' most popular trails, the Essex Quarry Nature Preserve.

Buckthorn is a dense understory shrub that has devastated ecosystems across the Northeast and Central United States by changing native soil chemistry, harming wildlife, and suppressing native plant growth. Essex Quarry, a roughly 1.25-mile trail loop, has a lot of this invasive species, which CATS has tried to remove using various mitigation strategies. One of these methods of buckthorn removal was a chemical treatment, where an herbicide called Glyphosate was used. Another method involved the use of black trash bags, which were placed over freshly cut buckthorn to prevent sunlight from reaching any new growth. In total, there were five mitigation methods. It was my job to look at these methods and find which of the five proved most effective at not only removing buckthorn but also increasing native plant biodiversity. I did this through first an experimental study looking at native:non-native cover across each of the mitigation sites, and second a cost-benefit analysis using results from the experimental study and a series of interviews with CATS and its associates about the history of each mitigation site.

What I ultimately found through this two-step process was that while the non-chemical method of buckthorn removal followed by the use of trash bags did prove most effective at increasing the number of native plants out of the five treatment methods, all mitigation strategies performed better than the control at increasing the ratio of native:non-native plant cover. I also found that despite obtaining the lowest number of species, the chemical treatments using glyphosate did prove 30 times more efficient at improving the native:non-native cover ratio. This data is useful to CATS in two ways.



Firstly, CATS in using this data can make more informed decisions as to the future of buckthorn mitigation efforts within Essex Quarry. Secondly, CATS can use this data to obtain funding for future buckthorn mitigation projects within the Essex Quarry Nature Preserve.

For more information related to study results and the methodology used, access my research poster here (Or via this full URL code: https://drive.google.com/file/d/1u27jC9Y5TPzX3Kqn1ZHJ0EU-I6y5yCBG/view?usp=sharing)

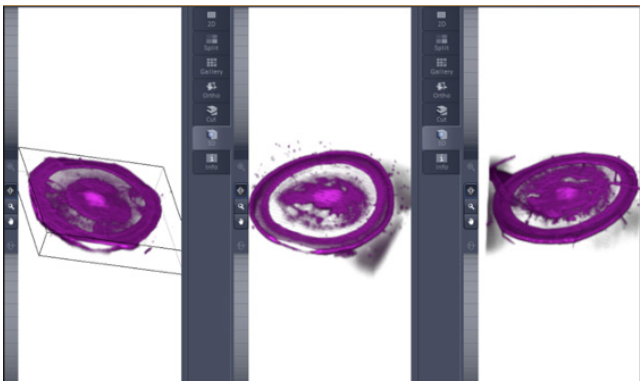
Research Fellow: **Thomas Brew (2025)** **Concentration: Physics**
Faculty Mentor: **Rebecca Metzler** **Department: Physics and Astronomy**
Title of Project: **Identifying the type of Biomineralization in Barnacles**
Funding Source: **National Science Foundation Grant**
Project Summary:

Barnacles are sea-fouling creatures that inhabit intertidal zones. Before settlement, a barnacle goes through two stages of metamorphosis. In the first stage, it swims around as nauplii. Nauplii are free to consume phytoplankton and other microbes. The second stage is the cyprid stage. In this form, the barnacle is still mobile; however, it survives on fat reserves and can no longer consume food. The final stage is the barnacle. Cyprids begin the final metamorphosis when they attach to a surface by secreting a proteinous solution called a baseplate. Soon after settlement, the parietal plates form and surround the barnacle. The purpose of the experiment is to determine the kind of biomineralization that occurs in barnacles.

Biomineralization is the process by which an organism uses environmental chemicals to form structures. Barnacles use either extracellular or intracellular biomineralization for their parietal plates. Extracellular biomineralization is the process where an organism forms minerals outside of the cell on a surface known as the organic matrix. Intracellular biomineralization is where minerals form within vacuoles inside the cell. A vacuole is a compartment that cells can have where they can store chemical resources needed to perform cellular functions.

In this project, we used a chemical dye known as calcein to attempt to determine the kind of biomineralization. Calcein is a dye that reacts with calcium, a chemical necessary for the biomineralization of calcite in barnacles. Once calcein reacts with the calcium and is exposed to a specific laser frequency, it fluoresces. There are two kinds of calcein we use: calcein and calcein AM. Calcein AM is cell-permeable and calcein is not. So if calcein fluoresces and calcein AM does not, we would know it is extracellular, not intracellular, and vice versa.

The main issue is that barnacles auto fluoresce, so we needed to identify a type of calcein that did not fluoresce the same color as barnacles. Initially, we used a fluorescent microscope to study barnacles' fluorescence under three kinds of lasers: green, blue, and red. Under this initial observation, we noticed that the weakest fluorescence is red, the second weakest is blue, and the strongest is green. Since red was the weakest fluorescence, we experimented with red and orange dyes. After comparing the color red to the control, we could not tell the difference between the two. Our test with calcein orange was more successful. The barnacle did not autofluoresce orange. So far, we have only used calcein orange and are currently waiting to use calcein AM orange to compare the results.



3 Confocal images of juvenile barnacles. The images are of Control(left), Calcein Deep Red(center), Calcein Deep Red AM (Right)
Tha images were analyzed using the ZEN Software

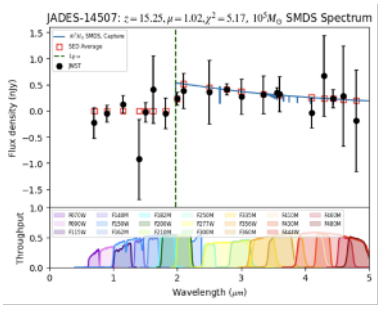
Research Fellow: **Tori Broadnax (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Cosmin Ilie** **Department:** **Physics and Astronomy**
Title of Project: **Search for Super Massive Dark Stars**
Funding Source: **Justus '43 and Jayne Schlichting Student Research Fund**
Project Summary:

The James Webb Space Telescope (JWST) has detected numerous compact celestial objects that appear excessively luminous for their formation to have occurred within the first 500 million years (Myrs) following the Big Bang. One potential explanation for these observations is the existence of dark stars—hypothetical stars powered by the annihilation of dark matter.

Dark stars can form if Dark Matter is either in the form of Weakly Interacting Massive Particles (WIMPs) or in the form of self-interacting dark matter particles. In either case, these particles would accumulate within a dark star's core and undergo annihilation and thus release the energy necessary to counteract gravitational collapse and sustain the star's luminosity. The early universe would have had a higher density of dark matter, which would facilitate the formation of dark stars in this primordial environment.

Dark stars, due to their reliance on dark matter annihilation for energy rather than nuclear fusion, would be relatively cooler and would not emit high-energy photons like traditional stars. This lack of high-energy emissions allows them to accumulate mass over time, potentially growing very large. Such characteristics align with the observations made by JWST.Moreover, dark stars could have played a role in the formation of supermassive black holes. They may have served as the initial seeds for these massive objects. Three celestial objects identified as potential dark star candidates are JADES-GS-z-13, JADES-GS-z-12, and JADES-GS-z-11. Our research aims to discover additional candidates for dark stars.

To identify these candidates, we utilized JWST data alongside the Nelder-Mead algorithm for optimization. Our analysis involved deep field surveys from projects such as UNCOVER, CEERS, CLASS, and JADES. We processed the photometric data, including fluxes and their uncertainties, to generate plots with critical values.We also use spectral data from the TLUSTY. A chi-squared analysis was then employed to assess the fit of these plots. Higher redshifts (typically $z \geq 8$) correspond to earlier formation epochs in the universe. Additionally, we analyzed the mass distribution to refine our candidate selection. Two primary mechanisms for forming a dark star are: DM Capture and Adiabatic Contraction (AC). We applied different computational codes for each criterion. Our research is heavily computational, involving large datasets from various deep-field surveys, which poses challenges in tracking and maintaining consistency across multiple observations. To address these challenges, we developed specialized codes for different catalogs, telescopes (HST, JWST) and various observational bands. As a result of our analysis, we identified several promising candidates that fit the profile of dark stars. Many of these candidates have associated spectroscopic data that further support our hypothesis and enhance our understanding of these enigmatic objects.



Research Fellow: **Oscar Brown (2026)** **Concentration:** **History**
Faculty Mentor: **Monica Mercado** **Department:** **History**
Title of Project: **Campus Places and Queer Spaces: Gay and Lesbian Visibility at Colgate University, 1965-1985**
Funding Source: **Walter Broughton '63 Research Fund**
Project Summary:

Histories of collegiate gay and lesbian activism often begin with the formation of student groups—Gay Student Alliances, Gay Liberation Fronts, Student Homophile Leagues, or another kind of campus-based club or organization. This narrative, however, neglects a wide array of non-traditional spaces queer students occupied prior to the inception of these highly visible gay student groups, leaving a crucial aspect of queer history relocated to the margins. So, what were the spaces gay and lesbian individuals inhabited before visible gay student groups emerged? How did these spaces evolve? How are these spaces unique? What kinds of visibility opportunities did they provide?

Examining Colgate University's history of gay and lesbian visibility from university-sponsored lectures and panels in the mid 1960s to the formation of the second gay student group on campus and their ensuing publicity in 1984 and 1985 first disrupts common narratives about queer organizing dominantly occurring in urban spaces, as what scholarship currently suggests. Additionally, this research seeks to recenter the ways we examine historical representations of queer visibility by integrating practices from queer and feminist theorists, like Michael Foucault, Jack Halberstam, and Finn Enke, into historical analysis. These acts reveal a new way of discussing the spaces gay and lesbian individuals inhabit, and are seen in four types, all of which contribute to an ever-growing understanding of queer history. These spaces are (1) campus places, or, spaces not built for long-term networking or community-building for queer individuals, but occasionally provide visibility and recognition; (2) emerging spaces, comprised of pre-established organizations or groups on campus that support queer individuals and provide small, yet long-term opportunities for queer individuals to form networks and communities; (3) outgrowing closets, where, through previously-established networks or communities, queer individuals are able to form public-facing, visible student groups or advocacy efforts; (4) newspapers, a dynamic stage which exists as a campus space, an emerging space, and outgrowing closets because of its ability to accommodate for a multitude of types of visibility and advocacy efforts.

Archival material was drawn from Colgate University's Special Collections and University Archives from collections of the Office of the President, the Dean of the College, the University Church, LGBTQ Initiatives Office Records, The Colgate News, and The Colgate Maroon. The Salmagundi collection at Case Library and Geyer Center for Information Technology and the oral archives conducted by the Queer Activism at Colgate Digital History Project were also highly pertinent.

This research revealed a stark need for reconsideration of the way historical scholarship represents gay and lesbian history on campus. We must take the time to look for gay and lesbian history outside of 'expected' places, as other less 'traditional' spaces of organizing and gathering are just as historically transformative. Moreover, we must acknowledge and work in consideration of the unique circumstances in location, institutional type, student and administrative culture, and organizational infrastructure to ensure non-traditional queer histories are not neglected because of overarching assumptions about what 'queer space' should look like.

Research Fellows: **Zachary Brown (2025)** — **Concentrations: Music; History**
Sophia Fossati (2025) — **Concentration: History**
Faculty Mentor: **Graham Hodges** — **Departments: History; Africana & Latin American Studies**

Title of Project: **Henry Highland Garnet In Central New York**
Funding Source: **SOSC Division**
Project Summary:

In 1815, Henry Highland Garnet was born into slavery in Kent County, Maryland. At age 9, he and his family fled their enslaver, Colonel William Spencer, arriving first in Delaware, then Pennsylvania, and eventually settling in New York. Henry was given a formal education at the African Free School in New York, where the young man began his work as an activist. Throughout Garnet's life, he would become a pastor and fervent member of the Abolitionist Movement, working to ensure safety and equality for his fellow men.

This past summer, we assisted Professor Graham Hodges in researching Garnet for Professor Hodges' upcoming book on him. We were tasked with doing archival research, driving to and from the Bird Library in Syracuse to look through documents regarding Garnet. We shifted through many archival boxes of Gerrit Smith's bills and receipts, looking to find records of his donations and payments to freedom-seekers and free black men and women. Smith, who lived in Peterboro, NY, was a major Abolitionist figure and funded a majority of figures- such as Frederick Douglass, John Brown, and Garnet -, events, and everyday people in the pursuit of antislavery. These documents, though we couldn't find too much on Garnet himself, were evidence of the extent of Smith's financial dedication to the cause. Smith proved himself an example of a man "behind the scenes", more focused on assisting those who needed it rather than getting glory himself.

We also assisted Professor Hodges in transcribing and reading archival documents pertaining to Garnet sent to him from archives in Scotland. During the 1850s, Henry Highland Garnet worked as a preacher in Scotland, becoming an ordained minister of the Presbyterian Church. While it was extremely difficult to read the paleography of the pieces, the challenge was a rewarding experience. In spending time with the documents, we were able to hone our skills of reading 19th-century handwriting while learning more about Henry Highland Garnet. These documents helped further our understanding of the extent of Garnet's influence as a pastor and depicted the eagerness with which the Scottish Presbyterian Church wished for Garnet's presence.

We also assisted and participated in a few of the NEH (National Endowment for the Humanities) Summer Seminar classes, learning from Professor Hodges about slavery and the Underground Railroad. This experience allowed us more insight into the atmosphere in which the subjects of our research were living. We also attended a few of the NEH guest speaker talks. We were able to ask other historians in the field, such as Marcus Rediker, Kate Clifford Larson, and Manisha Sinha, questions regarding the research we were assisting with.

Research Fellow: Abby Call (2026) **Concentration:** Peace and Conflict Studies

Faculty Mentor: Frances Wang **Department:** Political Science

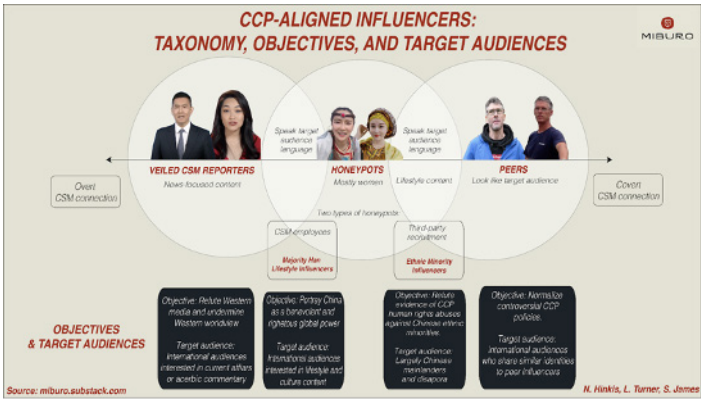
Title of Project: Buying Influence: Analyzing Chinese Outsourced Foreign Propaganda in Asia

Funding Source: SOSC Division

Project Summary:

As China continues to expand its economic, political, and security interests across the globe through programs such as the Belt and Road Initiative (BRI), the Chinese Communist Party (CCP) has bolstered its efforts to sway the hearts and minds of foreigners through external propaganda. This study explores how China has outsourced propaganda through the contracting and training of foreign media agents within Southeast Asia. This approach of hiring foreigners to spread pro-China sentiment allows messages to be specialized to each region's unique perception of China, helping the CCP avoid criticism and distrust in its efforts to shape narratives. These foreign agents include journalists from local news organizations, social media influencers, university students, overseas Chinese, and Chinese ambassadors. To unpack these foreign propaganda supply chains, our research team examined government archives, contracts, think tank and private social media analytics firm reports, white papers, foreign media articles, and social media accounts.

Foreign journalists of smaller, local media organizations are recruited through state-holding media enterprises, known as China Media Group (CMG). Our research revealed that several Memorandums of Understanding (MOUs) have been signed between foreign news organizations/journalist unions and Chinese media companies such as CGTN, CRi, and CCTV, directly funded by the CCP. These contracts include content-sharing and professional development of journalists. We have also identified several foreign journalists who work for both CMG enterprises and foreign local news agencies. These actors often publish "opinion" pieces for foreign news agencies and their content is reposted by Chinese ambassadors on Facebook and X. Moreover, CMG offers many media summits and scholarship programs, where they receive expense-paid trips to China for content-sharing, contract signings, and training run by the CCP.



Social media influencers act as a benign method of spreading propaganda to foreign audiences with significant outreach that is difficult to track. Many of these influencers are featured in professional CMG content and also publish their own vlogs, ranging from sharing positive travel experiences in China to geopolitical opinions and conspiracy theories that support the CCP. This mixture of professional and novice content cultivates authentic personalities. Events such as "China in my Camera" Blogger Experience Camp in Henan, China provide training and content for these CCP-aligned influencers. These individuals do not display their connection to the CCP on their accounts. Due to the informal nature of influncer content, CMG connections to these agents are not registered in government databases. Budgets and contracts are not available for these influencers, even under the US Foreign Agent Registration Act data base. This allows these agents to remain separate from the Chinese government to avoid scrutiny as a propaganda operation. An American YouTuber recently leaked an email chain claiming to reveal how these influencers are recruited by CMG. We suspect this same method is used for recruiting Southeast Asian influencers.

Foreign university students and overseas Chinese are also recruited as foreign agents. Talent programs such as the Homeland-Serving Action Plan provide financial support for overseas students to complete state-funded "service activities" and encourage students to "serve the motherland" by participating in and hosting exchange meetings for overseas students. While these exchange programs are subtle in their impact, many of these foreigners are featured in CMG content excessively praising China, and likely shape narratives of China in their home countries. Many reports of these talent programs also suggest they are a substantial security risk to foreign countries.

Research Fellow: **Madison Cammarata (2026)** **Concentration:** **Environmental Geology**
Faculty Mentor: **Paul Harnik** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Variations in Bryozoan Feeding Rates Along a Coastal Productivity Gradient**
Funding Source: **National Science Foundation Grant**
Project Summary:

Human-induced nutrient enrichment has significantly augmented coastal primary productivity, forming an extensive "dead zone" in the northern Gulf of Mexico and other locations globally. This rapid increase in productivity may profoundly influence the biology of marine organisms, specifically the feeding rates of suspension-feeding marine animals in the Gulf of Mexico. Cupuladriid bryozoans, colonial invertebrates inhabiting tropical continental shelf environments, may alter their traits in response to such environmental changes. The size of autozooids, the feeding structures in the bryozoan colony, determine the colony's feeding rate. These structures are hypothesized to vary in response to local productivity levels across regions of the Gulf of Mexico. Specifically, larger autozooids are expected in less productive environments (e.g., Florida) and smaller in more productive environments (e.g., Alabama). This hypothesis can be evaluated by analyzing autozooid areas; larger autozooid areas correlate with larger feeding organs (lophophores), enabling higher feeding rates and, thus, more rapid food intake. This rapid food intake benefits organisms in less productive environments, as it allows for optimal food consumption in areas where food is sparse.

Bryozoan colonies were taken from field samples collected with a box corer at 20m water depth in two regions (FL, AL). Field-collected dead (i.e., historical) bryozoan colonies were categorized by genus and reproductive strategy, then assessed through a combination of light and scanning electron microscopy (SEM) (Figure 2). Using DeepBryo AI software, measurements of autozooids were extracted from SEM images. Statistical analyses conducted in R Studio revealed significant differences between Alabama and Florida populations in mean autozooid areas, with larger sizes observed offshore of Florida (Figure 1). Variation in autozooid size corresponds to regional differences in phytoplankton abundance, with Florida characterized by lower productivity. This suggests that bryozoans may adapt to human-induced changes in nutrient levels: smaller autozooids in increasingly more productive environments as lower feeding rates are adequate to meet energy demands. However, the size difference in the autozooid area we observed may also be attributed to differences in watershed size between Alabama (larger) and Florida (smaller). Future work will investigate this possibility by examining of live-collected bryozoan samples from these two regions.

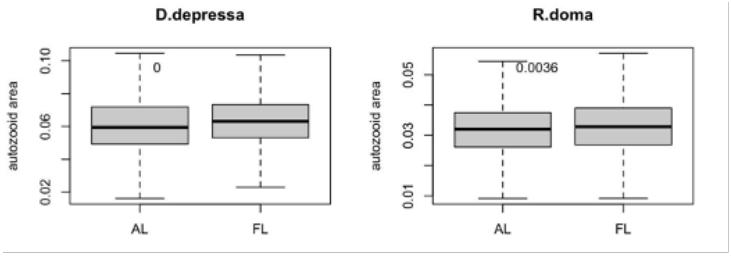


Figure 1: Geographic Comparison of Autozooid Area of D. depressa and R. doma (mm); p-value located in the upper-left corner of each graph

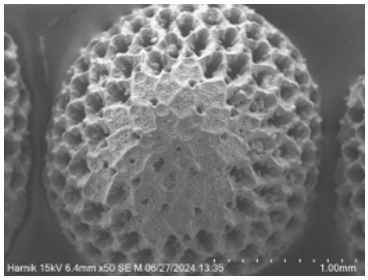


Figure 2: SEM Image of R. doma Colony

Research Fellow: **Carlson Cao (2025)** **Concentration:** **Biochemistry**

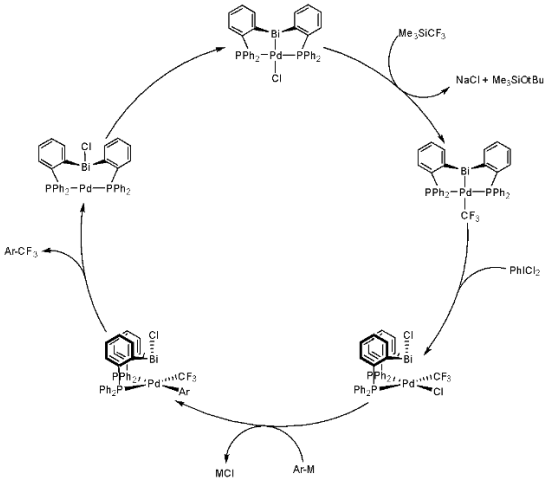
Faculty Mentor: **Gongfang Hu** **Department:** **Chemistry**

Title of Project: **Exploration of Bismuth-Palladium Bimetallic Complexes for Catalytic C(sp^2)-C(sp^3) Cross-Coupling**

Funding Source: **Justus '43 and Jayne Schlichting Student Research Fund**

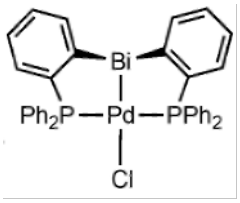
Project Summary:

xC(sp^2)-C(sp^3) cross-coupling is a chemical reaction that forms carbon-carbon bonds between sp^2-hybridized carbons and sp^3-hybridized carbons. This technology is essential in creating complex organic molecules with precision, and its applications are diverse: in pharmaceuticals, it's used to synthesize drugs like Vemurafenib for cancer and Oseltamivir for influenza. In agrochemicals, it helps develop effective herbicides like Pyroxasulfone, and in consumer products, it contributes to unique fragrances and cosmetics.



However, such a reaction is inherently hard to harness. Issues like poor selectivity, competing side reactions, and the need for specific catalysts to facilitate the bond formation under mild conditions keep preventing people from applying it to wider fields and generating products hard to manage, and finding a catalyst that facilitates this reaction efficiently and cleanly is a valued topic to study.

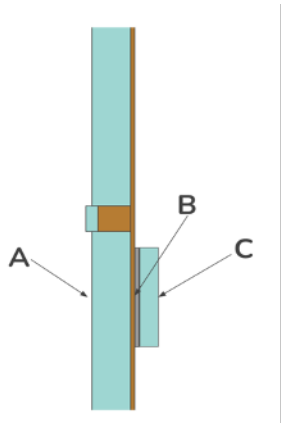
In this summer, our group explored an organometallic compound, which by calculation, showed thermodynamically favorable properties for Csp^2-Csp^3 cross coupling. This bismuth-palladium compound shown on the right was studied for its hydrogen-evolution reaction properties previously. The bismuth-based ligand acts as a X-type ligand, which renders a palladium(II) formal oxidation state. Also, it is known that the bismuth ligand can be potentially converted into a lewis acidic (III) state in the literature, which is an essential step in the full catalytic cycle shown. Furthermore, density-functional theory calculations showed that this cycle is downhill in energy in each step, implying that such a catalytic cycle may potentially proceed spontaneously.



To start this cycle, we plan to coordinate a sp^3-hybridized carbon on the palladium to replace Cl, and this step has shown to be successful, but the difficulty was the isolation of formed compounds. We had tried different reaction reagents in different conditions, and were able to get the mixed NMR spectrum along with co-crystaled XRD data of such Pd-CF3 complex. The future plan is to optimize the purity and fully characterize the compound, and use it as the starting point for the next point.

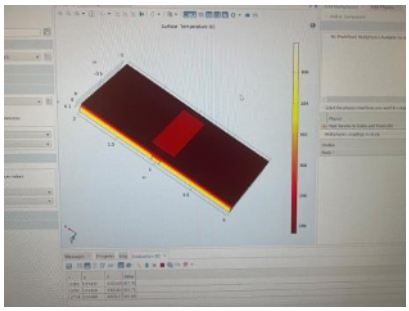
Research Fellows: Jerry Cao (2026) — **Concentration:** Physics
Sherlyn Shi (2027) — **Concentration:** Undeclared
Faculty Mentor: Beth Parks — **Department:** Physics and Astronomy
Title of Project: Modeling heat transport in insulation measurements
Funding Source: NASC Division
Project Summary:

Most homeowners in the U.S. don't have any records from their home's construction including the insulation present in the walls. The first step to improve energy efficiency is to learn what the current insulation is. Therefore, it's necessary to develop a tool to measure the wall insulation. In our research this summer, we tested a method to measure wall insulation. One challenge in measuring insulation is that walls are not uniform: they include both insulated regions and wooden studs. The photograph shows a section of a wall with a horizontal stud separating two insulated regions.



We measured the R-value (the effectiveness of the insulation) in several different arrangements, using both a heat flux transducer and an inexpensive thermocouple). We tested using a metal plate underneath the insulator to average over the different wall temperatures in order to find an average R-value instead of only the R-value where the sensor was located. The second figure is a cross-section of the wall showing where the junctions of a thermocouple could be attached to measure the R-value of just the insulation; it was moved higher on the wall in order to average over the stud.

We found that the average R value for the thermocouple on the stud is 18.08 and the average R value for thermocouple on the insulation is 21.14. The difference in these values is due to the higher thermal conductivity of the wooden stud compared to the insulation.



Moreover, we used a COMSOL to simulate the measurement process, and obtained similar results from our measurements. The screenshot shows how COMSOL displays the temperature and heat flux results.

Future work will try to improve the reliability of the measurement system so that we can obtain the R-value with fewer measurements.

Research Fellow: **André Cattouse (2026)** **Concentrations:** **Educational Studies; International Relations**

Faculty Mentor: **Bruce Moseley** **Department:** **Upstate Institute**

Title of Project: **Bridging Barriers: English as a Second Language (ESL) Education at Midtown Utica Community Center (MUCC)**

Funding Source: **Upstate Institute**

Project Summary:

The Midtown Utica Community Center (MUCC) is a crucial institution in Utica, New York, committed to aiding refugees and immigrants beyond the initial 90-day governmental assistance period. Utica has a long history of welcoming refugees and has become one of the largest refugee cities in the United States, having accommodated 20,000 refugee families since the 1970s. MUCC's mission is to tackle persistent challenges such as language barriers, economic hardship, trauma-related issues, and cultural nuances, thereby fostering a multicultural, refugee-friendly environment. MUCC offers a wide range of services to help refugees and immigrants integrate into their new community, including ESL education, citizenship classes, after-school programs, arts and cultural activities, and much more! The center has served over 4,000 community members and is continuously expanding its programming and physical space to better serve its constituents.

During the summer, I had the opportunity to work at MUCC in two significant roles: as a grant writer and as an Adult ESL teacher. As a grant writer, I connected with local media to raise awareness about MUCC and its fundraisers, and I spearheaded the development of a Mental Health Program for Youth. This program aims to create a safe and supportive environment for young individuals to learn self-care practices and engage in activities promoting mental and physical well-being. In my role as an Adult ESL teacher, I observed, co-taught, and solo-taught students ranging from 27 to 60 years old from diverse backgrounds, including Burma, Ukraine, and the Dominican Republic. This experience was profoundly impactful, as it allowed me to contribute directly to MUCC's mission of helping refugees adapt to their new environment, find jobs, integrate socially, succeed in education, access necessary resources, and foster a sense of belonging.

Working at MUCC provided me with invaluable experience and a deeper understanding of the challenges faced by individuals from diverse backgrounds. As a Belizean woman who migrated to the United States, I could relate to the experiences of the refugees and immigrants I worked with, which made my role even more meaningful. This experience has reinforced my belief in the transformative power of education and ignited a sincere dedication to making a positive impact in the lives of the students I will teach.

MUCC plays a crucial role in supporting refugees and immigrants in Utica, providing essential services that help them integrate and thrive in their new community. My experience at MUCC has been transformative, both personally and professionally, and has solidified my commitment to education and community service. The work done at MUCC is a testament to the power of community support and the importance of addressing the unique challenges faced by refugees and immigrants.

Research Fellows: **Jaydon Chalichemala (2025)** **Concentration: Biochemistry**
Barrett Regan (2025) **Concentration: Philosophy**
David Stephens (2026) **Concentration: Chemistry**
Faculty Mentor: **Jason Keith** **Department: Chemistry**
Title of Project: **Examination of Fluoride Ion Affinity to Predict Lewis Acid Catalytic Activity for Diels-Alder Reactions**
Funding Source: **Justus '43 and Jayne Schlichting Student Research Fund; NASC Division; National Science Foundation Grant**

Project Summary:

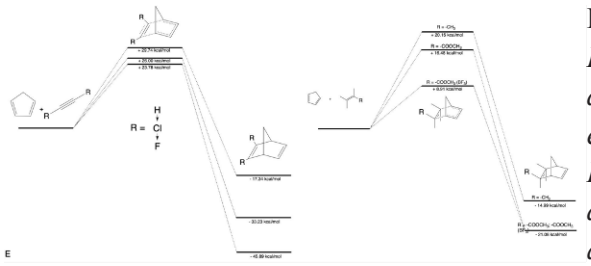
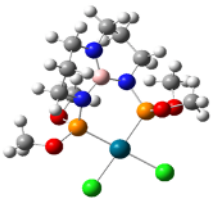
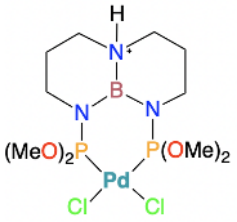


Figure 1
Left: Energy diagram for Diels-Alder reaction, demonstrating lowering of barrier through addition of electron withdrawing groups.
Right: Energy diagram for Diels-Alder reaction, demonstrating lowering of barrier through addition of an electron withdrawing group (-$COOCH_3$), followed by further lowering through Lewis acid catalysis (BF_3).

The Diels-Alder reaction is a powerful concerted, pericyclic reaction that has shaped the synthesis of polymers, biomaterials, and natural materials. The presence of electron-withdrawing groups (EWGs) on the dienophile has been shown to lower the energy of the transition state, increasing the rate of product formation. Lewis acids are vital in determining the efficiency in bond activation or catalysis, yet they have been seldomly utilized in quantifying relative transition-state energy barrier changes, as we have in Figure 1. To gauge Lewis acidity as a basis in explaining simple Diels Alder energetics, we examined the relative transition state energies of the reaction between cyclopentadiene and an alkene with various R groups. The bonding between the diene and dienophile (or alkene) in Diels-Alder reactions occurs due to the interaction of the highest occupied molecular orbital (HOMO) of the diene and lowest unoccupied molecular orbital (LUMO) of the dienophile. In this example, the Acetylene HOMO bonds to the Cyclopentadiene LUMO because of its favorable geometric, energetic, and spatial overlap. The HOMO of the transition state shows the creation of the two new C-C bonds to form Norbornadiene.

We are applying these ideas to investigate a novel catalyst, Figure 2 (right), involving a TBDPhos bound Pd atom. Using these principles proven above, we aim to understand the energetics of this cooperative catalysis between the Pd and B centers of the catalyst. Understanding the mechanism of this class of catalysis can aid in finding new applications of this powerful technology. Using Fluoride Ion Affinities (FIA) we aim to quantify Lewis Acid acidity, we aim to understand implications for catalysis using similar molecules. These calculations are executed using the Gaussian 16 suite with the B3LYP-D3 functional and the 6-31G basis set for atoms in the first, second, and third periods and the LANL08(d) basis set and effective core potentials for heavier atoms. For FIA final frequency calculations, the DSDPBEP86-D3BJ functional was used in conjunction with the 6-311++(2d,2p) basis set for first, second and third row elements and LANL08(d) for those elements in the fourth and fifth rows, and LANL08(f) for Ni, Pd, and Pt.





Research Fellow: **Lance Chen (2025)** **Concentration:** **Physics**

Faculty Mentor: **Cosmin Ilie** **Department:** **Physics and Astronomy**

Title of Project: **Nebular Emission from Super Massive Dark Star**

Funding Source: **NASC Division**

Project Summary:

This summer, I continued previous work on Nebular Emission with the team. I mainly focused on modeling Dark Star candidates and then simulated their Nebular status for analysis. In short, Dark Stars are theoretically stellar body models that are really massive, huge and energetic, powered by Dark Matter Particles. We believe there are two kinds of Dark Star formation, either through Adiabatic Contraction or Dark Matter Capture. As a team, we worked on tackling different parts of the project. My parts involved creating a massive "grid" that asked the computer to automatically do all the model calculations for us. Then through coding, I compared the calculated data with observed data from JWST (James Webb Space Telescope).

Initially, I worked on finding out the expected hydrogen density of the nebular. To do so, I first studied the related background knowledge about the relation between the radius of the nebular and the hydrogen density of it. Using the equations in the book, I made a python script to calculate all the expected hydrogen density of our table of candidates. After figuring out all the desired hydrogen density values, I turned to building Dark Star models. As Shafaat Muhmud has previously worked with the software, TLUSTY, he assisted with setting up all the required files and parameters. From there, I learned about parallel computing which breaks down the big process of building a Dark Star model into relatively small pieces that are processed at the same time to save time. Using this technique, I wrote a script to ask the computer to automatically build all the models by providing an input parameter sheet. Through this process, I had some trouble figuring out how to perform parallel computing in the terminal window on the Super Computer. Hence, I searched online and with the help of Chatgpt, I was able to finish the work successfully. This was my opportunity to work on the Super Computer. I learned a lot with terminal commands. Thanks to Kai who was very helpful when I had a question, I slowly learned to perform work on the platform. Now with the knowledge of creating a grid, I used a similar procedure with nebular emission. With a finer grid, we were able to examine the effect of a slight shift in hydrogen density on the output SED (spectral energy distribution). At the end of my research, I also tried to zoom into one specific range of wavelengths to closely examine the effect of nebular emission. However, I encountered some difficulties. I tried to reach out to the author of the software, but hadn't got any news back yet. Hence, I will probably try to figure a way out in the fall.

Research Fellow: **Brigid Clive (2027)** **Concentration: Undeclared**
Faculty Mentor: **Rachel Amann-Burns** **Department: Upstate Institute**
Title of Project: **Identifying and Mitigating Barriers to Student Participation in Saranac Lake Community School's 21st CCLC Programs**
Funding Source: **Upstate Institute**
Project Summary:

In 2018, Saranac Lake Central School District (SLCSD) began using the term "community school" to explicitly indicate its commitment to eliminating inhibitors of student success and well-being. Since then, its resources and services have grown tremendously; distinctly, the 21st Century Community Learning Centers grant (21st CCLC) awards the school $756,000 a year from 2022-2027 to provide high-quality out-of-school-time enrichment programming to all students and families in the district. In order to receive this money, the grant requires SLCSD to meet a threshold of 360 students at 15 hours of participation in programs. Although in year two of the grant SLCSD quickly met this goal and continued to reach 75% of students with at least one hour of programming, the program management staff aims to serve 100% of students.

Thus, my research focused on identifying reasons why students and families have low participation and strategies to get them involved. I created a survey for parents of students with less than five hours of participation and asked various questions about barriers, potential activities of interest, and best times to schedule events–in addition to inviting other feedback. We then sent out the survey links addressed to the parents with a personalized note to emphasize we were truly interested in their answers. In some families one student participated in a multitude of hours, while the other child attended very few events, if any. We saw this as an opportunity to incentivize the less active students by creating a sibling competition. In the note attached to the survey, we congratulated the student with more hours and expressed our desire to hear from the other student on how we could make programs more appealing.

Ultimately, we received 43 responses out of the 99 sent. I learned the top barriers to participation are lack of time, interest, and transportation. The most surprising comments informed me that some parents hesitate to sign up for programs because they worry they will take a spot away from less fortunate families. To mitigate these barriers, it is important to inform families why these opportunities are for everyone. Community schools create a space where all students and families can benefit from the same experiences and resources, regardless of economic class. Shared experience is an essential part of community building and it is a service that SLCSD is committed to providing. In addition to changing new programs to accommodate interests and scheduling, we are planning on creating a Saranac Lake Community School Instagram account that will inform students and families in the district of the programs and services that everyone is encouraged to use.

Moreover, the school will implement a Saturday Academy this fall in response to the transportation and financial challenges my survey highlighted. The school recognizes the restrictions its families face and has made efforts to be a "one-stop shop." In this festival-like event, the school takes an innovative approach to offering free access to essential community resources while creating a space for all families to relax and enjoy. Furthermore, my report will guide decisions for schedules, offerings, and logistics of programs in the future. School administrators will also use the data I collected for the 21st CCLC grant renewal process.

Research Fellows: **Claudia Coolidge (2025)** **Concentrations: Psychological Science; Sociology**
Rediet Shiferahu (2025) **Concentration: Psychological Science**
Faculty Mentor: **Jennifer Tomlinson** **Department: Psychological and Brain Sciences**
Title of Project: **Sleep and Relationships in Adulthood**
Funding Source: **NASC Division**
Project Summary:

This study investigates the impact of shared exciting activities on health outcomes in older adult couples. Building on evidence that shared leisure activities enhance relationship satisfaction and individual well-being, we explore how these activities influence sleep and overall health. We hypothesize that engaging in exciting activities with a partner improves sleep quality and subjective well-being, which in turn affects health. We will recruit 100 couples aged 55 and older for a 10-day daily diary study, during which participants will record their shared activities, perceptions of partner responsiveness, and daily mood and satisfaction. Additionally, objective sleep data will be collected using actigraphy watches. Two follow-up assessments, two months and one year later, will measure long-term psychological and physical health. This research aims to link positive relationship processes with health outcomes, potentially offering actionable insights for improving sleep and well-being in older adults.

This summer our research team recruited participants in the Hamilton, NY area to complete our study. We recruited fourteen participants, making our current total of 20 couples. Along with running the study, we learned how to analyze actigraphy watch data and perform statistical analyses to provide participants with sleep reports. These sleep reports examined average time in bed, sleep duration, sleep quality, sleep latency, wake after sleep onset (WASO), and sleep efficiency. We were able to compare across measures using the subjective daily diary data and objective actigraphy data. Furthermore, we learned how to use the program REDCap to build and edit surveys, and continuously check on our participants' completion status. This fall we plan to continue recruiting participants and are hoping to further investigate our hypotheses.

Research Fellow: Mavric Crotty (2025) **Concentrations:** Asian Studies; Political Science
Faculty Mentor: Frances Wang **Department:** Political Science
Title of Project: Buying Influence: Analyzing Chinese Outsourced Foreign Propaganda in Asia
Funding Source: SOSC Division
Project Summary:

China has long surpassed its previous days of being the "sick man of Asia" and now sits among the most powerful nations in the world. But still, China's image encounters debate and ridicule on the global stage, because of China's political system, past and current controversies, and unclear future goals. China uses propaganda to deal with these public image issues and to expand its influence internationally. In today's world, information and media is readily available and easy to consume, which is a positive, but can be warped and manipulated for nefarious purposes. This research project focuses on understanding and tracking Chinese propaganda being outsourced to local agents in foreign countries to be disseminated in the agent's home country. Tracking and understanding China's external propaganda operations are often complex and murky, due to: why, how, and where examples pop up. By internationally outsourcing of propaganda, China is able to have its propaganda appear in the target country under the appearance of being legitimate information. Often China uses foreign media agencies, journalists, think tanks, public relations firms, Chinese diaspora communities, people of influence, and universities to be the local agents to spread their CCP favorable content domestically. Our research team searched through various sources such as: media sources, think tanks, contracts, and scholarly publications to better understand and follow the outsourcing of Chinese propaganda.

China has a three sided approach to expanding its global influence: propaganda, censorship, content delivery. China's expansion of propaganda is centered around Xi Jingping's idea of telling the "Chinese story" well. Telling the "Chinese story" is about expanding international understanding of Chinese values, history, and ideals. This idea of teaching foreigners about China appears as an international positive, but by understanding the CCP's true goal, it is clear this is a societal danger. The telling of the "Chinese story" is not about cultural exchange or enrichment, but rather about dominating the discourse surrounding China. This is seen through the Chinese government spending billions of dollars on content delivery and censorship. The Chinese government's billions go to pay think tanks, news agencies, foreign journalist training, fake news companies, public relations firms, and lobbying groups to control the discourse and create a global atmosphere favorable towards the CCP's agenda.

China's global influence campaign has not gone without success, for instance Vietnam and Cambodia have taken to China's propaganda and surveillance model and have started training under Beijing's guidance. Additionally, in 2019, President Rodrigo Duterte's presidential communication group signed a MoU with China's National Radio and Television Administration. In 2023, Thailand's Minister Puangpet signed an MoU with CMG (China Media Group) about news and information sharing that has caused concern about China's growing influence in Asia. Similarly, other authoritarian regimes, such as in Africa, are being taught China's style of journalism, bringing the model back home, and receiving large amounts of Chinese funding towards their journalism industry. China's external propaganda is effective and prevalent, because it does not reinvent the wheel, but uses the local systems already in place to spread its narrative in a legitimate appearing manner that is familiar to the target audience: "borrowing the boat to reach the sea" (借船出海).

Research Fellow: **Annabelle Daley (2025)** **Concentration:** **Women's Studies**
Faculty Mentor: **Catherine Cardelús** **Department:** **Upstate Institute**
Title of Project: **Keeping Adirondack Businesses Alive by Connecting Aspiring Entrepreneurs with Retiring Business Owners**
Funding Source: **Upstate Institute**
Project Summary:

This summer, I worked with Adirondack North Country Association (ANCA) – an economic development organization that works to build a stable, equitable economy for all residents in the Adirondack North Country region. They work to achieve this goal with four teams: small businesses, clean energy, food systems, and equity and belonging. My work this summer has been with ANCA's small business team, which exists to keep small businesses open and thriving, because they are an integral part of our rural economy. You can learn more about ANCA's work and teams here.

During my first week at ANCA, I learned about the problems that small businesses face in the Adirondack North Country. One of the biggest challenges here is also a national problem, known as the "silver tsunami." This is where there are more baby boomers leaving the workplace than there are young people stepping into those roles. On a local level, this problem manifests itself as not having a big enough population of ready, aspiring entrepreneurs to take over small businesses when their owners retire. ANCA has found that there are over 10,000 small businesses owned by folks wanting to retire soon, but who have no succession plan.

ANCA has partnered with other local economic development organizations and chambers of commerce to create the Center for Businesses in Transition (CBIT) in order to match retiring business owners with aspiring entrepreneurs who can take over. However, even with CBIT's work, there are still too many retiring business owners who cannot find someone to buy their business. I sat on a CBIT quickfire call during my first weeks with ANCA in order to learn more about why this problem still exists. Liaisons from CBIT shared that the aspiring entrepreneurs that they work with often get overwhelmed with the buying process and fall through the cracks. They attributed this problem to the fact that many of these aspiring entrepreneurs do not have traditional backgrounds in business and might not understand the nuances of owning a business in a rural area. My work this summer was focused on helping aspiring entrepreneurs be caught up to speed so that they can continue working with CBIT and be matched with retiring business owners. Hopefully these initiatives will help more businesses in the Adirondack North Country stay open through ownership transitions.

My project this summer was to create educational materials– namely a comprehensive, user-friendly workbook, for the general aspiring entrepreneur – which start far before the outlined buying process. This workbook seeks to be a less-stressful onboard to the world of business ownership, and is a material that individuals can work on alone before they begin meeting with a CBIT liaison. My goals for the workbook were that it was educational, hands-on, visually appealing, and succinct. Most of my summer was spent taking the problems I heard from liaisons and my supervisors at ANCA on the small business team, and creating an educational page or worksheet addressing them. At the end of this process, I compiled these materials together into the workbook. The workbook is broken down into three sections: exploring, preparing, and taking-the-leap. In the first, there is a worksheet that prompts the user to think about the skills they bring to the table, outside of traditional business experience. By the end of the book, we have users preparing a buyers profile that they can actually use while they are talking to potential sellers, as well as helping them to brainstorm questions they will ask during these discussions.

Research Fellow: Ryan D'Errico (2025) **Concentration:** Geology

Faculty Mentor: Alison Koleszar **Department:** Earth and Environmental Geosciences

Title of Project: The Eruptive Personality of Augustine Volcano

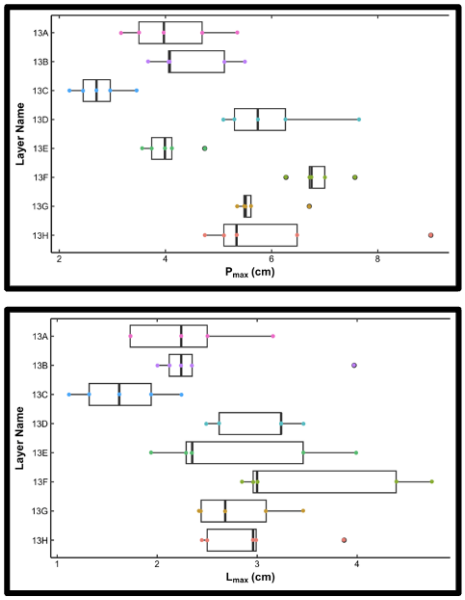
Funding Source: National Science Foundation Grant

Project Summary:

Augustine Volcano is an intermediate stratovolcano located within the Cook Inlet in Alaska that poses significant hazards on land and to aviation (Ewert et al., 2018). Recent eruptions of Augustine have been less explosive than the large, more hazardous eruptions at ~450, ~750, and ~1100 years ago (Tephras B, M, and C, respectively). It is important to understand why the modern eruptions have been less explosive, so we can know whether this is a trend likely to continue or if the volcano will have more hazardous eruptions in the future. My summer research consisted of fieldwork on Augustine Volcano and further analysis in the lab. We hiked to several outcrops of Tephras M and C, described the stratigraphy, and collected samples. We measured Pmax and Lmax (the size of the largest pumice clasts and the largest lithic fragments) within eight sub-layers of Tephra M because tephra grain size is correlated with eruption explosivity. We also took soil samples for carbon dating so that we could confirm the eruption ages for certain tephra deposits.

Digging a bench to allow for stable footing when exposing an outcrop.

In the lab, I prepared Tephra M samples for ICP-MS, determined componentry visually and with a handheld XRF (x-ray fluorescence) instrument, and compiled grain size data (mean clast size and statistical outliers) to quantify changes in clast size through Tephra M. I separately considered Pmax and Lmax to see if they indicate the same changes in explosivity throughout the eruption. I found that both Pmax and Lmax show similar changes in grain size; however, there are some differences. Both plots indicate greater explosivity in sublayers D and F, although Pmax indicates highest explosivity in sublayer F and Lmax indicates highest explosivity in sublayer D. Both clast types are smallest in sublayer C, suggesting the lowest explosivity in that phase of the eruption.



Pmax and Lmax for Tephra M by sublayer. The Pmax and Lmax were calculated for the 5 largest clasts in each sublayer. The geometric mean of the longest and shortest axis of each clast was used to calculate clast size.

Ultimately, we will be able to compare these changes in explosivity to the geochemical composition of the tephra fall throughout the eruption. This will help us better understand Augustine's internal plumbing system and magma sources, for a better understanding of why Augustine's recent eruptions have been more effusive than previous eruptions and whether this pattern is likely to continue.

Research Fellow: **Amanda DeSantis (2025)** **Concentration:** **Psychological Science**

Faculty Mentor: **Dionne Bailey** **Department:** **History**

Title of Project: **"Daughters of Jim Crow's Injustice": African American Women, Mass Incarceration, and the Business of Black Women's Bodies at Parchman Penal Farm**

Funding Source: **SOSC Division**

Project Summary:

For eight weeks this summer I had one of the most enriching experiences of my life. I worked as a research fellow for Professor T. Dionne Bailey who is working on her first book manuscript. The book, "Daughters of Jim Crow's Injustice": African American Women, Mass Incarceration, and the Business of Black Women's Bodies at Parchman Penal Farm, 1980-1980, focuses on the lived experiences of incarcerated Black girls and women from the late 1890s through the early 1980s. African American girls and women historically have been overlooked and silenced in histories of Mass Incarceration, thus, our research sought to shatter the silences.

I joined Professor Bailey and Bailey Misken in Mississippi in late June of this past year. We visited the National Civil Rights Museum in Memphis, TN. We viewed multiple exhibits and learned more about some of the people who we would be researching.

Over the next two weeks, we conducted archival research in Oxford, MS, at The University of Mississippi Department of Archives and Special Collections and in Jackson, MS, at the Mississippi Department of Archives and History. While at the archives at the University of Mississippi, we scanned thousands of pages of archival documents that provide an intimate look at the Civil Rights Movement in the Deep South through personal and shared experiences. We combed through Mississippi government and political documents, the papers of former Mississippi Governors and Senators, as well as Civil Rights Collections, the James Meridith collection, and many more. At the state archives, I examined and focused on their Parchman Penitentiary collection and photographs.

The most exciting part of the archival research was coming across a document that would be beneficial to the book, as there was a lot of stuff we could not use. These key findings were like gold to us. On the weekends when the archives were closed, we traveled around the Mississippi Delta, exploring human landscapes with historically complicated and racist backgrounds. We visited civil rights landmarks as well as traveled to the Mississippi State Penitentiary, also known as Parchman Penal Farm. I was amazed and intrigued by the sheer sight of such a notorious place that we have learned so much about in class and as researchers.

Further reflecting on my time in the archives and as we dove deeper into our research, there were so many things that caught my attention. More specifically, I was shocked at the level of racial discrimination that African Americans endured between the 1950s and early 1980s, which was far more than what I had previously understood. In many ways, what I learned in high school was being dismantled as we grappled with the primary sources. The archival documents that we collected as well as the historical sites we visited helped to open my eyes to the extremities of racism that occurred in the South at a time when some of my current living relatives were alive. Thinking about the South, racism, and discrimination from this lens was eye-opening and put into perspective just how recent these events were.

In conclusion, the research trip to Mississippi with Professor Bailey was the most enriching experience of my life. I also understand that this was likely a once-in-a-lifetime opportunity, and I am extremely grateful to Professor Bailey and Colgate for providing me with this experience. I believe that the background this experience provided me with is going to put me in a great position to be successful in graduate school.

Research Fellow: **Jared Diks (2025)** **Concentration:** **Astronomy/Physics**

Faculty Mentor: **Cosmin Ilie** **Department:** **Physics and Astronomy**

Title of Project: **Probing for Asymmetric Dark Matter in Neutron Stars via Black Hole Formation**

Funding Source: **NASC Division**

Project Summary:

Dark Matter, or DM, is a mysterious form of matter whose existence is required by our most advanced models of the universe. Interacting scarcely (if at all) with the "baryonic" matter that makes up everything we can touch, direct detection of Dark Matter particles has not been confirmed by any experiments on Earth. To circumvent this difficulty, we can instead look upwards, and deduce the properties of DM particles by predicting and observing its effect on celestial bodies such as planets and stars. In this research, I make two main assumptions. First, I assume that the DM particle is "asymmetric", meaning that it is not its own antiparticle. If this were not the case, then DM particles would be able to annihilate with each other in the same way that matter annihilates with antimatter, a case for which the following analysis would not be possible. Second, we assume that the DM particle is a "boson", which is the same category of subatomic particle that photons (light particles) and gluons (the particles that hold atomic nuclei together) fall into. Compared to their fermionic counterparts, (such as quarks and electrons), bosons can be packed much more densely, which means that bosonic DM that exists within a celestial body could form a core so dense that it collapses into a Black Hole.

By calculating the expected quantity of DM within a Neutron Star due to capture (the process by which ambient DM collides with the neutrons in a Neutron Star and loses enough velocity to no longer be able to escape again), I deduced the frequency with which a DM particle must interact with a neutron for each possible DM particle mass, creating a boundary below which the Neutron Star stays stable, and above which a Black Hole forms and collapses the star. By observing Neutron Stars in our own galaxy, this analysis will allow us to constrain the properties DM particles could possibly have.

Research Fellow: Chloe Dorris (2025) **Concentrations:** Psychological Science; Political Science

Faculty Mentor: Allison Zengilowski **Department:** Psychological and Brain Sciences

Title of Project: Profiles of Confusion: How Motivation and Self-Regulation Inform Students' Perceptions of Confusion in Online

Funding Source: NASC Division

Project Summary:

Though it may be surprising, confusion, when resolved, can increase students' learning comprehension (D'Mello et al., 2012; Richley et al., 2019). In response to this emotion, students may engage in self-regulated behaviors (e.g., setting their own learning goals) that influence their academic performance (Ejubovic & Puska, 2019; Ergan and Kandali, 2017; Greene et al., 2010). However, it is also important to know how these findings may apply outside of the classroom and in online learning spaces. My proposed project focuses on how learners with different self-regulation profiles perceive confusion in online asynchronous courses compared to in-person classrooms as well as what features of online asynchronous courses often induce confusion for undergraduate students.

For this project, students enrolled in a STEM-based online asynchronous class would be asked to fill out three surveys administered throughout the course. For my analysis, I would employ a multi-method approach beginning with latent profile analysis for responses in the first survey to the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich & De Groot, 1990). By utilizing this technique, I could separate participants into distinct subgroups and observe how students with different motivational beliefs and self-regulated learning strategies perceive confusion in online learning. Following this, I would utilize content analysis to examine open-ended survey questions, a qualitative technique that would allow me to examine patterns in textual data and identify them across groups (Kleinheksel et al., 2020).

For potential findings, I believe students would fall into one of three motivational profiles: (a) high motivational beliefs and self-regulation; (b) low motivational beliefs and self-regulation; (c) high self-regulation but low intrinsic motivation. Additionally, I believe students in each profile will also perceive confusion in the context of online learning differently:

	High Mot/High SR	**Low Mot/Low SR**	**Low Mot/High SR**
View of confusion	Not detrimental; an obstacle to overcome	Often encounter; natural part of learning	Very distressing; risk to academic performance
Response to confusion	Driven to resolve and solidify understanding of material	Not keen to manage or address it	Concern over having fewer resources to help resolve compared to in-person

In terms of online features that could induce confusion, I suspect that participants will cite assessment tools and the course's user interface as a source of struggle. Overall, an organized user interface can help create an engaging online learning experience, and, for those accustomed to in-person classrooms, navigating a more complex and expansive user interface may be challenging. Further, online assessment tools could also be an obstacle because students may receive their assignments back through automatic grading mechanisms, which limits relevant feedback for students and could provoke further confusion.

In this proposed study, the implications for both students and teachers in online learning are significant. For teachers, they could gain insight into what students find confusing about online learning, allowing them to tailor their lectures and content based on their pupils' needs. On the other hand, students would be better able to manage their confusion and develop strategies for academic success after identifying challenges they may encounter in an online learning context. For future researchers, the identification of these motivational profiles could help to discern how students are affected by classroom context. Moreover, by discovering features of online learning that provoke confusion, researchers can develop targeted methods to detect confusion in online learning platforms.

Research Fellows: **Michelle Du (2025)** **Concentration: Environmental Biology**
Kevin Fuentes Gonzalez (2027) **Concentration: Undeclared**
Abigail McGuire (2026) **Concentrations: Biology; Native American Studies**
Faculty Mentor: **Therese Frauendorf** **Department: Biology**
Title of Project: **Why is hippo dung important to river invertebrates?**
Funding Source: **NASC Division**
Project Summary:

Hippopotami play an important role in the Mara River ecosystem. They spend most of their lives in the water and add high amounts of dung into the river. Previous research showed that aquatic invertebrates benefit from hippo dung. Our main question for this research was "Why is hippo dung important to invertebrates?" We addressed this question by examining how dung is being used and if the amount of dung is significant to invertebrates.

Previously set up experimental streams contained various amounts and types of dung. The amount of dung in each stream ranged from 0g to 240g. These amounts reflected concentrations observed in the Mara River, except the 240g concentration. This high concentration of dung helped us observe if overloading of dung can be a problem. The experimental streams contained one of three types of hippo dung: blended dung (to determine if dung was an important food source for invertebrates), boiled (to determine if hippo dung was structurally important for invertebrates), or unprocessed dung (food and structure). After three weeks, the streams were drained, and the remaining material was preserved in ethanol. This summer, we picked and identified aquatic invertebrates from the samples. Invertebrate abundance was counted as we picked the samples, and identification to family and genus occurred after. What we found by the end of the summer is, as the amount of dung increases invertebrates abundance also increases. We also saw that 240g of dung is an overloading amount of dung, because invertebrate abundance consistently dropped across all types of dung (Fig. 1). Another finding was that invertebrate abundance succeeded best in streams that had unprocessed hippo dung (Food + Structure), and that streams with food only treatments typically had higher abundance than structure only streams. This means that nutrients and structure complexity from the hippo dung were important to increasing invertebrate abundance, but that hippo dung as a food source contributed more compared to structure.

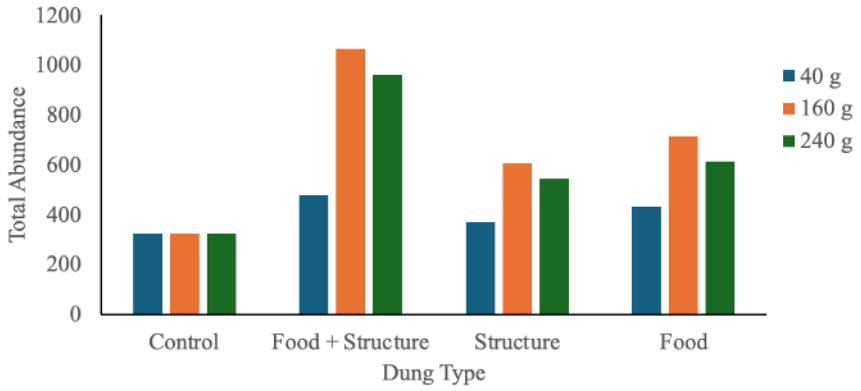


Fig 1. Total Abundance of Invertebrates vs. Type of Dung. Different colors indicate different amounts of hippo dung. Control streams did not have any hippo dung.

Research Fellow: Owen Fahey (2025) **Concentration: Environmental Studies**

Faculty Mentor: Rachel Amann-Burns **Department: Upstate Institute**

Title of Project: How Can Local Museums Better Serve Their Communities?

Funding Source: Upstate Institute

Project Summary:

My research this summer involved a needs assessment and audience discovery for The Chenango County Historical Society (CCHS). The Historical Society plays a crucial role as a community partner. Through the preservation of history CCHS fosters a sense of unity and belonging among residents. Showcasing the unique history and culture of the Central New York region, the Historical Society provides a tangible connection to the past, helping the understanding and appreciation of local heritage. For CCHS to continue their role as an active community partner and move away from a space that simply preserves historical artifacts, they needed to understand what their audience wanted. My project was to identify their audience and document the needs of their audience so the board and Executive Director could use this information as a roadmap for future development.

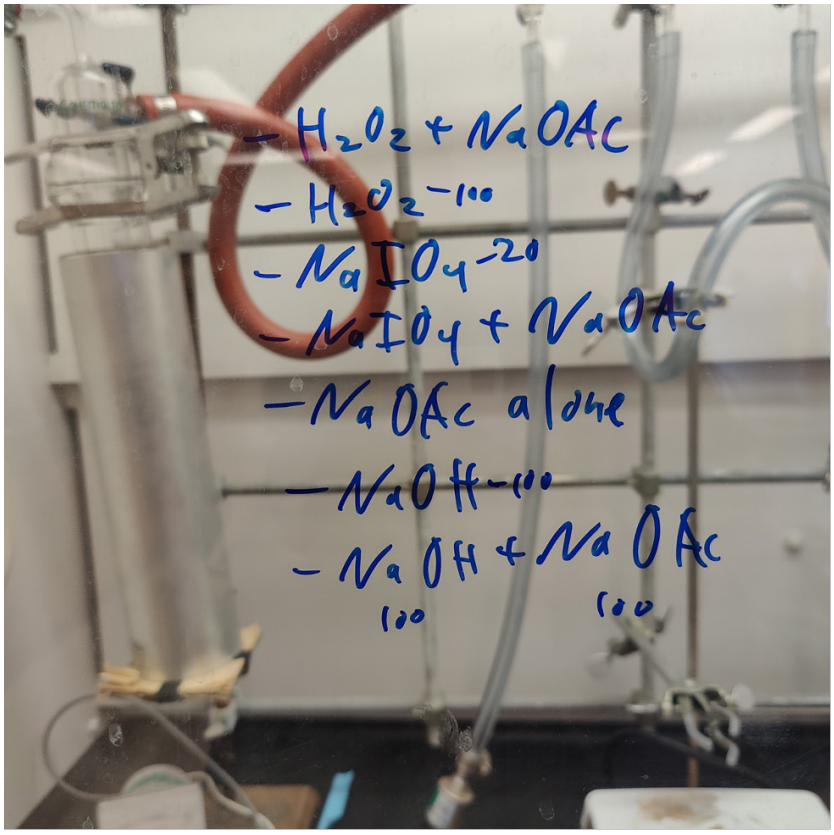
Combining the knowledge of the community and the skills I quickly learned with my early weeks at CCHS, I was able to conduct multiple interviews and surveys across an array of audiences. These questions were used to assess what role community members see CCHS playing within Chenango County. The audiences I found to be most crucial to the next steps of CCHS' developmental efforts are Educators, Community Members/Partners/Elected Officials, Visitors/Tourists, and Supporters/Donors/Corporations. These personas then became my focus for my project and were the core components of my continued research.

Moving my project forward, I wanted to connect with the community firsthand, which brought me to an array of qualitative research efforts to gain a better understanding of what Chenango County wanted from the museum. After speaking with local educators, I found that they wished for a component of the museum to come to the classroom to bridge the difficulty of getting students to the museum. Moreover, teachers expressed great fondness for how accurately CCHS ties local history to the New York State curriculum and they hope to see more of that in the future.

A common concern the community stressed was the need for more PR efforts from the museum to help connect the large county. Through my research, I learned the importance of spreading information with the use of social media, direct advertisement, and mailing as rural areas are spread so thin. While these communities are connected through their county boundaries and a shared Appalachian region, individual towns are often disconnected from one another. As the museum intends to preserve the entire county's history, it was encouraged by the audiences of CCHS that its outreach should go further than Norwich and its direct neighbors. After working as an Upstate Institute Summer Fellow, I can confidently say that I have a greater understanding of the importance of non-profit organizations. I am eager to continue growing my knowledge and working with institutions that work towards a united common good.

Research Fellows: **Eva Foketi (2026)** **Concentration: Biochemistry**
Sabrina Srabani (2027) **Concentration: Chemistry**
Faculty Mentor: **Dimitar Shopov** **Department: Chemistry**
Title of Project: **Novel Pyridine-Alkoxide Ligands for Iridium Oxo Dimer Formation and Water Oxidation Catalysis**
Funding Source: **NASC Division; Justus '43 and Jayne Schlichting Student Research Fund**
Project Summary:

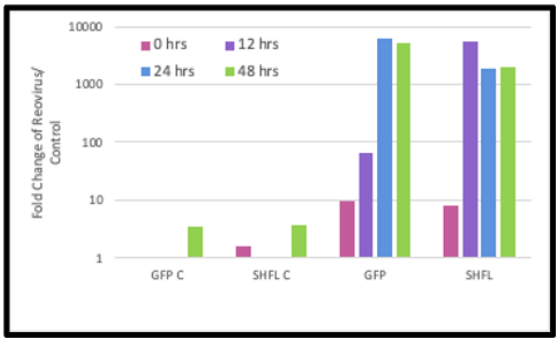
Our research was conducted in the area of inorganic chemistry in which our team explored the synthesis and characterization of a novel ligand (Biphpyalk) to transition metal centers, specifically Iridium. Biphpyalk is a ligand completely novel to existing research; it contains pyridine and tertiary alkoxide coordinating groups that promote oxo-dimer bridge formation between two metal atoms, which can potentially serve well for water oxidation catalysis. The structure of Biphpyalk makes it a resilient ligand to the harsh conditions required for such strong oxidation. Synthesis of the ligand itself was met with challenges which we overcame, presenting an opportunity to not just learn, but problem solve by using various classical and improvised techniques, including separations, NMR spectroscopy, and X-ray crystallography. We were able to prepare a number of iridium compounds with our ligand, and observed evidence for an unusual oxo-bridged dimer, which will be the subject of further investigations.



Research Fellows: **Cammy Foster (2025)** **Concentration: Molecular Biology**
Max Hopkins (2026) **Concentrations: Biology; Psychological Science**
Ella Monfort (2025) **Concentration: Biology**
Faculty Mentor: **Geoff Holm** **Department: Biology**
Title of Project: **The interferon-stimulated gene Shiftless restricts reovirus infection**
Funding Source: **Michael J. Wolk '60 Heart Foundation; NASC Division; Oberheim Memorial Fund**

Project Summary:

Interferons and the interferon-stimulated genes (ISGs) they activate are one way for a cell to respond to viral infection. When a cell becomes infected, it releases interferons that tell nearby cells to activate specific genes called ISGs that produce an antiviral state in the cell that restricts the virus's ability to replicate in the initial infected cell and prevent it from infecting other cells. Shiftless (SHFL) is an ISG known to restrict infection of a diverse range of viruses, but it has not yet been studied in reovirus. Reovirus is a double-stranded RNA virus that is used as a model in order to understand more complex or dangerous viral systems and is also studied for its potential as an oncolytic agent and future cancer treatment. This summer, we worked to understand the effect SHFL has on reovirus, including if it is able to restrict infection in cells, whether that effect is present across cell types and serotypes, and what stage of replication the restriction occurs.



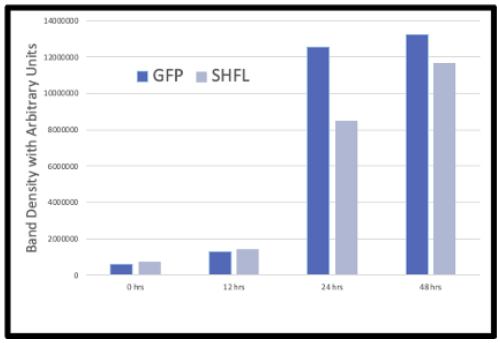


Figure 1: Reovirus transcription is not restricted by SHFL presence. We transfected 293T cells with SHFL or a control GFP plasmid and then infected the cells with the T1L reovirus strain, taking samples at 0, 12, 24, and 48 hours. We analyzed these samples with qPCR to determine RNA levels and found that our control and SHFL treatments had the same level of reovirus RNA.

Figure 2: SHFL overexpression reduces reovirus protein levels. We transfected 293T cells with SHFL or a control GFP plasmid and infected the cells with the T1L reovirus strain, taking samples at 0, 12, 24, and 48 hours. We analyzed these samples with immunoblotting to determine protein levels and found that the cells containing the SHFL plasmid, and therefore overexpressing SHFL, had lower amounts of reovirus protein in the sample when compared to our control.

We used a variety of techniques to collect data, including immunofluorescence, qPCR, and immunoblotting. We found that cells transfected with SHFL are more resistant to reovirus infection than control cells, and that this resistance likely comes from SHFL's ability to interfere with viral protein production rather than viral transcription. Future directions include repeating these experiments across viral serotypes and different cell lines, as well as using SHFL knockout cell lines to do an underexpression assay to further test SHFL's effect on reovirus infectivity.

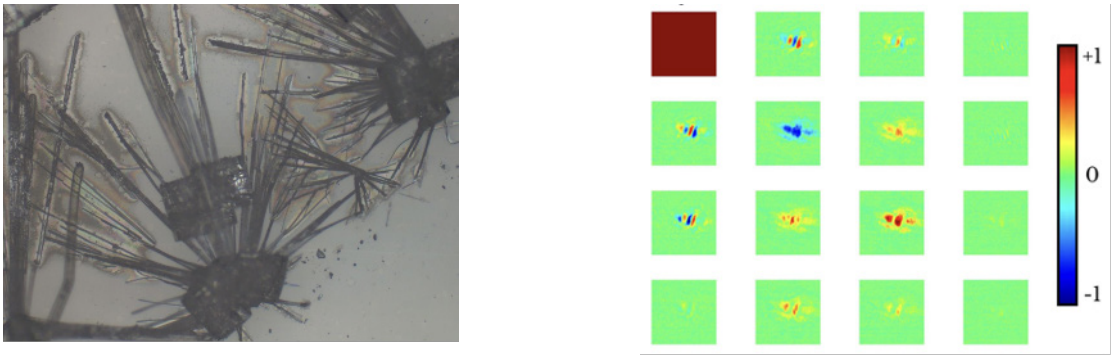
Research Fellow: Leia Francis (2025) **Concentration:** Physics
Faculty Mentor: Rebecca Metzler **Department:** Physics and Astronomy
Title of Project: Crystalline Guanine and Polarized Light
Funding Source: NASC Division

Project Summary:

Crystalline guanine is an organic biomineral found in a wide range of organisms, including some fish, spiders, reptiles, and eukaryotic microorganisms. In particular, crystalline guanine can be found in zebrafish eyes and scales, where it may be used for biological coloring or vision systems. The purpose of this project is to investigate the optical properties of crystalline guanine using Mueller Polarimetry, which will allow us to better understand its function in zebrafish eyes.

We began this study by using lab-grown guanine to optimize our method before moving on to organismal samples. This required us to synthesize crystalline guanine by reprecipitating guanine powder with NaOH and HCl. Then, we used SEM and light microscopy to image the crystals, finding two main polymorphs: long needle-like structures, and thick, layered squares. The needle-like crystals appeared uniform in structure and approximately 50 microns wide, making them desirable for this study.

Next, we assembled an optical setup designed to perform Mueller Polarimetry on single crystal samples. Mueller Polarimetry involves directing a polarized light beam through optical elements called half and quarter waveplates, as well as through a sample (the guanine crystal). This process allows us to encode and decode the polarization state of the light, which we can then use to understand the transformation that the light undergoes during its interaction with the crystal. The input and output states of polarization can each be written as 4 element vectors, and the 4x4 matrix which transforms the input state to the output state is the Mueller Matrix. Using Matlab software, we generated a Mueller Matrix for a single crystal of guanine. Our next step will be to interpret this matrix using polar decomposition, which will help us determine the function of crystalline guanine in zebrafish eyes.



Light microscope image of guanine crystal formation (left) and Mueller Matrix (right).

Research Fellow: **Meredith Francis (2025)** **Concentration:** **Chemistry**

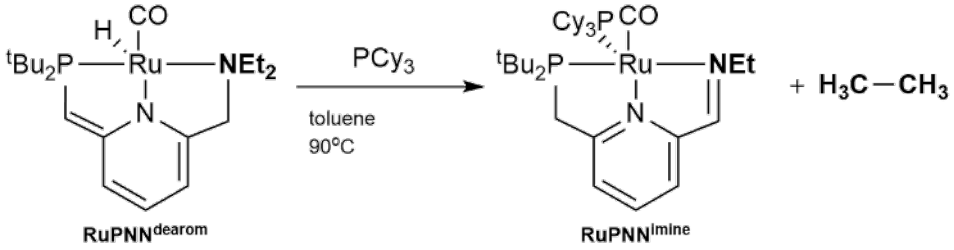
Faculty Mentor: **Anthony Chianese** **Department:** **Chemistry**

Title of Project: **Understanding the Mechanism of the Activation of Milstein's Catalyst**

Funding Source: **National Science Foundation Grant**

Project Summary:

Milstein's catalyst is a molecule used to assist other molecules in reactions such as hydrogenation and dehydrogenation (addition and removal of a hydrogen). The original proposed mechanism of the creation of this catalyst has been disproved, and the real mechanism has yet to be discovered. The goal of this research is to find the mechanism when the conditions below are present.



To work out the pathway taken, a time trial using NMR was taken over the course of roughly six hours. The NMR helps differentiate the different molecules present at a certain time. These spectra helped us understand the varying concentrations of different molecules and how they change over time. Using different equations, we are able to find the observed reaction rate (how quickly the reaction takes place). Throughout the different trials, it was observed that varying the concentration of the starting material changed how quickly the reaction took place. The more main reactant present, the quicker the reaction went. This shows that the initial concentration of the reactant does affect the speed of the reaction. Another observation was that varying the concentration of another reactant, PCy3, also changes the speed, but in the opposite direction (higher concentration slows reaction down). But, if there was not a sufficient amount of this reactant, a side product would form, which hinders the production of the final catalyst product. At the lowest concentrations of PCy3, ethylene peaks were visible (a molecule that comes off of the main reactant). This could indicate the reaction going towards a specific mechanism, but more investigation must be done to confirm the reason behind the ethylene release. After reaching a low concentration of the main reactant, the reaction was taken to a UV-Visible spectrophotometer. This was to confirm the observations are consistent at lower concentrations as well. As of now, it seems that at lower concentrations the reaction rate does not vary significantly, but the data does appear to be consistent. Further experiments will most likely be focused on finding where the ethylene is coming from and continuing experiments with UV-Visible spectroscopy.

Research Fellow: Matthew Freund (2026) **Concentration:** Neuroscience

Faculty Mentor: Ewa Galaj **Department:** Psychological and Brain Sciences

Title of Project: Neuroscience Lab of Addiction

Funding Source: NASC Division

Project Summary:

This summer I worked in professor Galaj's Lab, working to study addiction in the rat model. This included learning and performing western blots in order to measure ghrelin levels in rats from a completed administration experiment in which they were given heroin and then observed in enriched and non enriched environments. I also then sliced rat brains to visualize and qualify ghrelin and cfos levels from a paired/unpaired and food/no food study, learning how to use a confocal microscope in order to perform neural imaging after the use of the RNA Scope technique. I also learned importantly how to handle and gavage rats for our alcohol administration experiment, which will continue into the fall. At this time there are no results to report, but I will be continuing research with the lab in the coming weeks.

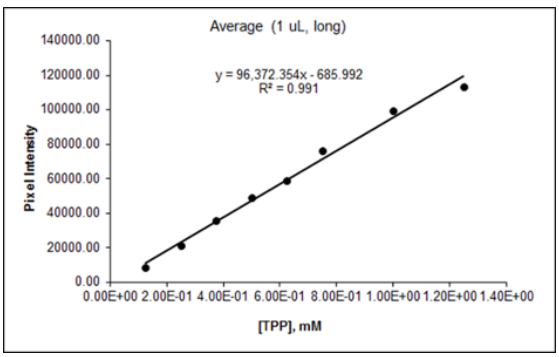
Research Fellows: **Jessica Furstein (2025)** **Concentration: Chemistry**
Jordan Lazaar (2026) **Concentration: Chemistry**
Faculty Mentor: **Rick Geier** **Department: Chemistry**
Title of Project: **Towards the Development of a TLC Method for Monitoring Porphyrin Forming Reactions, and Comparison to UV-vis and HPLC Methods**
Funding Source: **Warren AndersonFund; John C. Cochran Endowed Fund for Undergraduate Research/NASC Division**

Project Summary:

Porphyrins are a family of compounds of biological, fundamental, and commercial significance. Key to the study of porphyrins is the discovery of efficient methods for their synthesis. To develop efficient methods, several reaction parameters must be explored, requiring a large number of reactions. To minimize the time spent and resources needed for each reaction, efficient methods for quantifying the yield of porphyrins on an analytical scale are required. Previously, UV-vis and HPLC have been used to monitor yields in porphyrin forming reactions, but each have weaknesses. As an alternative, our research group has been exploring thin-layer chromatography (TLC), an analytical method that has the potential to afford a simple, rapid, inexpensive, and accurate estimate of porphyrin yield. White quantitative TLC has been applied to studies of other organic reactions, it has yet to be extended to porphyrin forming reactions. Our model reaction is the well-known synthesis of meso-tetraphenylporphyrin (TPP) from pyrrole and benzaldehyde.

A previous student began studies of a TLC method for monitoring the yield of TPP. The student performed control and reproducibility experiments to refine the method, prepared calibration plots relating integrated pixel intensity to the concentration of TPP, and performed preliminary experiments comparing analyses by UV-vis, HPLC, and TLC.

This summer, we became familiar with the preparation and analyses of TPP samples by UV-vis, HPLC, and TLC. Our preliminary work included characterization of a commercial sample of TPP to confirm its purity. We then performed a variety of control/reproducibility experiments and calibrations using each analytical method to confirm our group's previous findings. The linearity of calibration plots at high TPP concentrations was a key item explored. We performed a comparative analysis of the sensitivity and accuracy of detecting low concentrations of TPP by UV-vis, HPLC, and TLC. Sensitivity and accuracy from UV-vis and HPLC analyses were somewhat better. Nonetheless, TLC showed promising sensitivity and accuracy even at concentrations much lower than would be obtained from typical refined reaction conditions.



Research Fellow: **Zuzu Gacso (2025)** **Concentration:** **Neuroscience**

Faculty Mentor: **Ewa Galaj** **Department:** **Psychological and Brain Sciences**

Title of Project: **Addiction Lab Projects**

Funding Source: **National Science Foundation Grant**

Project Summary:

This summer began by drafting, editing, and finalizing a manuscript for our previous study investigating the neuroadaptations that arise from chronic fentanyl exposure in rats. This paper covered an extensive background of the endocannabinoid system, as the focus was evaluating potential up- and down-regulation of CB1 receptor expression within areas of the brain associated with drug-related, addictive behaviors (such as the VTA, SN, hypothalamus…). We then began our ghrelin study, in which rats housed in our sister university were exposed to heroin treatment along with an EE (environmental enrichment) or non-EE environment. The brains were sent to our lab, where we applied cryostat sectioning, sample preparation, gel electrophoresis, and quantification to perform western blot analysis for the GHSR (ghrelin receptor) protein. We aim to detect differences in ghrelin receptor expression between heroin-dependent rats housed with environmental stimuli compared to rats housed without the stimuli. At the same time, we began our alcohol study in which we learned to take care of rats, perform oral gavage, and observe surgeries. Beginning work for the semesters' projects, we concluded with learning how to perform an immunohistochemistry assay and apply the confocal microscope to observe cholinergic neurons and DREADDs virus in our rats' brain tissue.

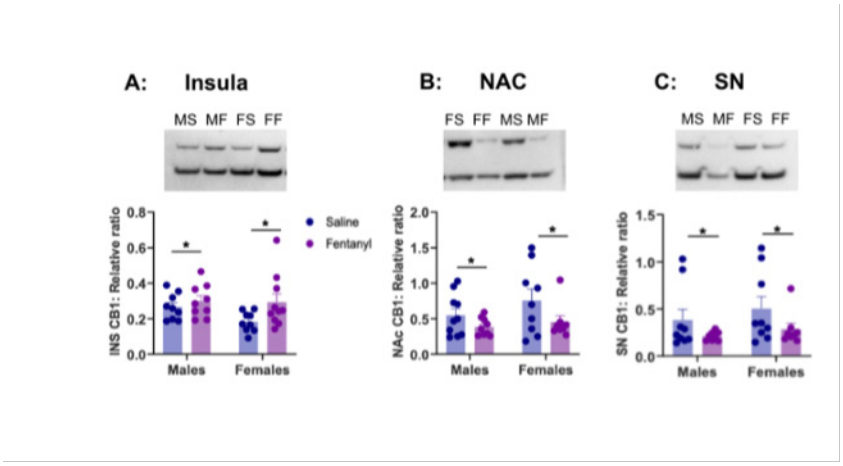


Figure 2A-C. CB1 protein expression in key brain regions after chronic saline or fentanyl exposure in adult rats.

Research Fellow: Evelyn Gao (2026) **Concentration: Mathematical Economics**
Faculty Mentor: John Crespi **Departments: East Asian Languages & Literatures; Asian Studies**

Title of Project: Can You Measure Satire? A Quantitative Study of Online Cartoons from China

Funding Source: J. Curtiss Taylor '54 Endowed Student Research Fund

Project Summary:

Cartoonist Kuang Biao (b. 1966) specializes in political satire and dark humor. From 1999 to 2013, he served as an editorial cartoonist for several newspapers. In 2013-2014, he became active on Chinese microblog platform Weibo. Despite facing restrictions, with over 30 of his personal Weibo accounts getting banned, he now shares sketch videos and photos of his drawings on his WeChat channel. During the COVID-19 pandemic (2020-2022), Kuang Biao became notably productive as the Chinese government intensified quarantine measures and clamped down on freedom of expression. By gathering and analyzing Kuang Biao's WeChat posts from 2014 to 2024 (up to the present), this research aims to quantitatively measure visual satire through keyword-based content visualization and conduct a comparative analysis of AI and human satire assessments.

Methodology:

- Data Collection: Random sampling of Kuang Biao's drawings from 2014 to 2024 involved selecting one month per year, recording data in a Google spreadsheet including date, format, captions, keywords, and 800 screenshots.
- Comparative Satire Assessment: Each of the 800 cartoons received satirical ratings from myself and then Vertex AI on a scale of 0-9, with scores plotted on a line graph for comparison.
- Word Cloud Visualization: Through wordart.com, two word clouds were generated to showcase content and concept keywords representing major themes in Kuang Biao's cartoons.

Results:

Comparing Human and AI Judgments of Satire

- There is a parallel trend between my score and AI's score, with the latter maintaining an average score approximately 0.71 points higher.
- The graph also depicts a fluctuating pattern occurring about once every four years.
- During COVID-19, the scores reached their lowest average levels in the ten-year span, leading to an intersection and crossover of my score and AI's score.

Word Cloud Visualization

- The word cloud for content keywords indicates that Kuang Biao predominantly features animals and characters in his work. The most frequently represented animals are dragons and mice, both appearing 24 times.
- Kuang Biao's concept keywords mainly include caricature, education, war, and soccer, with corresponding frequencies of 105, 67, 59, and 53 mentions.

Discussion:

As the line chart shows, the satire level scores provided by AI and my evaluations ran in parallel, suggesting that satire can be quantitatively measured. Although I initially assumed that the level of satire in Kuang Biao's works would increase between 2020 and 2022 due to the impact of COVID-19, the data presented in the graph shows a rather low level of satire during these years. Consequently, it seems that the pandemic may not have directly contributed to higher levels of satire in Kuang Biao's art.

Research Fellow: **Moureen Gao (2025)** **Concentration:** **History**
Faculty Mentor: **Jing Wang** **Department:** **East Asian Languages & Literatures**
Title of Project: **The Development and Decline of Female Official System in Ming China**
Funding Source: **SOSC Division**
Project Summary:

During the summer, I mainly researched the lives of female officials during the Ming Dynasty(1368-1644 CE) to investigate their political powers, their lifespan, their personal lives and potential social impacts. During the search for primary sources to provide enough information for the paper, I encountered some of the difficulties that the majority of the official records of the daily works by female officials were not preserved. From the preserved official records, there are very few details about the personal sides of these women that worked in the palace. In order to look into the details of these topics, I used primarily the poems written by female officials. Not all of them left behind poetries about their lives in the palace, but from the poems left till this day, one is able to uncover some of the feelings and thoughts conveyed by the female officials.

In this paper, I began with the introduction for the background of the female official system in the previous dynasties – the reason it was founded, how it evolved and developed, and how the founding emperor of the Ming Dynasty decided to establish his version of the female official system. Then I summarized the previous scholarships, which mainly focused on the design of such systems or the individual famous successful females, but their personal emotions involving being a female official, who is positioned between being away from home and working as an honorable servant for the imperial family, were not fully looked into. Therefore, from this perspective, I read and analyzed these poetries written by female officials, and then related them to the official records of their lifespan and families. I interpreted that the career of being a female official definitely elevated the social status of the female officials' family members, but usually at the cost of long serving time of women in the palace, bringing feelings of both honor and solitude to them. Especially as the Ming Dynasty experienced slow corruptions, the service of these female officials were prolonged and their political participation were restricted. Their poems increasingly showed that they felt trapped in the palace, with no way out. Therefore, I concluded that the private lives and the personal experiences of female officials during the Ming Dynasties were expressed through poetries, relating to the decline of the female official system.

Research Fellow: **Richelle Gao (2027)** **Concentration:** **Undeclared**

Faculty Mentor: **Julie Dudrick** **Department:** **Upstate Institute**

Title of Project: **Uncovering the Book Magic: Lifelong Benefits and Positive Community Impacts of Early Literacy Education**

Funding Source: **Upstate Institute**

Project Summary:

This summer I worked with Dolly Parton's Imagination Library (DPIL) through the Upstate Institute Summer Field School. DPIL is dedicated to increasing access to books for every child from birth to five by sending a free, high-quality, and age-appropriate book each month, regardless of family income. The DPIL organization pays for the books and local community partners pay for the postage. Unfortunately, MAD For DOLLY, the DPIL committee in Madison County, lost its long-term funder and therefore is facing discontinuation. This summer I assisted with preparing essential materials needed in the presentation for persuading the county board to include the DPIL program as part of their annual budget as well as creating promotional materials for fundraising and raising brand awareness.

I developed an animated data-driven presentation that tracks the quantified benefits a child enrolled in the DPIL program can receive at each critical life stage. My presentation illustrates how individual attainment aggregates to create community impacts and explains the Return On Investment of early reading intervention in a tax-revenue-related way. Through these work experiences, I learned how to generate creative alternatives when the data is extremely limited because the age range I'm focusing on is very small, and very few studies specifically investigate early reading intervention, separate from early childhood education in general. Often rapid assessment of academic papers is necessary to find the most valid substitute. Also, to show the consistently profound impact of the DPIL program throughout a child's life and community, I compared and unified data from studies using different methods of measurements and statistical analysis to make the data story-telling as logical as possible. For data not accessible through academic literature, I explored and learned to navigate adeptly government documents and educational databases. Additionally, by reading the brand guide carefully and consulting the media marketing experts on the DPIL team, I designed several promotional materials, including infographics, flyers, and Instagram photos. These experiences equipped me with in-depth knowledge of branding principles and how to arrange data spatially, using color patterns, voice, and word choice, as well as whether data are presented in a sufficiently understandable way, which can make a big difference in marketing results.

Prior to this work, as a STEM student, data presentation was for me a completely objective process. This was the first time that I used data to show a scientific fact and to tell the stories of children vividly, in order to evoke emotions from the audience. Moreover, after comparing, organizing, and integrating such a large amount of data from multiple sources and platforms, I developed a deeper understanding of the type of research and statistical analysis methods that would generate the most valuable results. All these experiences are priceless and I really appreciate this opportunity. Even though this position is not directly related to my major, I feel this can be a launching pad for me to do research work in the healthcare field (also community-based) in my future workplace.

Research Fellow: Kim Gates (2026) **Concentration:** Chemistry

Faculty Mentor: Gongfang Hu **Department:** Chemistry

Title of Project: Synthesis of Heterobimetallic Bismuth–Nickel Complexes

Funding Source: John C. Cochran Endowed Fund for Undergraduate Research/NASC Division

Project Summary:

Electrocatalysis has emerged as a powerful tool for addressing issues in energy sciences and chemical synthesis. Transition metal complexes with a single catalytic center remain mainstream in catalyst development. However, bimetallic systems are becoming increasingly attractive because of their potential synergistic effects, presenting advantages that cannot be readily achieved with individual metals. Main-group metals as supporting ligands for transition metals offer potential for bimetallic synergistic effects. Bismuth, the heaviest non-radioactive pnictogen, is notable for its low toxicity compared to other neighboring main-group metals, but bismuth-containing bimetallic molecules are largely underdeveloped.

We investigated a bimetallic system containing a bismuth-based pincer ligand and a Group 10 transition metal (palladium and nickel). Nickel, an earth-abundant metal, exhibits reactivities that sometimes complement those of palladium. In particular, single-electron transfers are more readily achieved using nickel complexes due to their accessibility to both even and odd oxidation states. Only a limited number of nickel complexes containing a bismuth ligand are known in the literature, and their reactivities are almost unexplored. This summer, we synthesized a series of bismuth-nickel complexes featuring various ligand trans to the secondary bismuthine. The molecular structures of these compounds have been fully investigated using proton-, phosphorus-31, and fluorine-19 nuclear magnetic resonance spectroscopy, in addition to X-ray diffraction experiments. In the future, we plan to examine the reactions of these bismuth-based bimetallic complexes with carbon dioxide, dioxygen, and dinitrogen, which are challenging chemical reactions closely related to renewable energy and sustainable chemistry.

Research Fellows: Cailen Geller (2026) **Concentration:** Neuroscience
Emma Slupik (2026) **Concentration:** Neuroscience
Faculty Mentor: Wan-chun Liu **Department:** Psychological and Brain Sciences
Title of Project: Exploring Context Dependent Co-song Gestures in Zebra Finch Birds
Funding Source: NASC Division
Project Summary:

While zebra finch song has been established prior as an excellent model for human language, the comparison of gestures that accompany this song to human beat gestures is novel. Song-entangled beat gestures have been identified as fast, lateral head movements occurring while a male finch sings; these appear to mirror beat gestures in humans through their alignment with song rhythm, co-development with song, social context dependency, and idiosyncratic nature. This study investigates in which ways co-song gestures are rhythmically aligned with zebra finch song through conducting behavioral coding of ten adult male zebra finches.

Using SAP analysis software, we quantified the motifs of each bird and analyzed fourteen sound features of each respective syllable. These song features were compared to a bird's likelihood of gesturing on a specific syllable in various social and temporal contexts (singing alone versus to a female, singing in the morning versus in the afternoon), obtained using BORIS software.

Preliminary results indicate that a zebra finch's co-song beat gestures are not randomly produced, and are more likely to occur when they produce a syllable of longer duration, which often tend to be more complex. Additionally, different social contexts may induce different emotional and motivational states, altering gesturing behavior; males tend to gesture more frequently in the presence of a female and their "preferred syllable" to gesture on may differ (Fig 2). The temporal context of morning versus afternoon singing seems to also change a bird's gesturing pattern, indicating a possible "morning effect" on song, where song and gestures are less rehearsed after leaving REM sleep and are practiced throughout the day, thus becoming more stable in the afternoon as opposed to the morning (Fig 2). While still ongoing, the quantification of co-song gestures is a critical first step to understanding the evolutionary purpose of co-song gesturing in songbirds and co-speech gestures in humans and informing therapies for communication and developmental disorders impacting language.

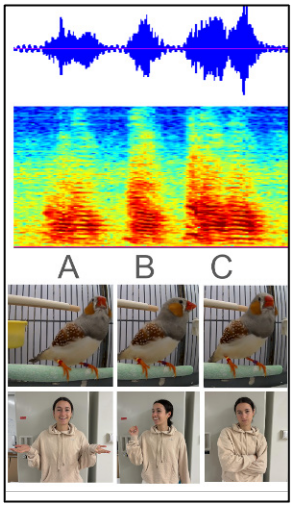


Figure 1. An overview of song-entangled beat gestures. Beat gestures are rhythmically aligned with a bird's song, characterized as a motif composed of syllables identified using a motif's waveform (blue) and spectrogram (red) (labeled A, B, C). These gestures are comparable to human beat gestures, which serve to emphasize parts of speech and facilitate understanding.

Figure 2. Beat gestures are altered by social and temporal context. Birds tend to gesture more frequently in general in the presence of a female and their "preferred syllable" to gesture on may differ (left). Co-song gesturing also differs when a bird sings alone in the morning compared to the afternoon (right).

Research Fellow: **Ashley Graegin (GR)** **Concentration: English (MAT)**
Faculty Mentor: **Jessica Murray** **Department: Psychological and Brain Sciences**
Title of Project: **The Effects of Ecologically Relevant Teaching Practices on Stress-adapted Students' Engagement in High School English Classes**
Funding Source: **NASC Division**
Project Summary:

Life history theory suggests that students who have experienced harsh and unpredictable environments during childhood may develop a pattern of behavioral and cognitive adaptations. For example, such individuals may be more present-oriented and have allocated more biological resources toward short-term survival. In students, these cognitive and behavioral patterns (often referred to as a "fast" life history strategy), can result in an environmental mismatch with traditional schools. In a typical classroom, content may often have low ecological relevance (connectedness to students' everyday lives, experiences, and interests) because they have been designed for students with "slow" life history strategies, who can be successful academically even when the content is not immediately relevant. The low ecological relevance of school for students with "fast" life history strategies may explain why students who face social and economic disadvantages show lower engagement, perform more poorly in school, set fewer academic goals, and have greater difficulty completing their homework than their peers.

This study tested the relationship between classroom ecological relevance, life history strategy, and engagement for participants' favorite and least favorite high school English language arts classrooms. A significant relationship was found between ecological relevance and cognitive, emotional, and behavioral engagement. On average, participants with fast life history strategies reported lower ecological relevance and engagement for their favorite and least favorite classes than did students with slow life history strategies. Results reveal the potential of ecologically relevant teaching strategies to improve outcomes for all students. Additionally, results offer an alternative explanation for why disadvantaged students perform lower in schools than their peers and imply a need to reframe students' adaptations to environmental stress as strengths within particular contexts rather than limitations.

Table 1
Descriptive statistics and Correlations for Study Variables

Variable	*n*	*M*	*SD*	1	2	3	4	5
1. Mini-K Score	217	18.30	13.39	—	.			
2. Engagement (Class A)	217	57.23	7.54	227**	—			
3. Ecological Relevance (Class A)	217	82.62	11.02	.276**	666**	—		
4. Engagement (Class B)	217	41.70	9.39	.239**	.454**	.349	—	
5. Ecological Relevance (Class B)	217	60.78	16.61	.254**	.363**	.414**	.726**	—

Research Fellow: **Chris Gross (2026)** **Concentration:** **Physics**

Faculty Mentor: **Rebecca Metzler** **Department:** **Physics and Astronomy**

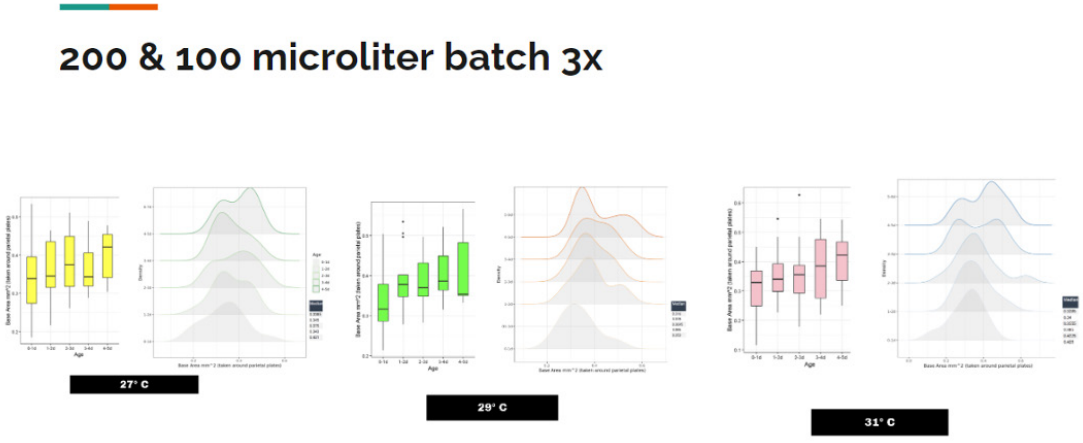
Title of Project: **Exploring the Growth Rates of the *Balanus amphitrite* in Relation to Temperature**

Funding Source: **NASC Division**

Project Summary:

The *Balanus amphitrite* (BA) is an arthropod in the class Cirripedia, commonly found in intertidal regions. *Balanus amphitrite* is an acorn barnacle. BAs are a parasitic species that attach to boats and other oceanic life forms. The attachment of barnacles to ships increases their drag and their fuel consumption. Consequently, the excess fuel consumption contributes to more CO2 in the atmosphere, leading to ocean acidification and warmer temperatures. The goal of this project is to investigate if rising ocean temperatures cause a fluctuation in BA growth rates. It was hypothesized that there would be a linear relationship between temperature and growth rate. A growth rate variation with increased temperatures would suggest climate change causes irreversible damage to these organisms. After conducting this experiment, we concluded further investigation was required. Moving forward, we plan to analyze the movement of the pre-barnacle stage of the cyprid in different temperatures, create a control group of BAs that are fed algae, and remove uncertainties in the measuring process.

Understanding the growth rate of anatomical marine structures such as the *Balanus amphitrite* is vital because it provides insight into the complex consequences of climate change. This experiment analyzes BA growth at three varying temperatures: 27°C, 29°C, and 31°C. The critical growth period of the species occurs within the first 72 hours, yet data collection will extend to seven days. In order to maintain these temperatures, the organisms were placed in incubators. Samples were periodically imaged at varying intervals during the procedure at 3x magnification. In order to measure the area with an imaging microscope, a software program was used to extrapolate data in millimeters per pixel resolution. The results suggest that the higher temperatures yield more consistent growth rates, while the lower temperatures hold a more sporadic and relaxed growth rate. The method section addresses the magnification error due to a turn-dial mechanism within the Leica S8APO model. Alongside the experiment, the BA specimens were removed at periods (0-1 day, 1-2 days, …, 6-7 days) to study the effects of temperature on biomineralization. These samples will later be analyzed with an SEM (Scanning Electron Microscope) and a PEEM (Photoemission Electron Microscope). For the entirety of the experiment, the barnacles were not fed. Furthermore, it is important to acknowledge that there could be some variability in fed and unfed, so by creating a separate batch of cyprids with the temperatures above, and feeding each group 20.9 um of algae (or zooplankton) per .785 mL for the first day could alleviate this question. Another question posed would be including temperatures greater than 31° Celsius to test these growth rates and understand if there is some upper limit in its rate of change.



Research Fellows: Sylvia Guo (2026) **Concentratioins:** Computer Science; Economics
Michelle Li (2025) **Concentration:** Mathematical Economics
Faculty Mentor: Mike Mei **Department:** Economics
Title of Project: Housing Markets and Heterogenous Households: leveraging linked migration microdata to define housing markets and household types
Funding Source: SOSC Division
Project Summary:

Housing markets and households within a city are heterogeneous. Traditional definitions of housing markets based on observable characteristics of neighborhoods and houses (like location, house size, neighborhood income, etc.) are based on researchers' choices. The various ways in which housing markets can be defined causes ambiguity in terms of policy evaluation. We provide for a network-based definition of housing markets based on revealed preferences on migration between different census blocks. By using actual migration data between locations, we can more accurately delineate between housing submarkets and better understand the heterogeneous impacts of policies.

Conceptually, we think of different groups of highly substitutable neighborhoods and household types. In an example given by Figure 1, different neighborhoods (defined by census blocks) and households are shown to have connections if a household has lived in that neighborhood. In Figure 1, the network structure is visible: there seems to be three discrete types of census blocks (which we call a housing submarket) and two types of households.

Data comes from Infutor/Verisk, which provides consumer level and property level information with address histories. The data for the Houston Metropolitan Statistical Area from 2016 to 2022 was imported and cleaned. A network defined by household moves was defined, and a bipartite stochastic block model was estimated to define housing submarkets and households types. Preliminary results (Figure 2) show that the estimated housing submarkets within the Houston area are somewhat geographically clustered. But these submarkets are rarely contiguous and also vary by observables like average income, pricing, and house size. Ongoing and future work evaluates the implications of such submarkets in terms of heterogenous impact on different populations and areas within the city, all using a housing market equilibrium model consistent with the estimated network structure.

Figure 1: Example of housing market network structure

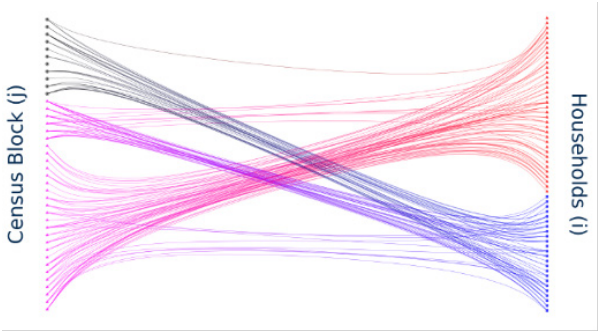
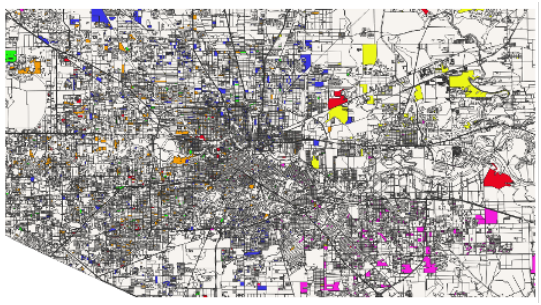


Figure 2: Examples of estimated Houston submarkets (each a different color) from stochastic block model



Research Fellows: Dylan Gutterman (2025) — **Concentration:** Psychological Science
Lindsay Hess (2026) — **Concentrations:** Art & Art History; Psychological Science

Faculty Mentor: Lauren Philbrook — **Department:** Psychological and Brain Sciences

Title of Project: Children's Sleep, Stress, and Learning Study

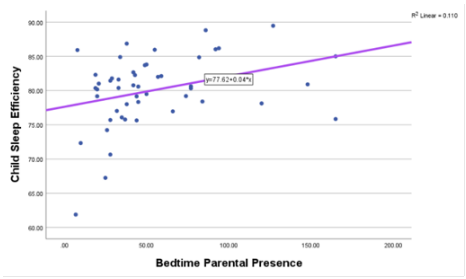
Funding Source: NASC Division

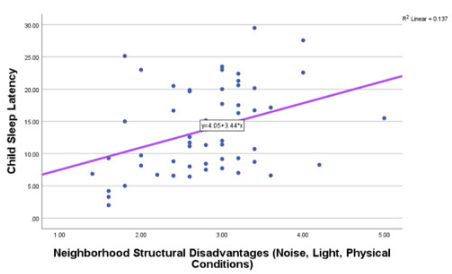
Project Summary:

This summer we began a three-year research study that focuses on how neighborhood, familial, and environmental factors impact preschool-aged children's stress, sleep, learning, and memory capabilities. Efficient sleep is especially important for 3 to 5 year-olds as they are establishing sleep habits prior to starting school. Sleep also plays a key role in emotional regulation and cognitive development, both of which are developing rapidly at this time (El-Sheikh et al., 2019). That being said, little research has been conducted on the topic of how home and neighborhood environments impact sleep among children. In the first phase of this study, Professor Philbrook determined that greater parental presence at bedtime may help to downregulate child arousal, leading to lower cortisol and better sleep (Philbrook et al., 2022; Philbrook, 2022). In this second phase, we will follow the same procedures but aim to double the sample size from 50 participants to 100. We will also aim to recruit a more socioeconomically diverse sample. Our sample for the figures below combines participant data from both phases since identical collections and assessment measures were used.

We collected data from each participant over the span of a week using a variety of measures. Parents complete a questionnaire about demographic information, perception of their neighborhood's characteristics, and child behavior. Children wear an actiwatch for seven consecutive nights while they sleep to record sleep latency, sleep duration, wake after sleep onset, and sleep efficiency. Additionally, parents collect saliva samples from their children before bed for three consecutive nights. Samples are analyzed for diurnal cortisol, a hormone that indicates stress levels. Families also record one night of a typical bedtime routine using a small, wide-angle infrared video camera. These videos are coded for variables including parental presence, sensitivity, close contact, and more. At the end of the week, children complete two cognitive performance tasks using the NIH Toolbox application for iPad (Gershon et al., 2013). These tasks assess attention and executive function.

Our results revealed several significant partial correlations between neighborhood and parenting variables, and child cortisol and sleep. For example, greater bedtime parental presence is associated with higher child sleep efficiency and greater bedtime parental presence is associated with lower child cortisol levels. Additionally, we found that greater neighborhood structural disadvantage is associated with longer child sleep latency. There were no significant effects on cognitive performance, though these results may differ in a full sample. These findings demonstrate the importance of both neighborhood environment and bedtime parental presence for children's stress and sleep.





Research Fellow: **Ammar Haider (2027)** **Concentration: Undeclared**

Faculty Mentor: **Raina Samuel** **Department: Computer Science**

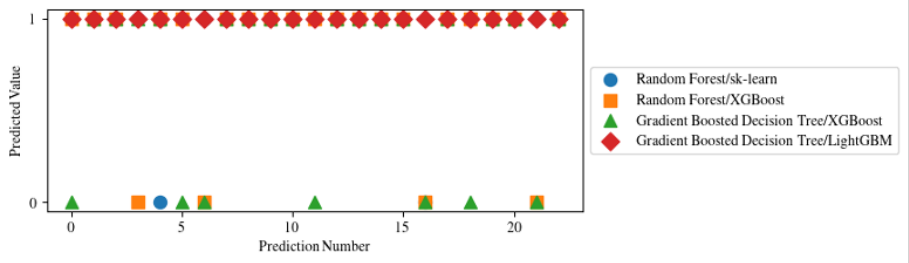
Title of Project: **Analyzing Inconsistencies Across Financial Services Machine Learning Algorithms and Implementations**

Funding Source: **Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science**

Project Summary:

In recent years, the financial services industry has witnessed a notable increase in the use of machine learning algorithms for various tasks such as fraud detection, credit scoring, trading decisions, and robo-advisory services. These algorithms are trained on extensive datasets, including financial transactions, market indicators, and loan performance, to make informed decisions. However, inconsistencies may arise across outcomes of different algorithms or across various implementations of the same algorithm when executing the same financial task. This inconsistency across outcomes at the algorithm level and at the implementation level can potentially undermine the fairness and reliability of the decisions made. Our research seeks to assess these concerns by adopting a multi-layered approach to evaluate inconsistencies both across different machine learning algorithms and across their implementations. By doing so, it aims to build on existing research and provide a more comprehensive understanding of the reliability of machine learning models in financial applications.

We began by selecting two algorithms along with two toolkits to implement each algorithm for both financial classification and financial valuation tasks. This resulted in four different algorithm/toolkit combinations to build models for both of the tasks. Then, we chose the datasets for training our models, dividing them into financial classification and financial valuation tasks. We trained four models per dataset, with each model representing an algorithm/toolkit combination, and collected the output data from each model to enable statistical analysis. To compare implementations, we compared the output data from the two respective toolkits for both algorithms applied to a dataset. To compare algorithms, we averaged the output data from both toolkits used to implement each algorithm. This average output represented the algorithm's performance, and we compared the averaged outputs of the two algorithms used for each task. We applied statistical tests to check for significant differences between the average output of each algorithm and the output of both toolkits used to implement each of the algorithms. We identified inconsistencies by observing statistically significant differences during the comparisons.



We can establish that evidence for statistically significant inconsistencies does exist across the algorithms and across their implementations considered by this research. However, the nature of inconsistencies can vary based on the training datasets. In situations where multiple algorithms and implementations may be used for a particular task and agreement in output data is desired, training datasets should be analyzed for inconsistencies during selection.

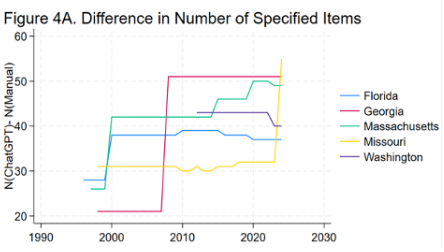
Research Fellows: **Jessie Han (2026)** **Concentration: Economics**
Lily Schoonmaker (2025) **Concentrations: English; Economics**
Faculty Mentor: **Yang Song** **Departments: Economics; Asian Studies**
Title of Project: **Human vs. Machine: Exploring the Accuracy of ChatGPT in Data Collection**
Funding Source: **SOSC Division**
Project Summary:

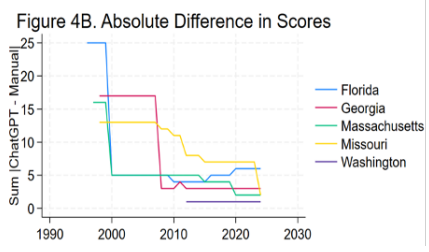
This study evaluates the accuracy of an artificial intelligence software, ChatGPT, in policy sata retrieval with an application on state charter school regulations. AI technology could greatly enhance efficiency and improve access to large and dispersed data sources. However, our understanding of how accurate ChatGPT and other AI are in data collection remains limited.

Since the 1990s, charter schools have rapidly expanded and have been a controversial policy issue. Although charter schools bring more choices to parents and provide public schools with more incentives to improve, the benefits of their higher levels of autonomy and their promises are debated (Cohodes and Parham, 2021). While some argue that autonomy leads to more innovations, high turnover rates and financial/operational mismanagement are assumed results of the increased autonomy. Through the examination of charter regulations by state and throughout the years, it is possible to observe how public charter school policy impacts turnover rates.

Looking through various state law documents is time-consuming. We looked to ChatGPT for potentially efficient and fast policy data retrieval. Yet we find surprisingly little evidence on the accuracy of ChatGPT in policy data retrieval. Following the creation of an organized list of 81 common charter school regulations across states, we collected data through two methods, manual and ChatGPT, and compared the policy data. We focused on five states, including Missouri, Florida, Georgia, Washington, and Massachusetts from the 1990s to 2024. A binary coding (1 = Yes, 0 = No) was used to indicate whether each of the 81 regulations exists in that specific state and year; if one is specified, whether it is true or false.

Our findings revealed that ChatGPT labels more items by these regulations than manual labeling (Figure 1), and that the accuracy of ChatGPT is higher in more recent years as well as for states where the charter law for recent years is more accessible through online resources (Figure 2). The breadth of sources utilized by ChatGPT and if/how often the AI improvises and fills in gaps. This study sheds light on the growing presence of AI in research data collection and calls for future studies to further explore the sources of discrepancies and how we could improve the accuracy of AI data retrieval.





Notes on figures: Figure 1 plots the difference between the number of charter law items identified by ChatGPT and that identified via manual labeling across the years. Figure 2 plots the sum of absolute difference in charter law restrictiveness scores between ChatGPT and manual labeling across the years.

Figure 1. Difference in Number of Specified Items
Figure 2. Absolute Difference in Scores

Research Fellow: **Amanda Harragan (2025)** **Concentration:** **Biology**

Faculty Mentor: **Priscilla Van Wynsberghe** **Department:** **Biology**

Title of Project: **Analyzing the Effect of Circadian Kinase KIN20 on Fertility in *C. elegans***

Funding Source: **Michael J. Wolk '60 Heart Foundation**

Project Summary:

C. elegans are transparent nematodes that are about 1mm in length. They are also hermaphrodites and thus produce large numbers of genetically identical offspring. *C. elegans* are great models for research due to their short life cycle and the possession of homologs of about ⅔ of human disease genes. Like humans, *C. elegans* are subject to a circadian clock which affects their biological processes, including development and developmental timing, which are a focus of our research. Circadian rhythm is a 24-hour cycle of the body's internal clock for essential functions. *C. elegans*have many homologs of circadian clock genes. An important one we focused on was the the homolog of the doubletime gene (dbt) called KIN20. *C. elegans* with the kin20(ok505) mutation have decreased fertility, a slow growth rate, an uncoordinated phenotype, and disruption of sinusoidal movement pattern.

Our main focus was elucidating the mechanism behind why KIN20 experiences this phenotypic disruption. We first looked at germline development through DAPI staining. DAPI is a blue fluorescent dye that binds to DNA in the nucleus and is excited by ultraviolet light. While we were able to get DAPI to fluoresce, it failed to highlight the oocytes, our central focus. Minor changes to the protocol and possibly a different fluorescent stain might prove more useful for our purposes.

To determine whether KIN20 mutant *C. elegans* experienced difficulty in egg hatching, we performed an assay in which one gravid worm was plated on 10 plates, waited 3 hours, and then counted the number of eggs laid. After 48 hours, the eggs developed into young worms that we could quantify. N2 worms showed a higher percentage of hatching, nearly 100%, while KIN20 mutants remained at around 70%. This would indicate that KIN20 is an important gene for egg hatching.

We also looked at whether KIN20 is responsible for overdeveloped eggs in utero. This was analyzed through a bleach assay which included picking 5 gravid worms per agar pad and letting it sit in 50% diluted bleach for 5 mins. Once the worm carcass dissolved, we counted the amount of eggs inside the worm for both N2 and KIN20. N2 worms had a greater average amount of eggs in utero as compared to KIN20, but mutant worms had more overdeveloped eggs. Altogether these results suggest that the KIN20 gene is important for egg hatching and germline development in *C. elegans*.

Research Fellow: **Rylee Hatch (2026)** **Concentration: English**

Faculty Mentor: **Julie Dudrick** **Department: Upstate Institute**

Title of Project: **Preserving Madison County's Agricultural History through Digitizing and Sharing Archival Records**

Funding Source: **Upstate Institute**

Project Summary:

My project as a Field School Fellow with the Upstate Institute this summer was centered on exploring archives housed at Cornell Cooperative Extension's Madison County division in Morrisville. As a community-oriented organization, Cornell Cooperative Extension (CCE) is committed to promoting economic vitality, ecological sustainability, and social well-being. CCE, which has extension offices in every county of New York, enhances community resilience and prosperity statewide by bridging the research of Cornell University's College of Agriculture and Life Sciences (CALS) and the College of Human Ecology with the public. CCE Madison County offers programs tailored to local needs, such as agricultural education, 4-H youth development, rural health, and economic development.

To delve into the rich history of CCE's work in Madison County, I organized, digitized, and analyzed a variety of historical materials, including newspaper clippings, scrapbooks, internal documents, and photos. Subsequently, I collaborated with CCE Madison to publish these materials in an engaging online database, accessible to the Madison County community. The goal in creating the website was to highlight some of the most fascinating materials we had in the archives — many of which revealed intriguing insights about old agricultural practices, educational programs, Madison County during WWII, and the role of women in the organization's history — and to categorize these archives by subject. This way, we could make fascinating local history accessible to anyone interested. CCE Madison has a rich history of being influential not only locally but also nationally. Various archives detailed the organization's response to environmental and economic crises, and some of the most captivating archives provided accounts of Madison County agriculture's efforts to meet wartime production targets, as well as the county's challenges with droughts and blights.

In my studies as an English major at Colgate, I'm particularly interested in exploring "ecocriticism," or environmental literary criticism. In a way, my experience at CCE enabled me to explore that academic interest in environmental literature and writing, which largely involves the interaction between place and narrative. There's no better way to see that interaction firsthand than by looking at documents from my local community about our region and its farms; CCE Madison's archives tell stories about the land we live on, work on, and eat from.

I'm also involved in student journalism, so my time at CCE was a fantastic opportunity to be immersed in local media. I was constantly struck by the bold rhetoric of early 20th-century journalism evident in the archives I explored, and even seemingly simple archives, like recipes or meeting minutes, were engaging windows into relatively recent history.

Research Fellow: Lilia Hayduchok (2026) **Concentration:** Molecular Biology
Faculty Mentor: Jason Meyers **Departments:** Biology; Neuroscience
Title of Project: Investigating the Role of Cyclin Dx in Zebrafish Neuromast Regeneration
Funding Source: NASC Division
Project Summary:

The lateral line is a system found in zebrafish consisting of organs called neuromasts. Each neuromast has sensory hair cells and support cells with mantle cells surrounding them. The sensory hair cells detect movement in the water, similar to how humans hear by detecting sound waves in the air. However, one big difference between zebrafish and humans is that zebrafish can readily regenerate hair cells. The support cells replace old hair cells. More specifically, support cells in the dorsal and ventral locations of neuromasts regenerate new hair cells. An enhancer trap screen found that when GFP was randomly inserted into the genome near the cyclin dx (ccndx) gene, it resulted in green fluorescence in the dorsal-ventral supporting cells, suggesting that cyclin dx might be an important gene in these progenitors.

To investigate the role of ccndx and test whether it was necessary in zebrafish, we used CRISPR-Cas9 to cut out two parts of the gene, making it ineffective. We selected a guide RNA (gRNA) that matches each part of the fish ccndx DNA sequence and recruits the Cas9 protein, cutting the DNA strand. Another gRNA was added to the CRISPR liquid that cuts out the Tyr gene, leading to decreased or no pigmentation. This lower pigmentation helps to identify the fish most affected by CRISPR. Fish embryos were then injected at the single-cell stage for maximum effects. The fish were characterized phenotypically by visual analysis and genotypically through PCR and gel electrophoresis.

Phenotypically, three-day-old control and CRISPR fish with ccndx-labeled cells have visually different amounts of tail neuromasts. At five days old, the neuromasts along the left side of the tail of 12 control fish and 10 CRISR fish were counted. CRISPR fish had a statistically different average number of neuromasts than the control (9.10 and 10.67, respectively; $p<0.05$). Additionally, neuromast hair cell fluorescence appeared dimmer in CRISPR than in control fish, and upon closer examination, the number of hair cells in each neuromast was distinct. Looking at only green fluorescent hair cells from a side view, the control (left) has many more hair cells visible (~14) than the CRISPR fish (right, ~8). This was seen in three to seven-day-old fish. Genotyping was conducted on one control and three CRISPR fish to confirm the successful cutting of the ccndx gene further. Two regions of the gene were amplified using PCR and ran through gel electrophoresis. The control showed clean bands at around 400bp. The CRISPRs had strong bands in the same region, but also had other bands of differing sizes above. This indicates our CRISPR was successful at disrupting the gene.

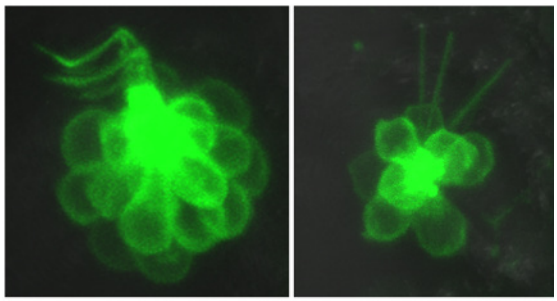


Fig 2. Sensory hair cells labeled with GFP in control (left) and CRISPR.

These data suggest that ccndx affects zebrafish neuromast development. Without functional ccndx, zebrafish have decreased lateral line development with fewer neuromasts on the tail and fewer hair cells in each neuromast. Looking at this trend, it is possible cyclin dx also affects the regeneration of hair cells—and potentially support cells too. We want to look into these possibilities through further research by ablating neuromast cells and watching their regeneration in CRISPR fish. Additionally, we are waiting for the CRISPR fish to reach sexual maturity for breeding. CRISPR fish have many different mutations in each cell, so breeding a CRISPR fish with a wild type would create a heterozygous mutant. Breeding those together would then lead to a homozygous mutant with only one mutation which we could study further.

Research Fellow: Yuliia Heleveria (2027) **Concentration:** Undeclared
Faculty Mentor: Georgiana Haldeman **Department:** Computer Science
Title of Project: Student Reactions to a Responsive Pedagogical Model in CS1
Funding Source: Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science

Project Summary:

Introductory computer science (CS) courses present many challenges, including diverse student bodies coupled with the need to cover a wide range of learning goals. Responsive pedagogies present advantages with these challenges over traditional pedagogies because of their student-centered approach that de-emphasizes the role of the teacher as the expert and provider of knowledge. Our goal for the study was to understand how students perceive the novel responsive pedagogy model. Professor Haldeman employed the POGIL (Process Oriented Guided Inquiry Learning) model in teaching COSC 101 during the semester of Spring 2024. In a typical POGIL classroom, students work in small groups with the instructor acting as a facilitator in order for students to construct their own understanding of material and improve skills of communication, critical thinking, and information processing.

A comprehensive literature review was conducted to access prior research on inquiry-based learning and POGIL implementation in STEM fields as a preliminary step of our study. This review identified gaps in understanding how students respond to POGIL in the computer science domain, where the abstract nature of concepts may challenge typical group dynamics and collaboration. To address these gaps, we designed surveys, conducted focus groups, and performed classroom observations to gather data on student performance and attitudes towards the course.

In order to obtain student feedback, the research team organized focus groups, where students were asked open-ended questions regarding their experiences in the classroom. Additionally, in-class observations were conducted in Spring 2024 to see how students engage within their groups and how they respond to the innovative teaching of material. Our methods of data collection and processing were qualitative in nature. To analyze student responses, I transcribed audio recordings of focus groups and label-encoded the responses. The next step was thematic analysis by coding student data and analyzing what themes and opinions emerged the most. Our results show that students' preferences lie on a spectrum between traditional and innovative pedagogical practices. While students generally appreciate the collaborative aspects of POGIL, their comfort with the model varies depending on prior experience with group-based learning. Many learning preferences stem from expectations primarily based on their prior experiences, including with CS courses. Other expectations we report on are domain-specific; for example, students expect to always be allowed to engage with the computer when working on problems.

After conducting an initial evaluation of students' reactions to the POGIL model in a CS1 classroom, we began preliminary work on a conference paper (SIGCSE) that delved deeper into how students engage with this responsive pedagogical framework. The paper centers on student experiences and perspectives of POGIL, with particular emphasis on challenges and benefits of collaborative learning in a technical discipline. The paper aims to offer insights into how inquiry-based, group-oriented learning models can be utilized for computer science education to benefit students' learning. As a result of engaging with the POGIL model, students emphasized positive impact on their problem-solving skills and understanding of abstract CS concepts. Moreover, students reported that the inquiry-based structure of POGIL helped them break down intricate programming tasks into more manageable steps. However, some students, particularly those with limited prior experience in group work or programming, struggled to balance the pace of team progress with individual understanding.

Research Fellow: Emma Herwig (2025) **Concentrations:** French; History
Faculty Mentor: Catherine Cardelús **Department:** Upstate Institute
Title of Project: Demystifying Deaccessioning: The Not-So-Secret Ways Museums Process, Preserve, and Protect Their Collections Held in Public Trust
Funding Source: Upstate Institute
Project Summary:

This research project focuses on the museum practice of deaccessioning, the ethics behind the decisions, and the logistical applications of deaccessioning in community museums like the Adirondack Experience. In the museum context, deaccessioning is the official removal of an item from a museum's collection. Items can be deaccessioned for a variety of reasons, but in most cases, deaccessioned objects should have never been accessioned—to become part of the museum's collection—in the first place. Many museums seek to deaccession objects without provenance relevant to its mission, meaning that the object's history of use, ownership, and/or creation are not pertinent to the purpose of the museum. Objects can also be deaccessioned if they are in poor condition, if the museum no longer has the facilities to properly care for the object, or if the museum is unlikely to display the object in the foreseeable future. Through deaccessioning, museums can refine and further curate their collections into ones that most accurately represent the museum's mission and vision. At the Adirondack Experience, The Museum on Blue Mountain Lake (ADKX), deaccession is crucial as it helps sharpen the staff's focus on telling authentic Adirondack stories.

Largely, this research sought to destigmatize the museum practice of deaccessioning, which, especially at community-oriented museums like the ADKX, is often a very taboo subject, one that invokes a strong reaction from museum patrons. Those outside of the museum sphere often misunderstand deaccessioning, seeing the practice less as a refining of the collection, and more like taking out the trash. In reality, the deaccession process is one handled with the utmost sensitivity; these are not decisions that are made lightly. I found that, most often, objects that curatorial staff chose to deaccession were objects that never should have been in the collection in the first place. For the ADKX, this often means objects that were not used, owned, or made in the Adirondack Park. The ADKX tells exclusively Adirondack stories, so objects that come from outside the park serve no purpose to the museum, its mission, or the community it serves. Deaccessioning based on provenance is an easy (or easier) decision to make, while deaccessioning based on care, use, or condition can be more difficult. Often, museums invite guest experts to aid in the deaccessioning process by judging the rarity, display value, and relevance of a collection of objects.

Deaccessioning is a crucial step in maintaining a robust and well-rounded museum collection. This process frees physical and intellectual space for museums to collect the most relevant objects to hold, maintain, and protect for the betterment and education of the public and of future generations. At the Adirondack Experience, the time and space freed by deaccession are valuable resources that award museum staff the opportunity to focus on preserving artifacts that are relevant to the museum's mission. Furthermore, the funds from sales of deaccessioned objects are used to acquire new objects and keep the collection accurate and authentic to the museum's vision and mission. As the ADKX maintains a collection held in trust for the people of the State of New York, caring for and preserving this collection is of the utmost importance and cannot be done without routine deaccessioning.

Research Fellows: **Emmett Hintz (2025)** **Concentrations: Economics; Computer Science**
Ayub Khan (2025) **Concentrations: Computer Science; Biology**
Faculty Mentor: **Ahmet Ay** **Departments: Biology; Mathematics**
Title of Project: **Multi-Stage Prostate Cancer Classification Reveals Key MiRNA Biomarkers With Links To Neurodevelopmental Diseases Through Machine Learning**
Funding Source: **NASC Division**
Project Summary:

In the United States, one in eight men will be diagnosed with prostate cancer, and across the world, prostate cancer is the second most diagnosed cancer among men. If detected early, successful treatments are available. Thus, much work has been devoted recently to developing accurate diagnostic tests. Here, we use two machine learning models, SVM and XGBoost, on a publicly available dataset to identify microRNA (miRNA) biomarkers in prostate cancer samples relative to controls. We further identify miRNA biomarkers that can delineate the prostate cancer stage. Analysis of the predicted targets of these miRNAs and the diseases associated with these target genes shows associations with retinitis pigmentosa and autism. Thus, specific prostate cancer-associated miRNAs are also crucial in developing these traits. Altogether, our machine-learning techniques have found novel biomarkers that can noninvasively identify the stage of prostate cancer. This work enhances our ability to detect this cancer early, when treatment is most successful, and increases our understanding of the genetic pathways underlying this disease.

Figure 1. Disease Enrichment Network of the Gene Targets of the Significant Prostate Cancer Predictive miRNAs. The target genes of the top predictive miRNA biomarkers from XGBoost and/or SVM were analyzed using GeneAnalytics to find their enriched diseases. The plot shows a network visualization of these enriched diseases connected to their respective miRNA biomarkers created using Gephi software. Pink nodes represent the miRNA biomarkers, and the size of these nodes is relative to the number of genes they target. The edges are weighted by the number of target genes associated with each disease and colored by disease, with green edges connecting to prostate cancer, orange edges connecting to autism, and blue edges connecting to retinitis pigmentosa.

Research Fellow: **Vuong Hoang (2024)** **Concentrations: Economics; Film and Media Studies**
Faculty Mentor: **Julie Dudrick** **Department: Upstate Institute**
Title of Project: **Nowhere to Go: Maternal Health in New York**
Funding Source: **Upstate Institute**
Project Summary:

In 2022, the United States had the highest maternal mortality rate in the developed world (McGregor et al., 2022). Despite all this, counties across the country are steadily losing maternal services: 10% of all obstetric (OB) units in the country closed between 2003 and 2013 (McGregor et al., 2022). As of 2018, 56% of rural counties do not have access to OB care (Waldman & Zimmerman, 2024). Between 2010 and 2024, over 171 rural hospitals closed or no longer provide inpatient services, with 420 more vulnerable to closure (Waldman & Zimmerman, 2024). We can see that the United States, especially rural America, is experiencing a maternal health shortage, and rural New York is no exception. My project at the New York State Association for Rural Health through the Upstate Institute Summer Field School, focuses on this very issue right in our backyards - in the rural counties of New York.

I first collected descriptive statistics on maternal health access in rural New York reported by other health organizations and government institutions. I collected data on how many hospitals/birthing centers are in each county, and which hospitals are qualified and equipped to deal with moderate-risk births and high-risk births. The main observation here is that there is a severe gap in maternal healthcare caused by a lack of providers.

I then collected descriptive statistics on measures of maternal health, including but not limited to maternal mortality, infant mortality and low birth weight. Some important findings were that maternal mortality in rural New York has skyrocketed since COVID, and that the number of births with low birth weight in rural New York has increased steadily. This shows that there is a decline in maternal health in rural New York.

As the project neared its end, NYSARH also asked that I set up a simple, linear regression model. I ran a linear regression with the outcome variable being maternal mortality with the treatment variable being a county's rurality (rural = 1 if the county is classified as rural, rural = 0 if the country is not). There is an additional control variable, which is birth rate, to control for counties with low populations and birth rates. Rurality had no statistically significant effect on maternal mortality in this specification of the model, most likely because of omitted variables.

Finally, I reviewed the existing literature on maternal health as well as previously proposed federal and local legislation addressing this shortage to provide my own policy proposals.

McGregor, A. J., Addo, N. K., Amutah-Onukagha, N. N., & Arroyo, J. (2022). "I feel like that was the only option I had:" A qualitative study of structural inequities in Obstetric Hospital Choice in Trenton, New Jersey. Journal of Health Care for the Poor and Underserved, 33(4), 1772–1792. https://doi.org/10.1353/hpu.2022.0137

Waldman, H., & Zimmerman, A. (2024, February). Rural Health Policy Documents: National Rural Health Association - NRHA. National Rural Health Association. https://www.ruralhealth.us/advocacy/rural-health-policy-documents

Research Fellows: Flannery Hogan (2026) **Concentration:** Astrogeophysics
Riley Taylor (2026) **Concentrations:** Geology; Natural Sciences
Faculty Mentor: Joe Levy **Department:** Earth and Environmental Geosciences

Title of Project: Antarctic Biogeochemistry: Is Soil Developing?

Funding Source: Norma Vergo Prize; Doug Rankin '53 Endowment - Geology Research

Project Summary:

Water tracks, the smallest hydrological feature in the cold desert of Antarctica, are small underground streams formed by snowmelt during periods of thawing. As Antarctica receives extremely little precipitation, water tracks are the only source of moisture to the ground surface. The formation of soil depends upon biogeochemical weathering occurring, which in turn depends on the presence of water. Thus, these water tracks may be crucial for soil formation in Antarctica. Previous research has found an abundance of dissolved silica in some water tracks, which is potential evidence for chemical weathering happening in the region, despite numerous studies arguing that only physical weathering occurs in Antarctica. If this is evidence of chemical weathering, the silica would be the product of aluminosilicate weathering. No existing research on aluminum in the area has been done, making it difficult to determine whether aluminosilicate weathering is happening. In order to further investigate the possibility of chemical weathering in these water tracks, we worked with samples of sediment collected from Antarctica's McMurdo Dry Valleys. These samples were analyzed to determine their grain size distribution and aluminum content. We predicted that, along water tracks, more chemical weathering will have occurred, leading to higher mud contents and aluminum concentrations.

To prepare samples for analysis, we sieved each sample for 10 minutes in order to separate the <63 µm clay particles from the sample's larger grains. In addition to sieving samples, we used samples that were sieved during previous years of Colgate student research. In total, this yielded approximately 200 samples with documented grain size distributions. In order to extract aluminum from each sample, we used the HACH AluVer3 aluminion kit. The recommended HACH method was followed with necessary small alterations. 10 grams of each sediment sample were divided into 2 Falcon tubes, and first washed with deionized (MQ) water. This process involved the samples being shaken and centrifuged, which removed particulates of down to 0.5 µm. The soak, shake, and centrifuge process was then repeated with 1 M acetic acid. The use of this mild acid dissolved aluminum that had been precipitated during chemical weathering reactions, but would not extract aluminum from unweathered sediment grains. Following the second centrifugation, samples were diluted tenfold with 1 M acetic acid. Each sample was pH balanced to approximately 4.0, which was ideal for extracting a measurable amount of aluminum from the samples as reported by previous publications. We then prepared two replicates of each sample using the HACH method. We determined each sample's aluminum concentration in milligrams per liter using spectrophotometry. In total, we completed 160 runs of 40 individual samples, measuring the aluminum content in triplicate for each sample .

After sieving was completed, in the vast majority of samples, mud (clay and silt sized particles) was found. This is likely indicative of chemical weathering occurring in and around the sampled water tracks. The results of analyzing the aluminum content data point towards a similar conclusion. The aluminum content was found to increase with depth, with any outliers to this pattern coming from a single particularly clay rich site. The data also reveals a general pattern between samples collected on and off the water tracks. Samples on the water tracks tended to have a higher aluminum content than those sampled from off track, particularly at shallow depths. At deeper depths, there was a less significant difference between on and off track. We hypothesize that this is due to the most significant weathering occurring at shallow depths along the water tracks due to longer thaws and warmer temperatures. Aluminum content noticeably increases alongside clay content, which we interpret as evidence of chemical weathering having occurred. We conclude that this data indicates that chemical weathering is occurring along these water tracks.

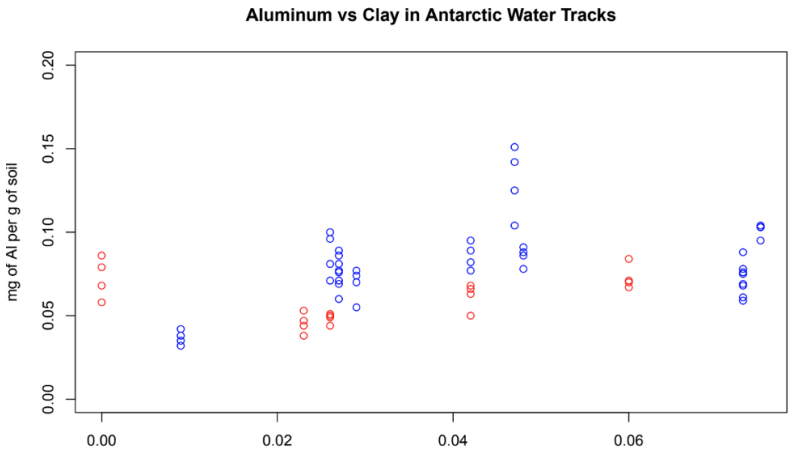


Figure 1- Aluminum content compared to clay content in Antarctic water tracks: As the amount of clay present (indicated by the mud mass fraction) increases, the amount of aluminum per gram of soil increases. Blue points indicate the sample was collected directly on a water track while red points indicate the sample was collected further away from the tracks. The simultaneous increase of both clay and aluminum is indicative of chemical weathering occuring. On track samples tend to have a higher aluminum content, which corresponds to our hypothesis that aluminosilicate weathering is occurring in Antarctica's water tracks.

Research Fellow: **Ekra Hoque (2026)** **Concentration:** **Biochemistry**
Faculty Mentor: **Anthony Chianese** **Department:** **Chemistry**
Title of Project: **Catalytic Hydrogenation of Amide using an RuPNN imine complex**
Funding Source: **John C. Cochran Endowed Fund for Undergraduate Research/NASC Division**
Project Summary:

Transition metal complexes are very useful in synthesizing organic compounds which have great implications in the industrial and pharmaceutical fields. The Chianese lab has been working on synthesizing different organic compounds using Ruthenium PNN pincer complexes. I spent most of the summer synthesizing amine and alcohol from amides using a RuPNN imine complex. The reaction (Figure 1) was done under room temperature and various solvents were used during the trials, such as Tetrahydrofuran, Dimethyl Ether, Isopropanol, and Toluene. Among these solvents, THF was the most efficient one.

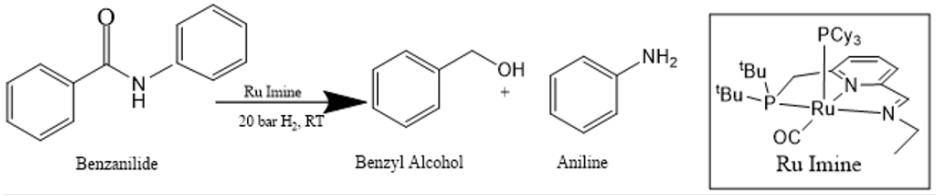


Figure 1: Catalytic Hydrogenation of Benzanilide

Benzanilide was chosen as the starting material for the reaction due to its availability and solubility in different solvents. It was recrystallized before using in the reaction to remove any impurities. Using THF as a solvent yielded success as the reactant was successfully synthesizing the desired products and using a varying amount of catalyst in three different trials showed that the reaction went faster as the amount of catalyst was increased. However, the reaction had problems with reproducibility and most of the summer was spent troubleshooting this issue. While work is yet to be done to solve the reproducibility of the reaction, significant progress has been made on the reaction kinetics. To study the kinetics, each of the reaction reagents were added to the catalyst and an NMR was done on the samples in order to determine which complex was the dominant resting phase. Analysis of the NMR samples showed that the Alkoxide complex was the most dominant resting phase of the catalytic hydrogenation. The following figure is the NMR spectra which helped conclude the alkoxide complex as the dominant resting phase, which was the most significant finding this summer.

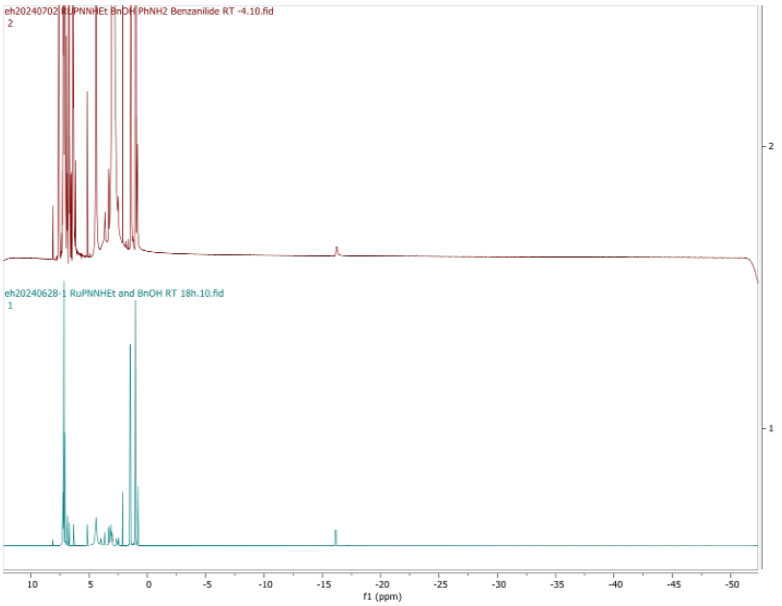


Figure 2: Alkoxide complex as the dominant resting stage of the reaction

Research Fellow: Ben Horner (2025) **Concentrations:** Japanese; Astronomy/Physics
Faculty Mentor: Jeff Bary **Department:** Physics and Astronomy
Title of Project: Modeling Spots on Young Stellar Objects
Funding Source: Justus '43 and Jayne Schlichting Student Research Fund
Project Summary:

Young pre-main-sequence (PMS) stars are characterized by strong magnetic fields, rapid rotation rates, and convective envelopes that can lead to the formation of large cool starspots covering most of their surfaces. The emission from these regions at temperatures cooler than the photosphere complicates the determination of fundamental stellar parameters such as effective temperature (Teff), spectral type, and luminosity. These in turn lead to spectral type mismatches, discrepancies in the masses inferred from optical and infrared spectra, and artificial increases in the spreads of inferred ages and masses for young clusters. Here we show results from a recent campaign to model the optical and near-infrared (NIR) spectra of 24 PMS stars wherein we reconstruct the entire optical and NIR X-Shooter spectra with a spotted model. Using our models, we constrain the temperature and coverage of spots on these PMS stars, comparing them to published spectral types and temperature from Manara+2013. Our results suggest that several of these stars are spotted, affecting the observed temperature and inferred ages and masses via the optical and NIR spectra.

To do this, we combine the flux (Fλ) of two BTSettl (Allard+2013) atmospheres of different temperatures, weighted by an instantaneous spot filling factor (fspot) to represent the stellar photosphere and spots (Pérez Paolino+2024).

$$F_{\lambda,\ model} = F_{\lambda}(T_{phot})(1 - f_{spot}) + F_{\lambda}(T_{spot})f_{spot}$$

We then use a Markov-Chain Monte Carlo (MCMC) algorithm to fit our models to the data. Below are examples of fits to the optical spectra from PMS Stars published on VizieR (Manara+2013). We then compared our spotted model of the PMS stars to a single temperature unspotted model of the star. The single temperature model was created using the same MCMC fitting algorithm, typically resulting in a temperature comparable to previously published effective temperatures of the star. The improved fit that the spotted model results in indicates that these stars may be spotted with a temperature differing from the Teff.

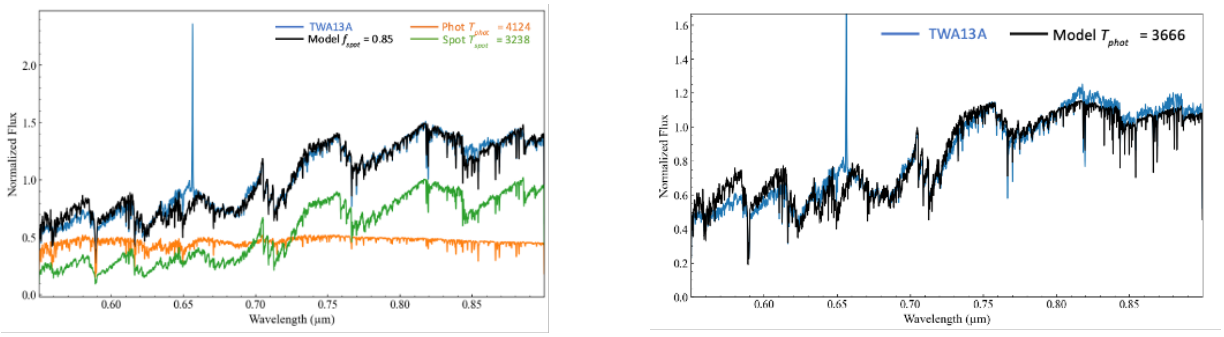


Figure 1: On the left, PMS star TWA13A is fit with the two temperature model, compared to the single temperature fit using the same MCMC fitting. Note the improved fit in the two temperature model around TiO bands around 0.75μm and 0.85μm.

Research Fellow: **Sia Hu (2026)** **Concentrations:** **Applied Math; Computer Science**

Faculty Mentor: **Ahmet Ay** **Departments:** **Biology; Mathematics**

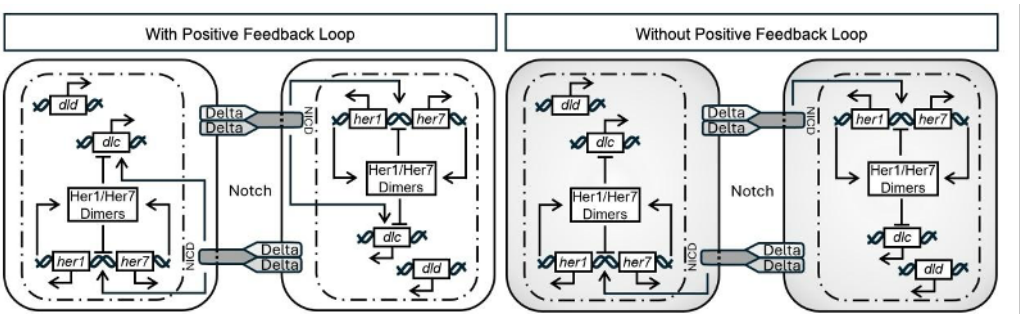
Title of Project: **Revealing the differential roles of DeltaC and DeltaD ligands on the segmentation clock dynamics**

Funding Source: **Michael J. Wolk '60 Heart Foundation**

Project Summary:

The vertebrate segmentation clock drives periodic somite segmentation during embryonic development. Her1 and Her7 clock proteins generate oscillatory expression of their own genes as well as that of *deltaC* in zebrafish. In turn, DeltaC and DeltaD ligands activate Notch signaling, which then activates transcription of clock genes in neighboring cells. While DeltaC and DeltaD proteins form homo- and heterodimers, only DeltaC-containing oscillatory dimers were expected to be functional. To investigate the contributions of DeltaC and DeltaD proteins on the transcription of *her1* and *her7* segmentation clock genes, we counted their transcripts by performing single-molecule fluorescent in situ hybridization imaging in different genetic backgrounds of zebrafish embryos. Surprisingly, we found that DeltaD homodimers are also functional. We further found that Notch signaling activates transcription of *deltaC* gene, thereby creating a previously unnoticed positive feedback loop.

We updated our previously developed mathematical model of the zebrafish segmentation clock network based on our new experimental findings: (1) Delta dimers are now explicitly introduced and differentiated from each other in the equations. (2) The newly identified intercellular positive feedback is added to the regulatory network. We found several parameter sets satisfying these four experimentally derived constraints: (1) *deltaC* mutants will cause an earlier onset of desynchronization than single *deltaD* mutants. (2) double *deltaC*;*deltaD* mutant phenotype will be similar to that of a single *deltaC* mutant. (3) *her1* and *her7* RNA levels will be reduced more in *her1*;*her7*;*deltaD* mutants than in *her1;her7;deltaC* mutants. (4) *her1* and *her7* RNA levels will be similar in *her1*;*her7*;*deltaD* and *her1*;*her7*;*deltaC*;*deltaD* mutants. Overall, the simulations provided insight into why *deltaC* mutants show a stronger phenotype than *deltaD* mutants, while segmentation clock transcripts are reduced more in *deltaD* mutants than in *deltaC* mutants. We next assessed the potential benefit of the newly identified positive feedback loop in the somite segmentation network. A previous computational model argued that while negative feedback loops are necessary and sufficient for generating oscillations, an additional positive feedback loop can make the oscillations more robust and tunable. Thus, we simulated the wild-type segmentation network with or without the newly identified positive feedback loop. We found that oscillations are more synchronized between neighboring cells with the positive feedback loop.



Research Fellow: Declan Huddleston (2026) **Concentration:** Geography
Faculty Mentor: William Meyer **Department:** Geography
Title of Project: State, Local, and City Parks and the Worthless Lands Thesis
Funding Source: SOSC Division
Project Summary:

The "worthless lands" thesis, proposed by the historian Alfred Runte, holds that national parks in the United States are situated on lands that are useless for conventional economic practices such as agriculture, grazing, and mining. Our project assessed this thesis at the state, local, and city levels by comparing the location of protected areas to the location of areas with little economic potential, and by examining sources regarding the rationale for the designation of parkland.

We began with a focus on elevation, slope, and distance from the main urban center in the City of Syracuse, Onondaga County, and New York State. Using ArcGIS, a geographic information system software, we mapped protected areas and the three "worthless" variables in each of the three study areas. Our initial methods for analysis involved the division of the study areas into groups based on the "worthless" variables, such that we could test the degree to which low and high value groups coincided with protected areas. We had some trouble with data distribution, but found that the thesis generally held true: protected areas seemed to correlate with high elevation, high slope, and high distance from the urban center. We then ran further tests focusing on elevation, slope, and soil survey data (flooding frequency for Syracuse; farmland desirability class for Onondaga and New York): adopting a new method for analysis, we set aside the top decile (top 10%) of each study area based on elevation, and did the same for slope and for the soil data. For each study area, we tested the location of the top elevation decile, top slope decile, and top flooding frequency decile (or bottom farmland class decile) against the location of protected areas to assess the degree to which the protected areas coincided with each given "worthless" variable. The percentage of protected areas that coincided with the top elevation decile, for example, could be tested against the 10% figure which represented the proportion of the overall study area that the top elevation decile made up. Our findings, like earlier, supported Runte's thesis. After that, we used the same method to test the location of impervious surfaces in Syracuse against the location of the "worthless" variables. Impervious surfaces, the most fully built up areas, presumably indicate high land value, so the expectation would be for impervious land to correlate negatively with "worthless" land. Such a pattern held true, validating our selection of "worthless" variables. We also ran the analysis in Syracuse with just parks built after 1950 to see whether transportation changes affected these patterns, and the results were fairly similar to our initial findings. Our focus then shifted to the nine northeasternmost United States: Maine, New Hampshire, Vermont, New York, Massachusetts, Connecticut, Rhode Island, Pennsylvania, and New Jersey. We ran the analysis as before, testing elevation, slope, and farmland class, and the findings favored Runte's thesis, although there were some exceptions. Next, we ran the analysis on Los Angeles, testing elevation, slope, and flooding frequency against the protected areas in the City of Los Angeles, Los Angeles County, and the Los Angeles metropolitan area (defined for our purposes as Los Angeles County and Orange County). Our findings here again supported Runte's thesis, and our continued work will assess patterns in the six most populous United States cities (New York, Los Angeles, Chicago, Houston, Phoenix, and Philadelphia), and in each of New York's five boroughs.

Research Fellow: **Joan Jatto (2025)** **Concentration:** **Biology**

Faculty Mentor: **Julie Dudrick** **Department:** **Upstate Institute**

Title of Project: **Raising Suicide Prevention Awareness in Madison County, New York**

Funding Source: **Upstate Institute**

Project Summary:

This summer, I had the opportunity to advocate for and raise awareness of suicide prevention for Madison County, New York, working as a Field School Fellow for the Madison County Council on Alcoholism and Substance Abuse (BRiDGES). BRiDGES is a local nonprofit organization that works to connect community members and those affected by addiction, suicide, substance misuse, and mental health to support and resources. The organization's mission is to provide advocacy and services to individuals, the community, the workforce, and families, through programs that promote good and healthy environments.

My work with BRiDGES this year is specifically centered around the STEPtember for Suicide Prevention Walk, which is an initiative to raise awareness about and reduce the rate of suicide and provide plans for suicide prevention in Madison County. BRiDGES had decided to host an in-person STEPtember Walk in September 2022. In order to make this day successful and accommodate as many participants as possible, I worked with my coworkers to create content on Canva to promote the walk for the organization's social media and updated the walk's social media platform as well as the website and registration process for the in-person participants. The goal of my work was to increase registration from community members all over Madison County and nearby areas to show their support for local suicide prevention.

Working with BRiDGES has allowed me to gain real insight into the world of nonprofits. This Fellowship increased my knowledge of ways to mitigate major health issues in upstate New York, and I appreciate the valuable support I received from the Upstate Institute along the way.

Research Fellow: Siddhant Jhawar (2027) **Concentration:** Undeclared

Faculty Mentor: Takao Kato **Department:** Economics

Title of Project: Wages that Work – Experimental Evidence for Gift Exchange

Funding Source: SOSC Division

Project Summary:

Neoclassical economics treats labor as a hired input into a firm's production function much like capital; however, workers can actively choose their level of effort which would have a significant effect on the firm's profits and total product. Interest in gift exchange – an exchange which involves voluntarily paying workers above market clearing in order to boost productivity – has pivoted on its potential to improve economic performance through increased workplace productivity that is, nevertheless, at the cost of allocative efficiency.

Unlike previous studies, this study investigates the effects of announced and actual gift distribution on employee productivity in a controlled, field setting, with particular emphasis on gender-based differences and team dynamics. We employ a unit and time specific fixed-effects model to analyze logged productivity across three phases. First, when the gift was merely announced but not yet given. Then, when the gifts were actually handed out. In the final phase, where the amount of the gift was unexpectedly larger for some high-performing teams. Results from Phase 1 show no significant change in overall productivity following the gift announcement, but a significant increase is observed for female employees. Phase 2 results suggest a marked productivity increase, especially in teams with gender mismatches. A detailed analysis of Phase 3, involving differentiated surprise factors, highlights substantial variation in productivity based on the extent of the surprise. These findings posit that people may be more motivated not just by the promise of a reward, but by receiving something better than they expected, especially in a team setting where different dynamics are at play. Furthermore, this finding is particularly important for employers looking to boost performance especially in contexts involving complex social dynamics such as gender and team composition.

Research Fellow: **Brady Johnson (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Anzela Niraula** **Department:** **Psychological and Brain Sciences**
Title of Project: **Is Microglia Number and Distribution Altered During Metamorphosis?**
Funding Source: **NASC Division**
Project Summary:

Metamorphosis is a significant period of growth and development in the life of the African Clawed Frog (*Xenopus laevis*), driven primarily by thyroid hormones (TH) (Brown, 2007). During metamorphosis, many obvious physical changes occur, most notably being the formation of front and hind limbs, the resection of the tail, and remodeling of the stomach and intestines (Brown, 2007). Along with the physical changes, the behavior of *Xenopus* tadpoles is greatly affected by metamorphosis. Feeding behavior changes, breathing changes as gills are replaced by lungs, and their movement changes (Bender, 2018). During early brain development, the brain undergoes a "critical period" that involves the formation of immature synapses. Efficient synapses are strengthened while inefficient synapses are removed, a process known as synaptic pruning. Microglia, the resident immune cells of the brain, are known to play an important role in synaptic pruning (Schafer et al., 2012). This project aimed to investigate what, if any, role microglia play in neuronal remodeling of *Xenopus* during metamorphosis by comparing the amount and location of microglia in the *Xenopus* brain across metamorphic stages.

This project utilized transgenic tadpoles of three metamorphic stages that were modified so that immune cells would express Green Fluorescent Protein (GFP). Our tadpoles carried GFP only in cells that expressed the gene *mpeg1*, which is a gene only expressed in macrophages. Cells positive for GFP were fluorescently tagged using immunohistochemistry and photographed at 20x zoom. As our GFP immunostaining stained the cytoplasm, slides were also stained with DAPI, a dye that stains only the nucleus of cells, to help distinguish cells from background signals. The three stages used in this project were stage 54, 58/59, and 66. Stage 54 is right before metamorphosis begins (premetamorphosis), while stage 58/59 is from the middle part of metamorphosis (prometamorphosis) and stage 66 is at the climax of metamorphosis.

Analysis of 10 *Xenopus* brains revealed that, when combining all regions, stage 54 had the highest quantity of microglia compared to stage 58/59 and 66. We then compared different elementary regions of the *Xenopus* brain, namely forebrain, midbrain and hindbrain. The hindbrain overall contained more microglia at each stage than the either two sections, while the forebrain contained the least. At stages 54 and 58/59, there is a diversity in the amount of microglia populations between regions. For example, at stage 54, the hindbrain had an average of twice the amount of microglia than the forebrain. But, by stage 66, microglia levels slightly stabilized across regions, with the forebrain sections still containing the least number of microglia. Future work should focus on analyzing specific regions of the brain, such as the hypothalamus and optic tectum, to better understand the functions of those regions.

Research Fellow: Sophie Karbstein (2026) **Concentration:** Russian & Eurasian Studies
Faculty Mentor: Jessica Graybill **Department:** Russian & Eurasian Studies
Title of Project: Caviar: Culture, Commodity, Catastrophe
Funding Source: UNST Division
Project Summary:

The nature of caviar is simultaneously self-perpetuating and self-destructive: the qualities of caviar both further its own commodified materiality and might eventually lead to the end of this item as it exists now and has existed for centuries. Questioning the culture, commodification, and catastrophe of caviar through texts including cultural and natural histories of caviar, Russian and Soviet travelogues, and contemporary journalism displays the deep interrelatedness of these phenomena. This research argues that an interdisciplinary caviar narrative can hence be explained as a positive feedback loop.

First, caviar's place in Russian culture and its global associations with luxury and status define the culture of caviar consumption. The consuming of caviar was historically a daily ritual in Russian and former Soviet societies. Russia does lay claim to two-thirds of the entire world's sturgeon population, but the roots of this ritual can be further traced to the influence of the Russian Orthodox Church, which upholds over 200 days of abstention from meat each year. Fish and fish products like caviar were promoted as religiously permissible alternatives for the pious during fasting periods.
Russian caviar only became a food of the wealthy once the Industrial Revolution generated innovations that allowed caviar to be easily exported to Europe, triggering its reinvention as a status symbol and a method of conspicuous consumption, and transforming it into a lucrative industry in Russia. Despite its exclusive contemporary nature, caviar remains a source of Russian national pride and an essential symbol of Russian identity. As these two different cultures of caviar together fueled a consumer desire for caviar, and as the Industrial Revolution led to the internationalization and commodification of caviar, the cycle shifts towards catastrophe.

The sturgeon's long life and later maturity, as well as its nature as a migratory species, make it inherently vulnerable to overfishing. As the international community eventually came around to protecting sturgeon, specifically with the introduction of an international convention, CITES, that attempted to regulate international trade in plants and animals, sturgeon poaching and caviar smuggling expanded.

As sturgeon disappear, caviar becomes increasingly rare and increasingly expensive, strengthening the perception of caviar as an extravagant delicacy, and hence reinforcing the culture of caviar consumption. This further fuels the commodification of caviar, pushing sturgeon closer and closer to a true extinction catastrophe and closing the positive feedback loop of caviar through culture, commodity, and catastrophe.

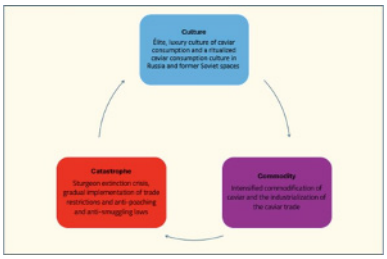


Fig. 1
The positive feedback loop explaining the interrelatedness of culture, commodity and catastrophe as these factors apply to a narrative of caviar

Research Fellow: **Kwakye Kendja (2025)** **Concentration:** **Physics**
Faculty Mentor: **Kiko Galvez** **Department:** **Physics and Astronomy**
Title of Project: **Gravitational Lensing Diffraction in Binary Systems**
Funding Source: **National Science Foundation Grant**
Project Summary:

Gravitational lensing occurs when massive objects bend light from distant sources, revealing unique insights into spacetime structure. In particular, regions of high magnification, known as caustics, generate distinct diffraction patterns due to the wave nature of light. This research examines wave-optic diffraction near caustics in binary lens systems through a combination of theoretical modeling and experimental simulations. By utilizing a spatial light modulator (SLM) programmed to mimic gravitational deflections, we recreated lensing effects in the lab with a coherent laser beam filtered through a single-mode fiber. Key lensing parameters were incorporated, including the Schwarzschild radius (r_s) representing each mass's compactness, the pixel distance between binary masses, and the distance from the lens to the imaging plane (z). Diffraction patterns were captured using a digital camera across multiple wavelengths (442 nm, 532 nm, and 633 nm), revealing intricate caustic shapes, such as astroid and deltoid structures, which closely matched theoretical expectations. These patterns remained largely wavelength-independent, suggesting stable caustic formation across different wavelengths. Additionally, systematic variations in the binary separation demonstrated significant changes in interference patterns, emphasizing the interplay between wave and geometric optics in these regions.

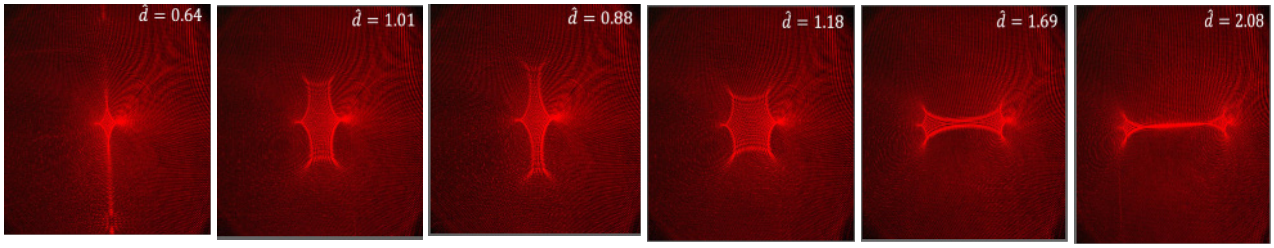


Figure 1: Diffraction patterns for different scaling parameters, highlighting how variations affect caustic structures and interference features.

Future Directions

The next phase of this study will focus on simulating lensing effects through more complex structures, such as black holes and cosmic strings, using advanced computer holography and optical table setups. These investigations aim to refine our theoretical models and contribute to foundational knowledge relevant for interpreting gravitational wave observations and understanding wave-lensing behavior in astrophysical systems.

Research Fellow: Ayub Khan (2025) **Concentrations:** Computer Science; Biology

Faculty Mentor: Ahmet Ay **Departments:** Biology; Mathematics

Title of Project: Machine Learning Uncovers Novel Sex-Specific Dementia Biomarkers Linked to Autism and Eye Diseases

Funding Source: NASC Division

Project Summary:

Recently, microRNAs (miRNAs) have attracted a lot of interest as predictive biomarkers for the most prevalent types of dementia, including Alzheimer's Disease (AD), Vascular Dementia (VaD), Dementia with Lewy Bodies (DLB), Normal pressure hydrocephalus (NPH), and Mild Cognitive Impairment (MCI). The use of machine Learning methods have made it possible to use miRNAs in highly accurate predictive models. In this study, we examine the differential expression of miRNAs across various dementia groups compared to normal controls (NC) and analyze their enriched biological and disease pathways. We evaluate the use of these miRNAs in binary and multi-class machine learning models for dementia prediction in overall and sex-specific analyses. Using data consisting of 1685 Japanese individuals (GSE120584 and GSE167559), we performed feature selection to identify miRNAs associated with five dementia groups. We thus introduce novel differentially expressed miRNA biomarkers between controls and five types of dementia. We achieved up to a 27% improvement in dementia risk prediction over baseline using miRNAs in binary and multiclass classifiers. Further analysis of miRNA target genes and enriched pathways revealed significant neuronal and eye disease pathways potentially associated with dementia risk. Sex-specific analyses highlighted unique biomarkers for males and females with miR-128-1-5 as a protective factor for males in AD, VaD, and DLB, and miR-4488 as a risk factor for female AD, highlighting distinct biological pathways and potential therapeutic targets for each sex. Our findings support existing dementia etiology research and introduce new potential and sex-specific miRNA biomarkers.

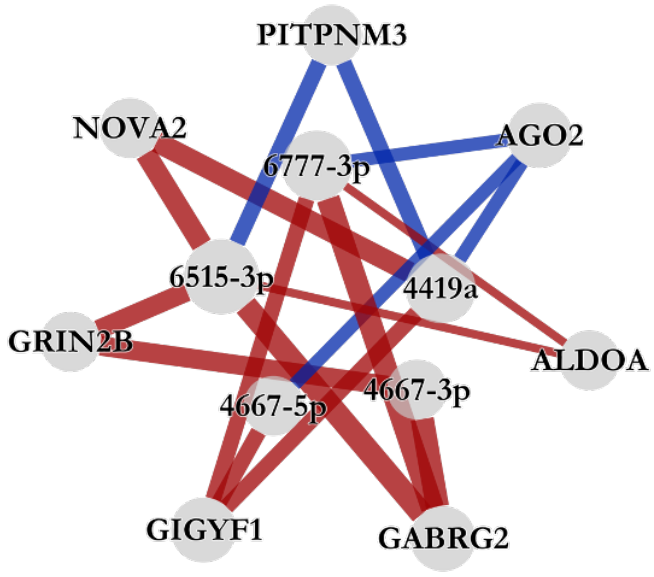


Figure 1. Target genes and enriched disease pathways of the common dementia associated miRNAs in the overall population. miRNAs that were significant after independent feature selections and multivariate logistic regressions in two or more dementia groups were selected. Significance was defined as adjusted p-value < 0.05 from logistic regression. Out of those, miRNAs that targeted genes involved in the top two enriched non-cancer diseases: Retinitis Pigmentosa (RP) and Autism Spectrum Disorder (ASD) were filtered for degree > 2 and plotted using Gephi, leaving five miRNAs and seven target genes. Inner circle nodes are miRNAs and outer ones are genes. Edge weight is the strength of the miRNA-gene connection from miRTarBase ($1/(\varepsilon+\text{p-value})$), and edge colors are: blue = RP, and red = ASD. Only highly significant (adjusted $p < 0.05$) diseases are shown.

Research Fellow: **Grace Klag (2026)** **Concentration: Biology**
Faculty Mentor: **Julie Dudrick** **Department: Upstate Institute**
Title of Project: **What is the Current Status and Availability of Low-Income Housing in Madison County?**
Funding Source: **Upstate Institute**
Project Summary:

This summer, as a Field School Fellow with the Upstate Institute, I was partnered with the Community Action Partnership (CAP) in Madison County to determine what the availability of subsidized housing units looked like in the county. Subsidized housing is a general term for government programs that offer rental and ownership assistance to low- and moderate-income individuals. CAP is one of the few outreach programs that works directly with the low-income community and has been advocating for the community for nearly 40 years. A lot of this connection is facilitated through the Rapid-Housing program which low-income families can contact in order to start the process of getting a new shelter.

In Madison County and New York as a whole, there is a housing shortage for low-income families. According to the 2023 Point In Time (PIT) count, on the state level, 52 out of 10,000 people are experiencing homelessness, compared to the national statistic of 20 for every 10,000 people. New York City has the highest community rate of homelessness which heavily factors into the 39% increase in statewide homelessness New York observed from 2022-2023. Since NYC is so massive, many of the state resources are allocated to the city's efforts. This occurrence glosses over the housing issue in more rural communities, like Madison County, because there is such a focus on urban environments. This is one of the main issues CAP is working to solve by bringing awareness to the lack of housing options in rural areas and by trying to supply as many individuals and families with resources to find housing. By working directly with low-income individuals, CAP is working to change and develop local policies to make sure the rural communities of Central New York are suitably served.

My main objective for this project was to get a better picture of the subsidized housing options and availability in Madison County. Having an accurate picture of the housing stock allows policymakers and administrators at CAP to advocate more thoroughly for the community's needs. There are 673 subsidized rental units in Madison County, distributed between 18 different properties. Only four properties will soon have available housing and 11 sites have no vacancies. Three properties were not able to confirm what their waitlist looked like. Many of the properties with no vacancies have waitlists that are about 2 years long. There is a very low turnover rate for these properties because it is challenging to get placed in a unit when there is a high demand and low supply of housing units.

With this information in a formal write-up, CAP will be able to use this data when applying for housing grants and to show policy makers that Madison County has a need for more affordable housing units. To help alleviate the local housing crisis, Madison County must take initiative to help educate its community members. It's important that Madison County is aware that homelessness looks different in rural areas than it does in metropolitan areas. Policy change will be important also, but it's much easier to get local changes if there is community support, which starts with educating the community. Furthermore, there needs to be more reliable ways of sharing information with the homeless community. Handouts with resources about local agencies that can help the homeless community should be distributed to those who need them. These handouts will also include the number for 211, a Central New York number which offers health and human services. Finally, Madison County should consider constructing a Warming/ Cooling center, where individuals can drop in when temperatures are too high or low. This is another place to distribute information and can demonstrate to the community that they are supported.

Research Fellows: **Samanta Kost (2025)** **Concentration: English**
Toby Wolfson (2025) **Concentrations: English; Religion**
Faculty Mentor: **Jennifer Brice** **Department: English**
Title of Project: **Living Writers**
Funding Source: **AHUM Division**
Project Summary:

Each fall, the English department invites a series of authors to campus to engage students in the classroom and deliver a public lecture. Living Writers, as it's known, is both a for-credit course of 50+ students from all departments who read and discuss each of the authors' books (about one book per week), as well as a program open to alumni, family, and friends of Colgate who wish to follow along at their own pace.

Spending the summer as a Living Writers fellow offers the enriching opportunity to read a wide selection of books and simultaneously conduct research on said books, their authors, and the topics and themes they address. We spent the beginning of the summer reading the ten books selected for this fall's visiting authors. After reading each book, we met with Professor Brice to analyze the texts, brainstorm questions for the author, and discuss how best each might effectively be taught (e.g., how to introduce them; what passages to explore; what outside material might help contextualize them).

Once we had a clear roadmap for further exploration, we worked to dig deeper into the world of both the books and their authors. This included everything from book reviews to researching historical context to biographical information about each author and their other works. Where are they from? What have they accomplished? Do they illustrate? Write essays? What intrigues them? This research was completed not only to assist Professor Brice in preparing for this fall, but also to populate the Living Writers website with author bios, summaries of each book, and curated links to helpful outside sources such as reviews, author interviews, playlists, or additional works by the author. This material serves to spark excitement in our participants and enhance their reading experience.

In addition to the intellectual work we completed, throughout the summer we assisted in myriad logistical tasks associated with the program such as tabling during reunion weekend, delivering books to co-sponsors, designing and populating a display case, and proofreading copy for web pages and print posters.

Overall, the Living Writers fellowship allows students to fully engage with texts by authors from diverse backgrounds and across a variety of genres. The program provides the opportunity to read books both underappreciated and well-loved that are written by new and established authors alike. It deepens your love for literature while also offering others a gateway into the world—without all the hard work!

Research Fellows: Audrey Kris (2026) **Concentration:** Neuroscience
Sophie Smyth (2025) **Concentrations:** Mathematics; Neuroscience
Faculty Mentor: Bruce Hansen **Department:** Psychological and Brain Sciences
Title of Project: Developing a brain-guided artificial neural network to gain insight into how the brain represents behaviorally relevant information
Funding Source: Mind, Brain and Behavior Summer grant; NASC Division
Project Summary:

The human brain has a unique way of processing visual information. Rather than interpreting visual information pixel by pixel like a camera does, we are able to interpret whole objects in a room with little to no active thinking required. For our research project this summer, we were interested in exploring how the brain codes task-relevant information and uses it to interpret the world around us. The brain can comprehend visual information to create neural representations by undergoing multiple transformations over time (Hansen et al., 2021). This can be depicted by coding a brain-guided convolutional neural network (BGCNN), which we developed over the course of the summer. In our BGCNN, the input images are compared to EEG neural data, and evaluated against different behavioral responses to the same images. The goal of the model is to correctly identify if an image was being used for one task or another. After coding our original version of the network, we created an alternate model that compared the convolutional output to the regression line for all participants. This version trained at a faster speed and reached a higher accuracy. After training a given model, we created reconstructions of the images using deconvolution. We found that using randomly generated weights instead of trained weights to create the reconstructions provided a good control for our model.

To better understand how our model learned, we ran analyses on neural data and behavioral -relevance maps that show which image regions participants deemed as important for performing different tasks. We ran a multidimensional scaling distance analysis on both task-specific behavioral-relevance maps and neural data for corresponding images, which showed that images with more similar behavioral-relevance maps also have more highly correlated neural data. Interestingly, we found the same trend in the network's performance. Over seven simulations, the average network error for images with similar behavioral responses was significantly lower than that for images with dissimilar responses. These findings helped us understand how our data is structured and how the model makes use of both the image data and the neural data.

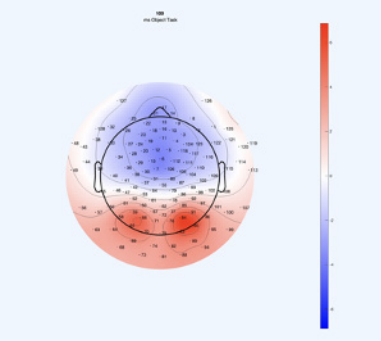


Figure 1: Topoplot showing neural activity averaged across both participants and images at 100 ms.

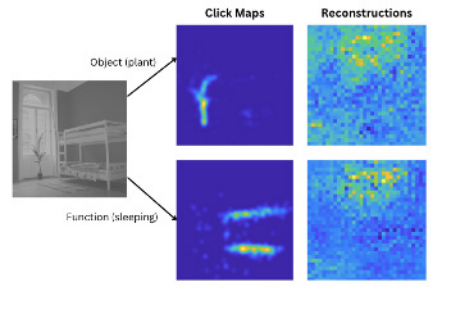


Figure 2: Original image compared to the corresponding click maps and reconstructions for object and function tasks.

Research Fellow: **Jackson Kustell (2025)** **Concentration:** **Physics**
Faculty Mentor: **Ken Segall** **Department:** **Physics and Astronomy**
Title of Project: **Developing Superconducting Neural Networks**
Funding Source: **NASC Division**
Project Summary:

Introduction. Computer programs have become more resource intensive with time. For the current history of the computer, this has been completely fine. Innovation in the size of the transistor, the basic building block of a modern computer, has kept pace with these increasingly demanding programs until recently. Unfortunately, we are now reaching a hard limit on the size of the transistor. This means that companies have taken to building large, energy inefficient, supercomputers to tackle modern computing problems. We propose a different approach. In the Segall Lab, we investigate using superconducting circuits as an energy, space, and resource efficient alternative to traditional computing.

The Segall Lab has employed the unique properties of superconducting circuitry to develop what we have coined the Josephson Junction Neuron or "JJ Neuron" (Figure 1). As the name suggests, it acts very similarly to a biological neuron. When sufficient current is applied to the Iin wire, a voltage spike is generated across the pulse junction (across Inductor and Josephson Junction labeled with a "p" in Figure 1). If the current is not sufficiently large, a spike will not be generated. This spiking threshold can be adjusted by a bias current Ib.

Spiking neural networks (SNNs) are composed of nodes, which release an output "spike" when they receive a combined input that is above their set threshold, and synapses, which attenuate an output spike. Currently, these networks are simulated on traditional computing hardware, and have complex machine learning and mathematical applications. The thresholding behavior of our JJ neuron acts exactly like a node in an SNN. We have also developed a synapse capable of modifying the strength of a current spike. If we can successfully connect a network of JJ neurons with a viable synapse, our circuitry will be able to run any algorithm accessible to a traditional SNN, but at much faster speeds.

Present Research. This past summer, we sought to demonstrate a viable network of JJ neurons and synapses in WRSpice simulation. By modifying the impedances and structure of the circuit, we have reached the following milestones. First, we demonstrated that it is possible to connect seven presynaptic JJ neurons, capable of positive or negative output current, to one postsynaptic output neuron. Second, we optimized the circuitry of the synapse to maximize the range of the current output strength. Figure 2 shows a recent iteration of the JJ neuron and synapse circuitry. The neuron is coupled to the synapse through a transmission line which maintains the pulse shape and magnitude. The synaptic circuit is an inductive divider which directs a variable amount of current through output depending on the amount of magnetic flux contained in the SQUID.

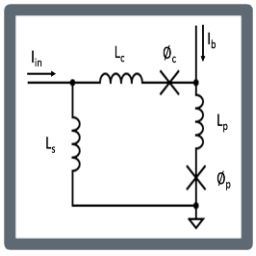


Figure 1

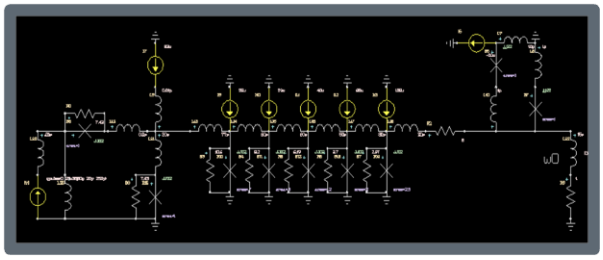


Figure 2

Research Fellow: **Grace Kwitek (2026)** **Concentration:** **Molecular Biology**
Faculty Mentor: **Priscilla Van Wynsberghe** **Department:** **Biology**
Title of Project: **External factors influence behaviors via lite-1 to lin-42 signaling pathway in *C. elegans***
Funding Source: **NASC Division**
Project Summary:

C. elegans is a species of nematode that is a model organism for studies in developmental genetics, eukaryotic cell studies, and disease and parasite-host research. *C. elegans* have a fully mapped genome, brief life cycle and utilize asexual reproduction so they are especially beneficial in genetic studies. The goal of our lab overall is to understand how circadian and developmental rhythms function across the animal kingdom using *C. elegan*s. Circadian rhythms are daily cycles that typically follow a 24-hour course in which external factors like light and chemicals are important for entraining biological processes such as sleep, growth, and feeding. Within the genome, there are certain genes that control these cycles that are conserved across species. LIN-42, for example, is a homolog of the period protein (PER) in Drosophilia that is essential in the function of a circadian clock. LITE-1 is a chemo-photoreceptor gene that is located in the phospholipid bilayer of cells and is used to detect external cues such as ultraviolet light and hydrogen peroxide. My research is to investigate if LITE-1 and LIN-42 function as a cellular pathway and to look into how LITE-1 acts as a chemoreceptor in the presence of hydrogen peroxide. To do this, we have worked with C. elegans that are mutants with the LITE-1 gene deleted from their genome and LIN-42 mutants with a FLAG tag applied to the C terminus of the gene. I analyzed protein expression of LIN-42 in mutants without the LITE-1 gene and performed phenotypic assays that tested hydrogen peroxide avoidance in different strains. With this information, we can better understand how LITE-1 and LIN-42 impact circadian rhythms within C. elegans.

I aimed to determine if protein expression varies across development in mutant worms. In the examination of protein levels, both PVW3 or LIN-42 worms with a FLAG tag and PVW3;LITE1 mutants were egg prepped and grown for 22, 24, 26, and 28 hours in a 25°C incubator. The samples are then collected with M9 solution and a protein extraction protocol was performed. A western blot gel is then loaded with the proteins and run. The proteins are then transferred to a membrane, treated with FLAG tag antibodies, viewed, stripped, treated with tubulin antibodies, and viewed again. These western blots have revealed that LIN-42 is rhythmically expressed and peaks around 26 hours of growth. It has also been observed that LIN-42 levels are generally decreased in LITE-1 mutant worms.

Additionally, I sought to find evidence for chemoreception in the LITE-1 to LIN-42 pathway using hydrogen peroxide. In the phenotypic assay of hydrogen peroxide avoidance, *C. elegans* strains: N2 (wildtype), LIN-42, LITE-1, and LIN-42;LITE-1 are egg prepped and grown for 40-44 hours. Worms were then collected using M9 and pipetted onto an unseeded agar plate. Worms are then treated with M9 as a control or hydrogen peroxide and observed for positive or negative avoidance behaviors. The data is collected and put into an avoidance index to quantify the phenotypic behavior of each strain in the presence of hydrogen peroxide. This assay is done blindly as to limit any subconscious bias of knowing the strain being tested. The results suggest that LIN-42 mutants have a decreased response to H_2O_2 and that N2 shows a greater response to H2O2. These results are promising, but repeated experiments must be done to gather a greater understanding.

Research Fellow: **Robyn Landes (2024)** **Concentration: Chinese**
Faculty Mentor: **Catherine Cardelús** **Department: Upstate Institute**
Title of Project: **Public Libraries in Rural Areas: Community Perception of the Long Lake Public Library**
Funding Source: **Upstate Institute**
Project Summary:

This research project explored the role of public libraries in small and rural communities in the Adirondacks through a community survey. The survey aimed to assess the value of the Cornelius Vanderbilt Whitney Long Lake Public Library (CVWLLPL) in the community. By surveying the library users, we collected data on the value of the library's programming, collections, and other services. The results from this research will inform future library programs, and help the library demonstrate its value and effectiveness to the broader community.

The Town of Long Lake is located in Hamilton County, one of the least densely populated areas in New York State, and also serves residents in the Town of Newcomb in Essex County. Long Lake faces challenges in employment, housing, and food, healthcare, and broadband access (Comprehensive Plan, 2022). As an aging population with many second-home owners, there is a small school enrollment and a lack of young families moving to the area. In the 2022-23 academic year, there were 56 K-12 students enrolled in the Long Lake Central School (NYSDOE).

The mission of the library is to support life-long learning and help meet the day-to-day educational, informational, cultural, and recreational needs of the people in the service area. This research project aimed to assess how the library fulfills its mission by understanding its role in people's lives and addressing the region's most pressing challenges.

The survey results indicate that the library is an important hub for community members. Out of the 13 respondents, 46% use the internet at the library, 83% consult with library staff, and 83% check out books or DVDs. Additionally, 57% want more weekend and afternoon open hours, 75% think the library's greatest strength is the friendly staff, and 73% value the welcoming and accessible environment. The initial analysis indicates there is no one-size fits all approach for library usage and people use a variety of resources. The impact of the library extends beyond literacy (83% are motivated to visit the library to check out books and DVDs), to social wellbeing (56%) and building community, which is essential for less populated areas. Based on the survey results, The library will continue to gather user feedback and adapt its services to meet the evolving needs of the community.

Research Fellows: Thomas Lanuza (2026) — Concentrations: Mathematics; Computer Science
Edmond Nzivugira (2027) — Concentration: Undeclared
Ethan Rackleff (2025) — Concentration: Computer Science/Mathematics
Faculty Mentor: Gabe Sosa Castillo — Department: Mathematics

Title of Project: The polynomials for the Hilbert series of special monomial sets

Funding Source: NASC Division

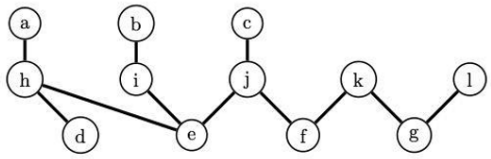
Project Summary:

Graphs are common mathematical structures that arise in various academic fields, ranging from computer science to biology. They act as tools to model networks, processes, and relationships. A graph consists of vertices (also referred to as nodes in the fields of computer science and data science) and edges that connect pairs of vertices. Understanding the properties of graphs can reveal important insights into the systems they are used to represent. Thus, deciphering properties of graphs can have ripple effects across many scientific fields.

One prevalent area of mathematical research concerns graph polynomials, algebraic expressions used to encode information about the properties or the structure of a given graph. Our summer research group focused on one such polynomial, namely the h-polynomial of the edge ideal of a graph. We attempted to answer an open question regarding the degree of the h-polynomial of a bipartite graphs, (bipartite graphs are a special class of graphs that can be divided into two disjoint sets of vertices, with edges only between vertices in different sets, and not between vertices within the same set). Although this set of graphs may appear too specialized, its applications are abundant. For instance, certain Large Language Models, which is currently an active topic of discussion in computer science, rely entirely on bipartite graphs. This illustrates the underlying complexity of bipartite graphs and the demand to understand them.

Our work this summer was situated at the intersection of Computational Algebra, Commutative Algebra and Combinatorics. We began our investigation with a comprehensive review of concepts ranging from Abstract Algebra to Combinatorics, so that our research group possessed the necessary background knowledge to communicate effectively and explore ideas properly. The main and consequently interconnected points of study included monomial ideals, quotient rings, the Hilbert series and Hilbert function, trees, bipartite graphs, independent sets, partially ordered sets and Hasse diagrams. Through understanding these concepts, we were able to make sense of high-level mathematical research so as to utilize previously known results in an attempt to attain our objective: to identify the structure of partially ordered subsets in a bipartite graph that would guarantee that the value of a parameter q, which represents the difference between partially ordered subsets of opposite parity, equals 0 .

To describe our work formally it is necessary to introduce notation. Suppose we are given a connected bipartite graph G with bipartition (U, V) such that $|U| \geq |V|$, i.e. the set U possesses at least as many vertices as the set V. We will denote V_W as the set of whiskered vertices in V, i.e. vertices in V connected to vertices in U that possess only one edge, while $\overline{V_W}$ will denote the complement of V_W in V. For every vertex v in V_W (the set of whiskered vertices of V) select a leaf vertex u (a vertex with only one edge) in U connected to v. Let U_L be the set formed by these leaf vertices u and denote the complement of U_L in U by $\overline{U_L}$. In the graph below it is clear that $U = \{a, b, c, d, e, f, g\}$, $V = \{h, i, j, k, l\}$, $V_W = \{h, i, j\}$, $\overline{V_W} = \{k, l\}$, $U_L = \{a, b, c\}$ and $\overline{U_L} = \{d, e, f, g\}$.



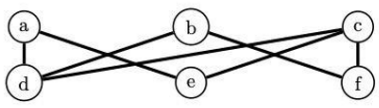
If we denote by X the collection of subsets S of $\overline{U_L}$ for which the set of neighbors of S (all of the vertices connected by edges to vertices in S) equals $\overline{V_W}$, formally

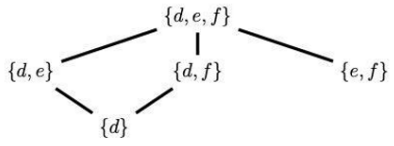
$$X = \{S \subseteq \overline{U_L} : S \neq \emptyset \text{ and } N(S) = \overline{V_W}\}.$$

and let

$$q = |\{S \in X : |S| \text{ is even }\}| - |\{T \in X : |T| \text{ is odd }\}|.$$

A result in a paper by Biermann, Kara, Augustine O'Keefe, Skelton, and Sosa Castillo states that if $q \neq 0$ then the degree of the h-polynomial of the edge ideal of a bipartite graph equals the independence number of the bipartite graph. Below is an example of a bipartite graph along with the poset structure of X that allows to compute q, in this particular case $q = -1$:



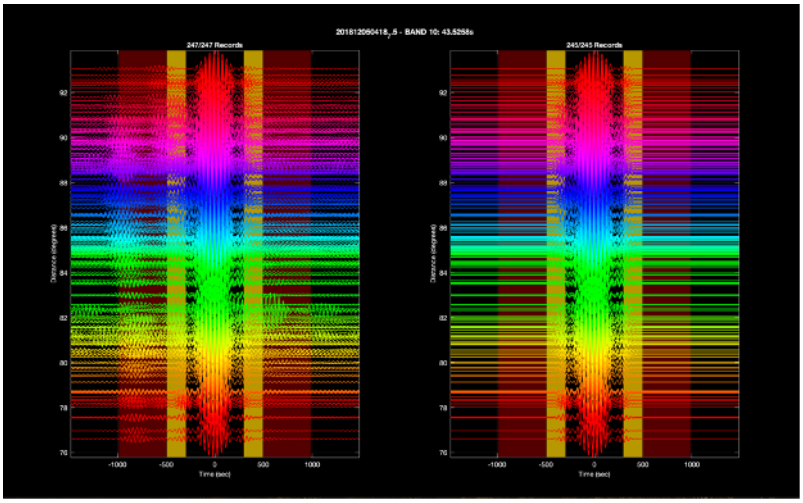


Computational data seemed to indicate that it is far more common for q not to equal 0, so our research objective was to characterize the poset structures that guarantee that $q = 0$. We were able to formulate when $q = 0$ when $\overline{U_L}$ consisted of at most four vertices. However, we were unable to identify a pattern when there were more than four vertices in $\overline{U_L}$. We created a Python program which when given the number of vertices for $\overline{U_L}$, would output all the relevant bipartite graphs such that $q = 0$. This program produced massive amounts of data. Unfortunately we were unable to characterize the bipartite graphs for which $q = 0$, but we are confident that by carefully analyzing the data we will be able to do so at some point this academic year.

Research Fellow: **Pierce Leclerc (2025)** **Concentrations:** **Geology; Applied Math**
Faculty Mentor: **Aubreya Adams** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Capturing Subsurface Structure of the Alaskan Subduction Zone using Rayleigh Wave Tomography**
Funding Source: **Bob Linsley/James McLelland Fund**
Project Summary:

In Southern Alaska, the Pacific tectonic plate is continually forced beneath the North American tectonic plate in a process known as subduction, generating earthquakes and influencing volcanic behavior. Some areas of this region experience larger earthquakes, or different amounts of earthquakes, than others. Using seismic data collected both onshore and offshore in Alaska, we are building a model that allows us to better understand properties of the rock below the surface, which can be helpful in determining causes for these differences in seismic activity across the tectonic border.

Data was collected by 105 broadband land and ocean-bottom seismometers from the Alaska Amphibious Community Seismic Experiment (AACSE), as well as the Alaska Transportable Array and additional regional networks. After tilt and compliance noise corrections for ocean-bottom seismometer stations in ATaCR (Automated Tilt and Compliance Removal), data was compiled and processed in Unix and Seismic Analysis Code (SAC). Data was then filtered and windowed in SEIZMO, a Matlab seismology toolbox, to isolate surface waves from each event for the inversion process. All processed events were compiled on a local server in preparation for two-plane wave inversions to determine Rayleigh wave velocity structure and a second inversion of surface wave dispersion curves to yield three-dimensional shear wave velocities.



Isolation of surface waves using SEIZMO from a magnitude 7.5 event on band 10 (39.6 - 48.4s).

Research Fellow: Sophia Lee-Wlodek (2025) **Concentration:** Biochemistry
Faculty Mentor: Ernie Nolen **Department:** Chemistry
Title of Project: Studies of Oxime Cyclizations to Synthesize a Tn Antigen Mimic
Funding Source: Miller-Cochran Fund
Project Summary:

A significant characteristic of cancer cells is the presence of Tn antigens on their cells' surface which are weakly immunogenic. However, a synthetic Tn antigen mimic that replaces the natural carbon-oxygen bond with a carbon-carbon bond has the potential to be strongly immunogenic which can lead to the development of cancer diagnosis and treatment techniques (Figure 1).

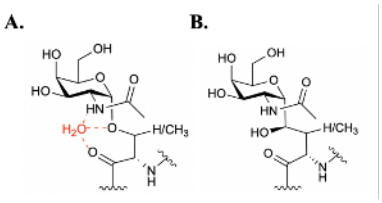


Figure 1. Structures of the Tn antigen (A.) and the Tn antigen mimic (B.).

A crucial step in the synthesis of the Tn antigen mimic is the cyclization of an oxime onto the pendant alkene to make the isoxazoline. To find the most effective methodology for this step, this summer the Nolen lab studied H- and CF_3-terminated oxime cyclizations on a simpler, easier to synthesize oxime in the hope of later applying it to synthesis of the actual Tn antigen mimic.

The H-terminated isoxazoline was produced with a 71% yield after the optimization of procedural steps and the H donor. Due to a hydroxyl byproduct made in early attempts of the experiment the freeze, pump, thaw method was used to eliminate atmospheric oxygen successfully. Additionally, the published procedure used THF as the H donor which was improved upon by using cyclohexadiene which increased percent yields by 130% (Figure 2).

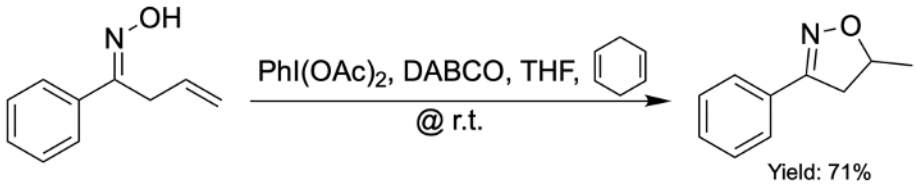


Figure 2. Synthesis of the H-terminated isoxazoline. Percent yield is reported.

The CF3-terminated product was not successfully synthesized, instead the Cl-terminated isoxazoline was made. In the next attempts of this cyclization, new procedures using an electrochemical method or Togni's reagent will be run to make the CF3-terminated isoxazoline.

In the future, we hope to continue running these cyclizations while consistently obtaining high yields so that we can apply the procedure to the oxime cyclization in the synthesis of the Tn antigen mimic.

Research Fellow: Nancy Lei (2026) **Concentrations:** Psychological Science; Computer Science/Mathematics

Faculty Mentor: Ahmet Ay **Departments:** Biology; Mathematics

Title of Project: Nuclei Alignment Detection via Deep Learning and Bioinformatics Algorithm

Funding Source: NASC Division

Project Summary:

The development of the zebrafish body axis is controlled by the segmentation clock during the early stages of embryo growth. In our research, we identified specific alignments in the mid-posterior somitogenesis mesoderm (PSM), which serve as key markers for key stages of this development. Detecting these stages helps us better understand embryonic growth and plays a vital role in improving ecological and environmental studies. Our summer research focused on automating the detection of these alignments by combining deep learning algorithms with bioinformatics techniques. To achieve this, we employed two complementary methods: Convolutional Neural Networks (CNNs) and an Intensity Comparison Algorithm (ICA).

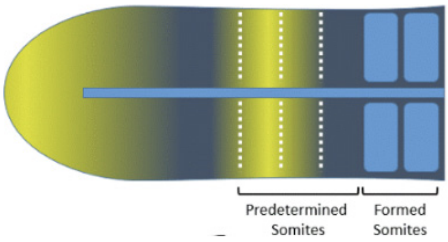


Figure 1. Nuclear alignment and somite formation.

The first method, CNNs, is a deep learning approach commonly used for image recognition and classification. We used CNNs to classify regions of alignment and non-alignment in zebrafish embryonic nuclei images. The images were taken from the middle layers across four z-stacks of the embryonic nuclei and were divided into evenly spaced blocks. Each block measured 128x256 pixels and was labeled as either “Class 1” (alignment) or “Class 0” (non-alignment). After training the CNN model on this labeled data, it achieved an average validation accuracy of 75%, demonstrating its potential as a tool for nuclear alignment detection.

In addition to CNNs, we developed an Intensity Comparison Algorithm (ICA) that leverages the spacing between boundaries during somite formation. The ICA calculates intensity levels within rectangular regions placed at 1000 evenly spaced positions along the central segments of the PSM. By summing these intensity levels and applying selection rules based on the typical size of somites, we identified local minima that indicate nuclear alignment. This method achieved a higher detection accuracy, with an average of 78.4%.

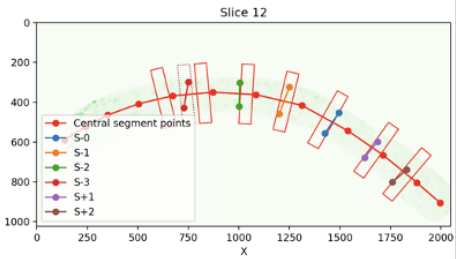


Figure 2. Predicted alignments from ICA.

Although CNNs provide a more comprehensive analysis of alignment features, our research was limited by the small sample size due to the challenges of obtaining zebrafish samples. The ICA we developed complements the CNN by improving both the accuracy and efficiency of nuclear alignment detection in zebrafish embryos. Together, these methods enable a more consistent and reliable identification of critical developmental stages.

Future work will focus on refining the current algorithms by optimizing the CNN architecture and improving the ICA’s selection rules to better capture biological nuances. We also aimed at improving preprocessing techniques and exploring additional deep learning models such as YOLO and EfficientNet to further optimize detection. These advancements will contribute to a more robust toolset for studying vertebrate development and its broader ecological implications.

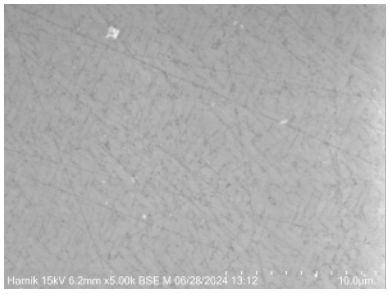
Research Fellows: **Emma Lewis (2025)** — **Concentrations: Biology; French**
Olivia Miller (2027) — **Concentration: Undeclared**
Robert Vanderhoef (2027) — **Concentration: Environmental Studies**
Faculty Mentor: **Paul Harnik** — **Department: Earth and Environmental Geosciences**
Rebecca Metzler — **Department: Physics and Astronomy**

Title of Project: **Marine Bivalve Shell Microstructure**

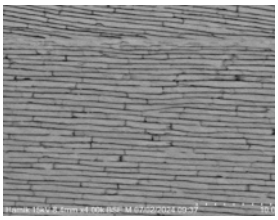
Funding Source: **National Science Foundation Grant; Justus '43 and Jayne Schlichting Student Research Fund**

Project Summary:

Anthropogenic climate change is affecting ecosystems worldwide. In the face of rising temperatures, ocean acidification, and sea level rise, marine organisms must respond to changing conditions while rationing energy. Specifically, calcifying marine organisms may alter their processes of biomineralization to respond to a changing climate. We aimed to analyze how shell microstructure varies according to present-day environmental conditions as a proxy for predicting the effects of future climate change on marine bivalves. We collected samples of marine invertebrates, primarily bivalve mollusks, from locations offshore of Louisiana, Alabama, and Florida. These three regions have varying degrees of primary productivity due to nutrient-rich runoff in the Mississippi River and Mobile Bay watersheds resulting from human activities. The variety in conditions at our sample sites allows us to consider how calcium carbonate crystal pattern, size, and growth rate vary with different environmental factors.



We examined 29 species that we collected in the Gulf of Mexico and investigated their crystalline structure using scanning electron microscopy. We prepared these specimens by embedding them in an epoxy resin and polishing them to expose a cross-section of the internal structure of each shell, which we imaged under high magnification with a scanning electron microscope (SEM). Continuous transects from SEM images acted as a map of the internal shell from which the microstructure could be determined. Most species contained multiple layers of different crystalline arrangements. The large majority of species that we observed exhibited crossed lamellar microstructure, meaning the biomineralized crystals are arranged in two perpendicular orientations.



We studied one genus, *Nucula*, more extensively because of its unique nacre microstructure, which has an appearance similar to that of a brick wall, with layers of nacre tablets (the "bricks") separated by an organic matrix (the "mortar"). The thickness of each nacre tablet was measured for over forty samples. *Nucula* samples analyzed include dead shells from the Gulf of Mexico as well as live-collected specimens from New York, Maine, Easter Island, and off the East coast of Florida. We are now comparing tablet thickness between present-day and historical shells across geographic locations, which allows us to investigate variation in microstructure across a greater breadth of environmental conditions, in particular ocean temperatures.

Imaging more species' microstructures and measuring crystal size will allow us to build a comprehensive microstructure atlas. This will lay the basis for quantitative analysis of how crystal growth rates change with environmental conditions. We would also like to determine if our samples are composed of minerals calcite or aragonite, as aragonite is less stable and more susceptible to ocean acidification. In conjunction with the crystalline structure, we intend to investigate genetic information, ecological data, and phylogenetic relationships among marine bivalves in future research.

[1] Image on the right margin is a crossed-lamellar structure in Nuculana acuta from Louisiana.

[2] Image on the left margin shows nacre tablets of a live-collected Nucula proxima from New York

Research Fellows: **Zach Lightfoot (2026)** **Concentration: Biology**
Eliza Podlas (2025) **Concentration: Biology**
Faculty Mentor: **Ana Jimenez** **Department: Biology**
Title of Project: **Summer phenotype House Sparrows (*Passer domesticus*) demonstrate only tissue-level differences in oxidative stress when acclimated to warm, stable cold, and unpredictable cold thermal treatments**
Funding Source: **NASC Division**
Project Summary:

With climate change increasing not just mean temperatures but the frequency of cold snaps and heat waves, animals occupying thermally variable areas may be faced with thermal conditions for which they are not prepared. Studies of physiological adaptations of temperate resident birds to such thermal variability are largely lacking in the literature. To address this gap, we acclimated summer-phenotype house sparrows (*Passer domesticus*) to stable warm, stable cold, and fluctuating cold temperatures. We then measured several metrics of the oxidative stress (OS) system, including enzymatic and non-enzymatic antioxidants and lipid oxidative damage, in brain (post-mitotic), kidney (mitotic), liver (mitotic) and pectoralis muscle (post-mitotic). For most antioxidant measurements, that is, enzymatic activity of catalase (CAT), glutathione peroxidase (GPx), concentration of superoxide dismutase (SOD) and scavenging capacity for peroxyl radicals, we found significant differences across tissues, but no significant differences between thermal treatment groups. Additionally, we found no differences in lipid oxidative damage across tissues or thermal treatments. Thus, our data suggest that ROS production is not associated with metabolic flexibility, as we found no differences across thermal treatment groups.

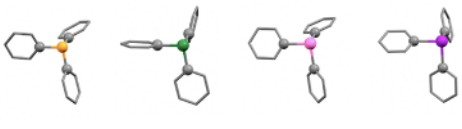
Research Fellow: Faye Liu (2026) **Concentration:** Chemistry

Faculty Mentor: Gongfang Hu **Department:** Chemistry

Title of Project: Synthesis of T-Shaped Bismuth Complexes for Catalytic Applications

Funding Source: NASC Division

Project Summary:



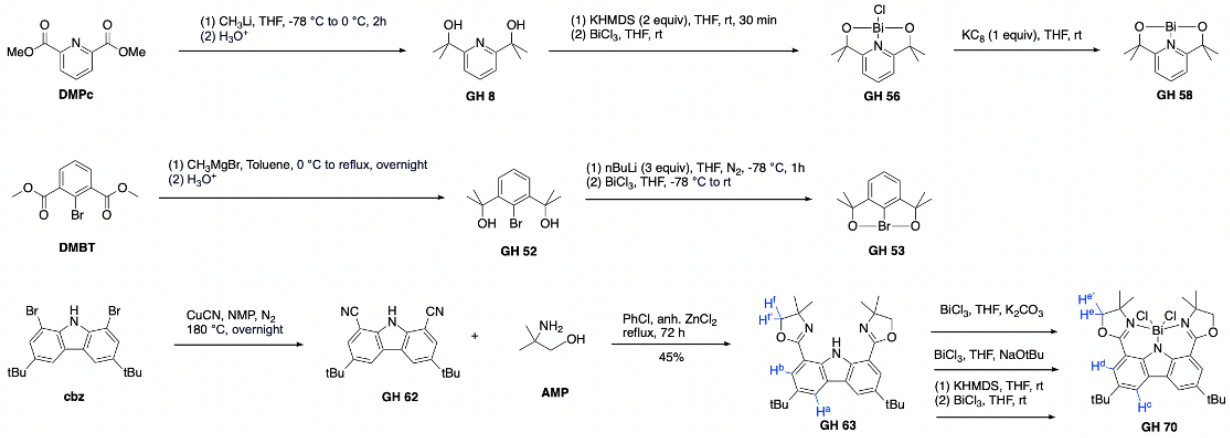
	PPH_3	$AsPH_3$	$SbPH_3$	$BiPH_3$
<(C-Pn-C)	102.7°	100.4°	96.6°	93.7°
d_{Pn-C} (Å)	1.93	1.96	2.15	2.25
E_{inv} (PnH_3) (kcal/mol)	35.1	39.2	43.9	63.1

Introduction

Bismuth is the heaviest non-radioactive and non-toxic element and is very cost-effective. Based on VSEPR theory, Bi should have a trigonal pyramid structure with three bonds. Experiment observation shows that the C–Pn(Pnictogen)–C angle gets closer to 90° when getting lower in the period table. (Pn = Pnictogen, Group 15 elements) The bond angle of C–Bi–C is 93.7° indicating that Bi uses three 6p orbitals directly to make bonds with the other three atoms without hybridization. The goal of this project is to synthesize three sets of T-shaped bismuth compounds.

Synthesis

In the pursuit of synthesizing various T-shaped compounds, three distinct variants were developed, each exhibiting unique structural and chemical characteristics. GH58 features alkoxide wingtips, and central to its structure is a dianionic ONO ligand with five-membered bismacycles. GH53 incorporates a trianionic OCO ligand. GH70 contains imine wingtips with six-membered bismacycle, and oxazoline provides potential chirality to the structure.



Conclusion

Different synthesizing methods were conducted and we found that all of the filtrate products tend to polymerize to give insoluble materials. To solve this, we can make the ligand bulkier by adding steric groups to R1 and R2.

Research Fellow: Tiffany Liu (2025) **Concentration:** Sociology
Faculty Mentor: Carolyn Hsu **Department:** Sociology & Anthropology
Title of Project: The Chinese Social Credit System: Analysis of State Media
Funding Source: SOSC Division
Project Summary:

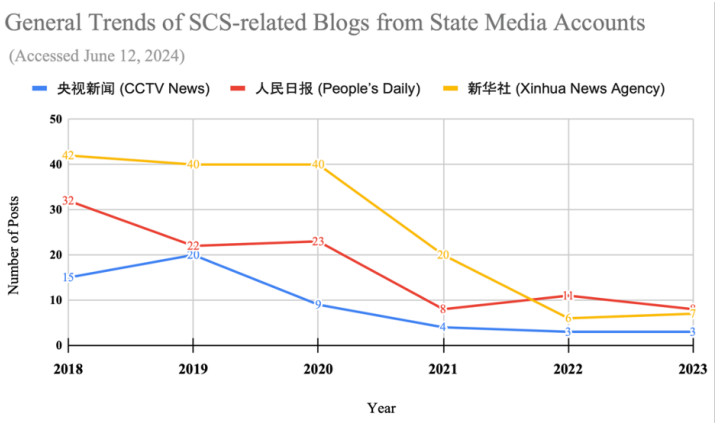
This study investigates how the Chinese government uses social media to implement the Social Credit System (SCS) in 2024. This study also examines SCS information that the state is disseminating in terms of persuading and gaining support/acceptance from society. The SCS is a unified numeric system that evaluates the idea of "trustworthiness" for the entire society based on information sharing between government institutions. Since its first appearance in the 2014 Chinese State Council announcement, SCS received global criticism for its implied power of state surveillance. According to the state timeline, the SCS would fully function in 2020. However, mixed evidence in 2024 questioned the definite implementation of a nationwide SCS in China (Hasmath et al., 2024). Articles about SCS rarely studied propaganda methods in popular social media platforms. Therefore, the purpose of this study was to investigate the Chinese state's current intentions through the analysis of state media. We conducted content analysis on SCS-related blogs posted by 3 state-owned Weibo (famous Chinese social media) accounts between 2018 and 2023. The collected data for each account is based on multiple keywords related to the Chinese term "信用 trust". The coding process was conducted in MAXQDA.

The discussion of SCS from state media accounts drastically decreased by around ¼ in 2023. This may imply that social media is not the major platform for SCS-related news dissemination to the public. Our results could also imply the Chinese state is no longer interested in SCS implementation but aiming for a revised version of surveillance based on national blacklists and financial credit systems. Overall, the discussion of SCS is primarily through problematizing behaviors to demonstrate its power of surveillance. Instead of clearly describing the evaluation and quantification of social credits, the state media accounts placed more emphasis on unilateral penalties. All accounts utilize a uniform phraseology and similar vocabulary for SCS-related blog posts, which is more evident in positive propaganda content. Blogs with negative propaganda appear most frequently to demonstrate the degree of punishment. Financially dishonest individuals are deliberately highlighted, blacklisted, and targeted for the promotion of SCS.

Works Cited

Hasmath, Reza, Timothy Hildebrandt, Carolyn L. Hsu, Jennifer Y. J. Hsu, and Jessica C. Teets. 2024. Civic Participation in China Survey, 2024. Retrieved July 25, 2024 (https://www.civicparticipationchina.com/).

Table



Research Fellow: Bill Luo (2026)
Faculty Mentor: Kiko Galvez
Concentrations: Physics; Applied Math
Department: Physics and Astronomy

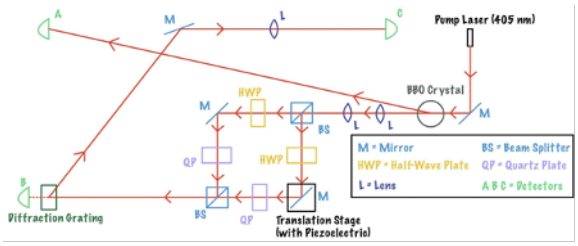
Title of Project: A New Quantum Eraser

Funding Source: National Science Foundation Grant

Project Summary:

Introduction: Last summer, I tested a new method of distinguishing light using time delays. When light is distinguishable, there is no interference. But when light is indistinguishable, there is an interference pattern. This summer, I am continuing my investigation into quantum distinguishability by attempting to observe light from an energy perspective rather than a time perspective.

Theory: Light travels at almost maximum speed through free space (in air). But we can slow down light by passing it through a medium depending on the medium's index of refraction. Moreover, white light—light that comes from common everyday objects—is unpolarized, but we can polarize it by propagating it through a filter, or polarizer, which absorbs the light depending on its orientation. Birefringence combines these two ideas. The light that passes through birefringent material will be refracted by different amounts depending on their polarization, thus creating a delay between light between the vertically polarized and horizontally polarized components. In our apparatus, we used birefringent quartz to incorporate this concept.



Apparatus: We sent a beam of down-converted photons through a Mach-Zehnder Interferometer setup. Detector A is the idler, which measures the total count of photons being downconverted. The 50-50 beam splitters allow equal amounts of light to pass through each arm, and there are half-wave plates (HWP) and quartz plates (QP) placed symmetrically along each arm. After the Mach-Zehnder, we placed a diffraction grating on a rotating mount as a spectrometer. Lenses were placed at specific distances along the path to allow the beam to expand and focus to increase the resolution of the beam. We rotated the diffraction grating, which caused different angles of the diffracted beam to be focused on Detector C, thereby measuring counts over different wavelengths.

Experiment: We collected data with our apparatus by rotating the diffraction grating within a range of 0o to 90o from normal. First, we took a scan with both arms of the interferometer identical. We expected to see a main peak with small fringes at the apex in our data. Second, we took a scan with the QP at 90o in one arm, creating a time delay in one of the arms. We expected to see larger fringes with the shape of the main peak enveloping the fringes. Thus far, our current data does not match our expectations, and we are investigating the data that we have taken to further our understanding of the results.

Research Fellow: **Paul Lynch (2025)** **Concentrations:** **German; International Relations**

Faculty Mentor: **Edward (Ed) Fogarty** **Department:** **Political Science**

Title of Project: **Migration Integration and the Rise of Germany's Far Right: Failed Policy or Unfortunate Circumstances**

Funding Source: **Lampert Institute for Civic and Global Affairs**

Project Summary:

Immigration has long been a difficult area of policy. Least of all in Germany where immigration again has been one of the main areas of criticism for the ascendant far-right party Alternative for Germany. My research delves into the complex issue of migration integration and under which circumstances it elicits a negative response from the native population in the form of support for anti-migration populist platforms. There are a variety of situational characteristics that can influence the situation, not limited to the gender composition and skill level of the immigrant population. However, my research found that it was unemployment in the native population that appeared to correlate with higher rates of support for far-right parties. This paired with the paradoxical fact that anti-migratory sentiments were highest in regions of Germany with comparatively low levels of immigrants. My final policy recommendation is that the German government needs to pursue policies to lower unemployment in regions where far-right parties poll well.

Research Fellow: Sayed Shafaat Mahmud (2026) **Concentration:** Astronomy/Physics
Faculty Mentor: Cosmin Ilie **Department:** Physics and Astronomy
Title of Project: Using Monte Carlo Methods to Detect Dark Star Candidates Based on JWST Spectra
Funding Source: Justus '43 and Jayne Schlichting Student Research Fund
Project Summary:

Dark Stars, hypothesized to have formed during the cosmic dawn era, are unique stellar objects that utilize dark matter annihilation as their primary source of energy against gravitational collapse. These stars can reach immense sizes, and shine as bright as a galaxy. As such, they can be the precursors to the many observed supermassive black holes at high redshift, which remains an open question in Astronomy.

In this study we investigate the detection of dark star candidates in the early universe by applying Monte Carlo methods to spectroscopic data from the James Webb Space Telescope (JWST). Simulated spectra of dark stars formed via adiabatic contraction (AC) were compared with observed data from four high-redshift galaxy candidates: JADES-GS-z11, JADES-GS-z13, JADES-GS-z14-0, and JADES-GS-z14-1. By close agreement with the spectroscopic redshifts of these objects and comparing them to our simulations, we identified best-fit models that suggest the presence of supermassive dark stars (SMDS).

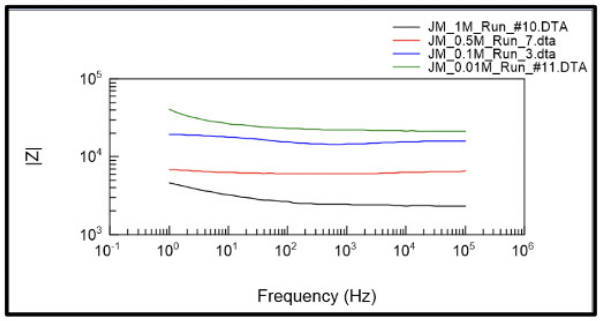
For JADES-GS-z14-0, we found a strong fit to a dark star model with a mass of $1.67\times10^6 M_\odot$ at a redshift of $z=14.44\pm0.1$, including a potential He1640 absorption line, further supporting the dark star hypothesis. Similarly, JADES-GS-z11 and JADES-GS-z13 were fitted with dark star models at redshifts $z=11.37\pm0.05$ and $z=13.17\pm0.05$, with corresponding masses of $6.37\times10^5 M_\odot$ and $4\times10^5 M_\odot$ respectively. We also examined JADES-GS-z14-1, which displayed distinct characteristics at $z=13.9$. These results demonstrate the potential of combining JWST spectroscopic data with Monte Carlo simulations to identify dark star candidates in the early universe. The identification of possible He1640 absorption lines in multiple galaxy candidates suggests a promising alternative dark star explanation, providing new insights into their formation and the astrophysical conditions of the early universe. In the figures below we show the best fit of JADES-GS-z14-0 as a dark star candidate.

Research Fellow: **Jai Mangal (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Ramesh Adhikari** **Department:** **Physics and Astronomy**
Title of Project: **Leaves as a Bio-based Substrate for Electrochemical Sensing**
Funding Source: **National Science Foundation Grant/NASC Division**
Project Summary:

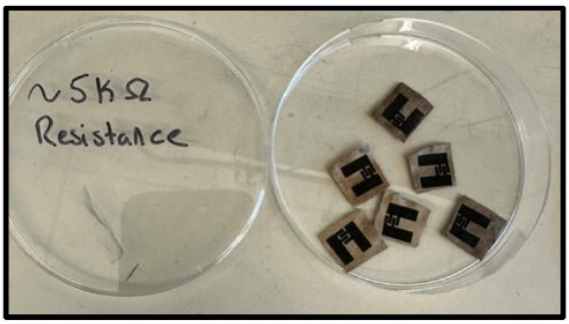
As the modern world constantly evolves and envelopes new technologies, we see a growing need to tackle challenges concerning electronic waste. To help minimize the dangers of e-waste to our environment, efforts have been made to produce more sustainable electronic materials. Utilizing leaves has been a point of interest in these new developments, specifically for their great durability in environmental settings due to their robust vein structure and hydrophobic qualities. Here, we show how common leaves, such as *Quercus imbricaria*, or "shingle oak," can be used as a suitable substrate for sensing capabilities.

We first tested sensing capabilities using carbon paint. Carbon paint was applied using a standard paintbrush in a two-probe design pattern. Afterward, electrochemical impedance spectroscopy (EIS) was successfully conducted as a means for sensing various concentrations of NaOH solutions. Through the results of the EIS data, this model can be used to identify various concentrations of analytes in different environmental settings.

To further investigate the utility of the 'shingle oak' leaves, we implemented a new technique of electrode manufacturing, laser-induced graphene (LIG). LIG is a process whereupon a CO2 laser scribe converts organic polymers, in our case, the lignin contained in leaves, into porous graphene structures that are conductive. The CO2 laser was thoroughly calibrated to very carefully create these graphene layers on the leaves such that a simple 2-electrode design is created on the leaf's surface.



Electrochemical impedance spectroscopy data for sensing NaOH in various concentrations. Molarity is as follows: 0.01 M (green), 0.1 M (blue), 0.5 M (red), 1 M (black).



Laser-Induced Graphene electrodes on *quercus imbricaria*.

In this work, we have successfully shown that the *Quercus imbricaria* can be utilized as a suitable substrate for sensing capabilities. We have also demonstrated an effective way to create LIG as a means of electrode construction directly on the top of the leaves. These results highlight the versatility and future potential of minimizing e-waste via leaf substrates.

In the future, we hope to optimize LIG functionality on leaves to develop more complex devices, notably, a supercapacitor, which will only need to be supplemented with an electrolyte solution. We also intend to better optimize LIG such that surface resistances are more effectively reduced to allow for a wider range of use cases.

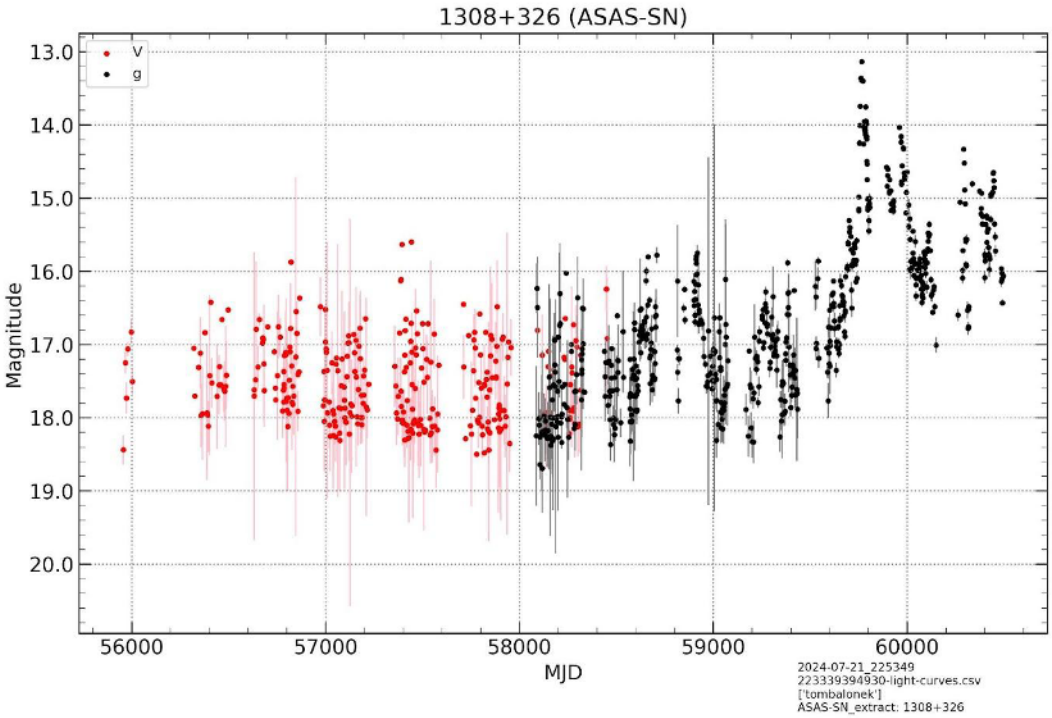
Research Fellows: Aurora Markwell (2025) — **Concentrations:** Astronomy/Physics; Music
Chris O'Connell (2025) — **Concentration:** Astrogeophysics
Faculty Mentor: Thomas Balonek — **Department:** Physics and Astronomy

Title of Project: ASAS-SN as a Replacement for ATLAS for Studying Quasars

Funding Source: NASA New York Space Grant; NASC Division

Project Summary:

Over the course of this summer, we used the ASAS-SN database to collect data in an effort to see if it can be used for long term monitoring of quasars. Quasars are active galaxies that possess a jet in the center of them created by the falling of material into the galaxy's central blackhole. Their brightness varies as more or less material falls in. Originally intended for use with supernovae, the ASAS-SN database has allowed us to collect data on objects that we have worked with in the past and create light curves, a graph of brightness over time. We found that these light curves were significantly better than those we had made last summer through our work with the ATLAS database. In order to create these light curves, we had to use Python programs to manipulate the data. This was done through a code that I initially wrote and then Professor Balonek added on to. Eventually, a code was created that would graph the two filters that ASAS-SN has and convert one to the other so we have more overall data. In addition to this, we are still working on using other data we possess such as the flux values so that we can exclude bad data points and later run statistical tests on the data.



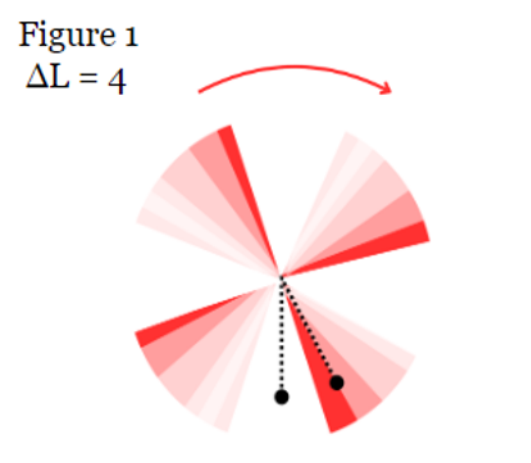
Research Fellow: **Priya Martin (2024)** **Concentrations:** **Psychology; Philosophy**
Faculty Mentor: **Bruce Moseley** **Department:** **Upstate Institute**
Title of Project: **Telling the Story of the Earlville Opera House**
Funding Source: **Upstate Institute**
Project Summary:

The Earlville Opera House was founded in 1972 as a not-for-profit, volunteer-based, community service organization. The EOH's mission is to enrich the Central New York community through the visual and performing arts while preserving its historic building – a unique second-story theater that was constructed in 1892. The EOH promotes the arts in rural Central New York by offering programs of cultural, educational, and historical significance, all while preserving and restoring the architectural and historic integrity of the opera house.

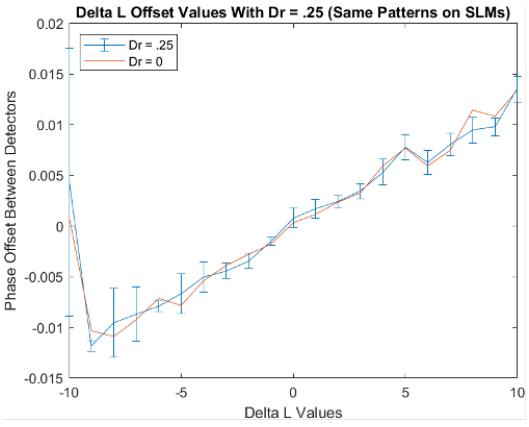
My research project was to summarize the recent history of the EOH into an up-to-date pamphlet. An informational pamphlet about the EOH already existed (created by Rose Wellman in 2005), but its contents did not reach the present day. My task was to edit and update the original pamphlet, extending it by about 45 years. This updated pamphlet could then be displayed in the EOH merchandise section of the opera house and offered for sale to opera house attendees who may be interested in learning more about the EOH's history. Thus, this pamphlet would enrich EOH patrons' understanding, appreciation, and enthusiasm for the opera house, all while contributing to merchandise sales, helping make future EOH events possible.

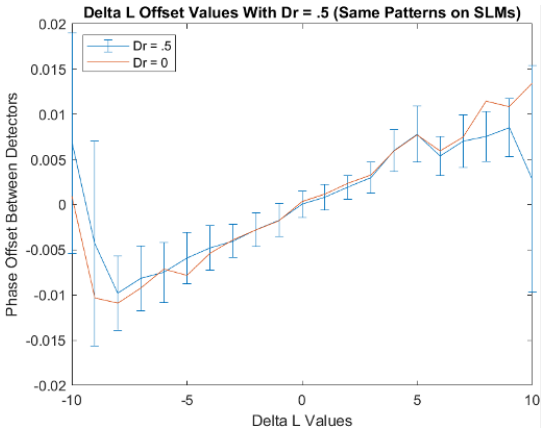
To create the new pamphlet, I combed through historical documents – mainly newspaper articles – that detailed the recent history of the EOH. Countless documents have been saved over the years. I am grateful for the previous EOH historians that made that effort, enabling me to do this work in the present day. For weeks, I dove into the depths of the opera house's immense history, digitizing many of the wrinkled old photographs and dusty newspaper articles in their storage. In this way, I created a sort of archive or timeline of the visual artists and musicians that have graced the EOH galleries and stage over the years. I then added the data I had collected on the opera house's recent past into the original pamphlet.

Research Fellow: Eli Mayes (2026) **Concentration:** Physics
Faculty Mentor: Kiko Galvez **Department:** Physics and Astronomy
Title of Project: Free Space Communications With Rotating Beams
Funding Source: National Science Foundation Grant
Project Summary:



Today, most digital communication utilizes radio waves as a medium for communication. However, radio waves expand a great deal after leaving their source. This is very useful in certain circumstances, as it allows for many listeners; however, when it comes to covert communications, the use of radio waves that propagate in all directions is a major disadvantage because messages can be intercepted by unintended listeners. In order to eliminate this issue, one can encode information into a beam of light and send a message in a singular direction, creating a non-interceptable message. We have previously demonstrated that it is possible to encode information in rotating Poincaré Beams. In order to encode information this way, we give each ΔL (the number of maximums in the beam) value some significance and then by measuring the intensity at 2 points of the beam we are able to determine which ΔL was sent thus allowing us to determine the message (Figure 1). Our current investigation is to study the effects of turbulence on these patterns and the effectiveness of transmission through simulated turbulent mediums. Preliminary results have shown that at lower levels of turbulence our methods of encoding remain effective. In figure 2, with minimal amounts of turbulence, the offset values remain similar with the expected values. Whereas in figure 3, although the mean offset remains consistent, we begin to see a larger margin of error. The next steps are to begin increasing the turbulence.



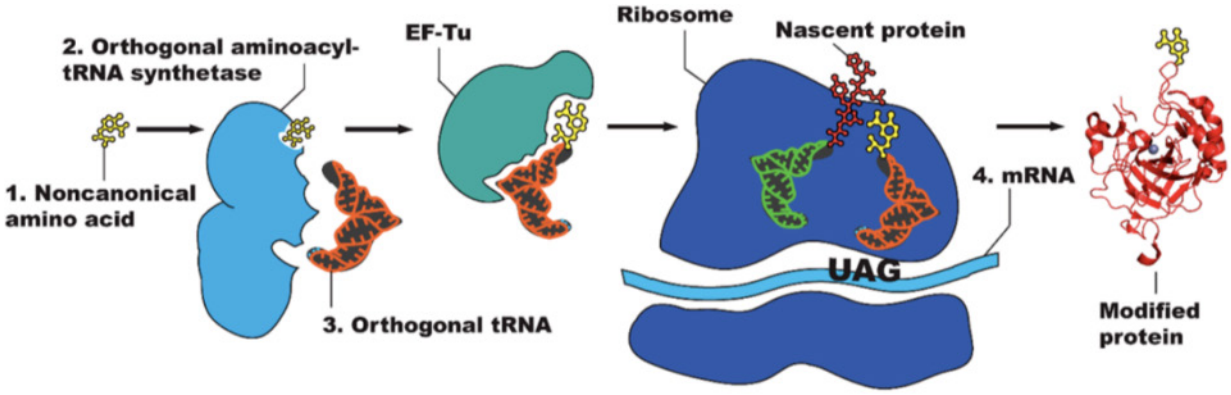


Research Fellows: **Liam McCarthy (2026)** **Concentration: Biochemistry**
Jason Mrosla (2027) **Concentration: Biochemistry**
Brian Pallares (2026) **Concentration: Biochemistry**
Faculty Mentor: **Jacob Goldberg** **Department: Chemistry**
Title of Project: **Incorporation of Fluorinated Amino Acids into Proteins**
Funding Source: **Mind, Brain and Behavior Scholars Award; Michael J. Wolk '60 Heart Foundation; NASC Division**

Project Summary:

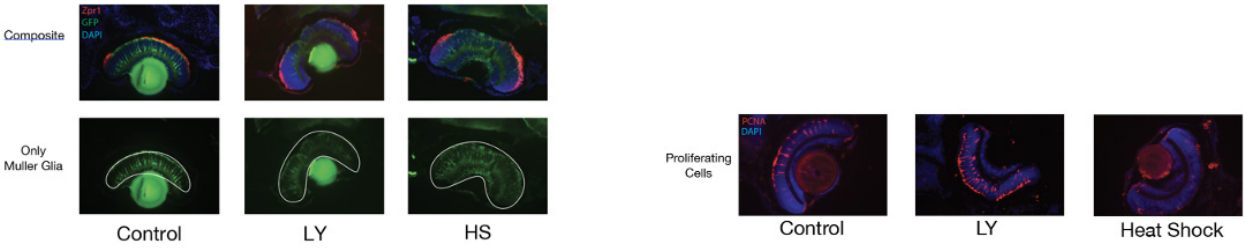
The goal of our research was to incorporate the unnatural amino acid 4-difluoromethylphenylalanine (dfmF) into proteins. This unnatural amino acid contains fluorine, making it suitable for 19F-NMR, a diagnostic tool that allows for the determination of structural changes in proteins and ligand binding. The incorporation of dfmF into proteins and subsequent 19F-NMR detection has potential applications in medicinal chemistry research, specifically for monitoring protein conformational changes through observation of the chemical shifts of the particular protein. The goal for our research this summer was to expand our library of unnatural amino acid containing proteins.

Our laboratory incorporates non-canonical amino acids using genetic code expansion techniques. The technique uses transformed E. Coli with mutated tRNA synthetase originating from an archean, *M. Janaschii*, to pair a tRNA molecule with the corresponding fluorinated amino acid during protein expression for incorporation into a desired protein. Using the previously engineered tRNA and tRNA synthetase pair which is specifically evolved for 4-trifluoromethylphenylalanine (tfmF), we successfully incorporated dfmF into two proteins, carbonic anhydrase (CA) and superfolder green fluorescent protein (sfGFP), in two different positions in each protein. Using SDS-Page gel electrophoresis, we confirmed the expression and purification of these unnatural amino acid containing proteins.



Research Fellow: **Trey McDermott (2025)** **Concentrations:** **Neuroscience; Philosophy**
Faculty Mentor: **Jason Meyers** **Departments:** **Biology; Neuroscience**
Title of Project: **Top-Notch Regeneration in Zebrafish Retinas**
Funding Source: **NASC Division**
Project Summary:

Unlike humans, zebrafish can regenerate extensive retinal damage, a process that holds potential for developing treatments for certain types of blindness. This regenerative capacity is largely driven by Müller Glia (MG) cells, which, upon retinal damage, re-enter the cell cycle, becoming proliferative precursor cells that differentiate to replace lost retinal neurons. The molecular mechanisms regulating this process, particularly the role of Notch signaling, are still not fully understood. Notch signaling has been implicated in promoting precursor cell differentiation into MG during retinal regeneration. My research aimed to confirm this role by modulating Notch signaling activity. At 7 days post-fertilization, zebrafish larvae retinas were lesioned using high-intensity light and subsequently treated with either DMSO (control), LY411575 (LY, a Notch inhibitor), or subjected to heat shock to activate the Notch intracellular domain (NICD) in transgenic fish. Tissue was then collected and stained to visualize the effects of these treatments on cell proliferation and differentiation. Inhibition of Notch signaling with LY resulted in fewer Müller Glia and an increase in proliferating cells compared to the control group, whereas Notch activation through NICD expression had the opposite effect. These results suggest that Notch signaling directs precursor cells to differentiate into MG, replenishing the population lost during early stages of regeneration. Ongoing research will explore the interaction between Notch and Wnt signaling, which is known to promote cell proliferation. Experiments modulating both pathways simultaneously are underway, and additional data will be required to understand their combined roles in retinal regeneration.



a) b)

Figure 1

a) Photoreceptors are stained red (the absence of red on the retina indicates photoreceptor damage); MG are stained green. The number of MG decreases when Notch is inhibited (LY) and increases when Notch is hyper-activated. Nuclei are stained blue.

b) Proliferating cells are stained red. LY increases the number of proliferating cells and Heat shock decreases it. Nuclei are stained blue.

Research Fellow: Flynn McGrath (2026) **Concentration:** Physics

Faculty Mentor: Jonathan Levine **Department:** Physics and Astronomy

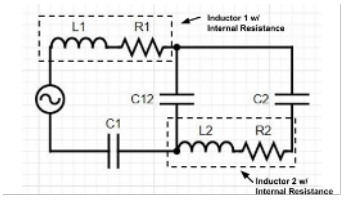
Title of Project: Investigations of Fano Resonances in Atomic, Mechanical, and Electrical Systems

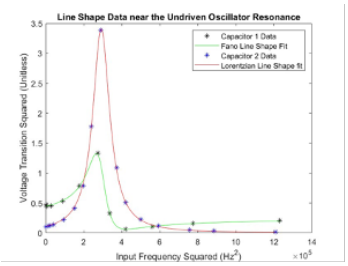
Funding Source: Justus '43 and Jayne Schlichting Student Research Fund

Project Summary:

Ugo Fano derived the equation describing the behavior of the resonances that now bear his name when working on autoionization [1]. Autoionization occurs in multielectron atoms when multiple electrons are excited to a bound state with total energy large enough such that transferring the energy to just one of the electrons would eject that electron from the atom, ionizing it. Fano's equation describes the probability of ionization from an initial state through an autoionizing state as a function of the energy (or frequency, equivalently) of the light that induces the transition – the line shape. The equation captures the characteristic asymmetry of autoionizing transitions, which arises from the quantum interference of two paths from the initial state to the final ionized state at the same energy level as the autoionizing state: the incident light can directly ionize the atom, or the light can excite the atom into the autoionizing state, which then decays – because of interactions between the multiple excited electrons in this state – into the ionized state.

My introduction to Fano resonances this summer came in the study of autoionization as a method of efficiently ionizing strontium for use in mass spectrometry. I sought to test the viability of this method by mathematically simulating ionization through an autoionizing state. However, rather than reproducing the interference effects that produce the Fano line shape, my simulation simply made use of the Fano equation to describe the probability of ionization as a function of laser frequency. Therefore, at the suggestion of Professor Levine, I began to study a classical Fano resonance in order to gain a better understanding of the origin of the Fano line shape after finishing the simulation. Iizawa et al. [2] have shown that the Fano line shape can be mathematically derived – albeit approximately – from the coupled driven oscillator problem whose electrical analog is the circuit pictured in the bottom left. In the coupled oscillator problem, the lineshape is the amplitude of the response of the oscillator as a function of the driving frequency squared. I constructed the circuit analog as a tool to help my analysis of the problem, and I found that the same had been done in [3]. However, Ahmed [3] measured the voltage across resistor 1 as the dependent variable for the line shape, while I measured the voltage across capacitor 1 because it is analogous to the oscillator that exhibits the Fano resonance in the mechanical coupled oscillator. My data shows a Fano line shape in agreement with the predictions of Iizawa et al. [2], and it also shows a Lorentzian line shape in the response of capacitor 2 – the undriven oscillator. These data were taken near the resonance of the undriven oscillator, so it is interesting to see that the coupling only slightly shifts and widens the line shape of the undriven oscillator, while the driven oscillator gets a Fano line shape. The investigation of the classical Fano resonance demonstrates the importance of the swift phase shift of a resonant response around the resonant energy for the creation of a Fano lineshape – both classical oscillators and atomic transitions exhibit swift phase shifts about their resonances, and in both cases the coupling of oscillators with this phase behavior results in the Fano line shape.





Left: Circuit diagram of the electrical coupled oscillator problem. Right: Data from the circuit fit to the Fano equation (green curve) and Lorentzian equation (red curve).

[1] Fano, U. (1961). Effects of Configuration Interaction on Intensities and Phase Shifts. Physical Review, 124(6), 1866–1878. https://doi.org/10.1103/PhysRev.124.1866

[2] Iizawa, M., Kosugi, S., Koike, F., & Azuma, Y. (2021). The quantum and classical Fano parameter q. Physica Scripta, 96(5), 055401. https://doi.org/10.1088/1402-4896/abe580

[3]Ahmed, T. (2012). Classical Analogy of Fano Interference [Harish-Chandra Research Institute]. https://wwwth.mpp.mpg.de/members/taushif/pdf/Classical%20Analogy%20of%20Fano%20Interference_NISER_Prof%20Mohapatra.pdf

Research Fellow: Corey McLaughlin (2024) **Concentration: Environmental Economics**
Faculty Mentor: Bruce Moseley **Department: Upstate Institute**
Title of Project: Capacity-Building and Strategic Planning for The Bell Tree
Funding Source: Upstate Institute
Project Summary:

I spent this summer at The Bell Tree, Inc. in Earlville, a nonprofit that provides a safe space for community members where children can play, learn, and socialize. My tasks included organizing their files on Google Drive, revising their bylaws, and establishing stricter roles of the Board of Directors. I also created and conducted surveys to collect data from their patrons. The surveys record anonymous responses about what participants would like to see from The Bell Tree in the near future, whether that be afterschool programs, more days for playing, or programs from organizations outside of Earlville. I developed a strategic plan based on the survey responses that will guide the organization to expand their capacities while following an agenda that will help them better serve the community.

Surveys were administered throughout the month of July during The Bell Tree's free lunch program that runs Monday through Friday. Most patrons at free lunch also attend open play days throughout the year. Frequent visitors use The Bell Tree's space for birthday parties and other special occasions. The majority of survey respondents were women due to the fact that most of the children visiting The Bell Tree are accompanied by their mothers, grandmothers, or other female guardians. There were only a few male family members within the survey sample. The sample is small, most likely due to the lower attendance rates seen during the summer seasons. I created the surveys in the organization's Google Drive so the Board of Directors can continue to collect data into the fall and winter seasons.

The outcome of my project is a three-year strategic plan that offers ways of expanding and improving The Bell Tree's services and programs. For the remainder of the year, the Board of Directors will use the plan to stay on track with their goals: The Bell Tree wishes to become more environmentally-friendly while renovating the building and adopting programs in which both children and adults within the region can benefit. This may be through free meals, a safe environment for stimulating creativity, or access to local educational programs from organizations such as the Roger's Center in Sherburne. The Bell Tree will be focusing on developing the structure of its governance by organizing board members' responsibilities and expanding the number of volunteers for the upcoming year. In 2025, the nonprofit will apply for grants in collaboration with the Partnership for Community Development (PCD) and the Empire State Development (ESD) regional office in Syracuse. By 2027, The Bell Tree aims to have a usable commercial kitchen in the building's basement in which several local organizations of Upstate NY can rent out for different purposes.

Spending my last summer with the Summer Field School was a great way to wrap up my Colgate experience. The people I met through this program have become close friends in such a short amount of time. Both my advisors at the Upstate Institute and my coworkers at The Bell Tree are wonderful people that I will miss dearly. While I start my career beyond Colgate, I will continue to reflect on these amazing experiences and the knowledge that I'll carry with me into my future work with nonprofits. Not only do I have a better grasp on the life cycle of nonprofit organizations, but I also feel more prepared for the world that lies outside Colgate's campus. There is much more work to be done across the communities within Hamilton, Earlville, Sherburne, and other towns in the region. Community-based research has taught me that real change happens when everyone is involved and all voices are heard. I hope to visit The Bell Tree during a Colgate Reunion Weekend and see how much the nonprofit has improved over the years.

Research Fellow: Owen McMorrow (2026) **Concentrations:** Geology; Environmental Geography
Faculty Mentor: Aubreya Adams **Department:** Earth and Environmental Geosciences
Title of Project: Deep Earth Imaging of the Alaskan Subduction Zone
Funding Source: Hackett-Rathmell 1968 Memorial Fund
Project Summary:

According to recent studies, the Alaskan subduction zone experiences varying degrees of built up stress along its length as the Pacific plate is subducted below the surface. This has materialized as a noticeable difference in the locations and timing of great earthquakes (8.0 or greater) along the subduction zone, ultimately leading to new theories suggesting the hydration of the subducting plate dramatically impacting the characteristics of subduction in localized regions. Overall, the parallel or perpendicular geometry of long dead oceanic rifts along the surface of the Pacific plate may allow for varying amounts of hydration in the subducting plate, shaping the nature of the subduction of the Pacific plate in separate regions along the length of the trench. Prior to this summer research experience, earthquake data had been collected from the Alaskan peninsula and is currently being used to map the velocity of earthquake waves along the subduction zone, ultimately determining the amount of hydration in the subducting material. In order to identify these seismic velocities, procured earthquake data required multiple stages of manipulation and filtering before calculations could be performed.

This specific summer research experience focused on the Rayleigh wave, a unique surface wave produced by earthquakes that travels horizontally relative to the surface of the earth. Firstly, the seismograms derived from the raw earthquake data required filtering in order to remove seismograms that displayed no data, waveforms of too high or low magnitudes, or extremely poor data. Following this step, a Matlab program was utilized to manually window the remaining seismograms, specifically windowing around the Rayleigh wave in order to identify this waveform for further analysis. Although these further steps were not conducted during this specific summer experience, the identified Rayleigh waves will be used to derive an inversion of wave velocities. Thus, a map will be produced displaying the seismic velocities at each period of the waveforms for each point of latitude and longitude as a geographic representation overlaying Alaska. Ultimately, determining the seismic velocities at each period will allow for the comparison of velocity with wave depth below the surface. As theory suggests, hydrated material produces varying seismic velocities as compared with less hydrated subducting material, which will be determined from this relationship between velocity and depth. Throughout this data processing, multiple Linux codes were written in order to copy over data, prime data for use in Matlab, or to remove data from certain seismic stations. As someone with limited computer science knowledge prior to this experience, I feel that this aspect of the project was one of the greatest learning opportunities for myself. Encountering Linux coding and Matlab programs challenged my ability to understand computer code and programming language, and was extremely rewarding in being able to complete these tasks through problem solving. Overall, I feel that this was an unfiltered lens through which to understand the research process that takes place in the field of seismology, requiring a multitude of data manipulation in order to process earthquake data in an efficient and meaningful manner.

Research Fellow: Ned Meisel (2026) **Concentration:** Political Science
Faculty Mentor: Danielle Lupton **Department:** Political Science
Title of Project: Threat Construction During Crises: How Leaders Justify Coercion
Funding Source: SOSC Division
Project Summary:

When researching the act of threat justification within international politics, I explored the ways the construction and content of political threats can influence their credibility. My objective was to identify a relationship between how political actors justify threats and the impact of that justification on their effectiveness. Understanding the objectives and purposes behind threats is crucial for assessing their credibility, as a well-justified threat can enhance the coercer's credibility. More specifically, I focused on how political leaders justified compellent threats, which demand a material change in the status quo, rather than deterrent ones. Compellent threats are acts of coercion to get an actor to change their behavior through threats of force or even the use of limited force. Focusing solely on compellent threats, I extensively researched Todd S. Sechser's dataset of 210 militarized compellent threat episodes (MCTs) from the end of World War One in 1918 to 2001, inquiring how varying threat justifications influenced political leaders' credibility. During my examination of these episodes, I considered several factors that could influence the credibility of threats, such as specificity, severity, delivery, and rhetoric, to interpret how each was justified. Was the leader justifying their threat to protect their allies, defend their territory or citizens, or claim historical ties to a location?

Focusing on Sechser's dataset, I began by collecting extensive information and details to construct a comprehensive picture of the threat episode. This approach allowed me to later go back to the episode to refine my analysis and seek additional insights as needed. I started by examining the most recent militarized compellent threat, known as MCT 210 and worked backwards from there. This would enable me and the other research assistant, who began at MCT 1, to collaborate effectively and review each other's work. Beginning with a wide and inclusive net, I went through each MCT evaluating how the threat was made, the demands and consequences it had, the venue from which it was declared, and eventually how it was justified. For example MCT-206 which was the US and UK threat to Iraq in 1998, the consequences that Iraq would bear would be the backlash for defying the UN, and the militarization of US and UK forces. In MCT-168 which was the US threat to Iran to release the US personnel being held hostage at the embassy in Tehran, the threat was a justified attempt to protect its citizens and to also defend US international sovereignty.

Going through all of the Militarized Compellent Episodes starting in 2001 and working backwards, I noted the remarkable variety in threats, each deeply rooted in its historical context. This led me to focus on how these threats were communicated and framed to enhance their credibility and effectiveness. My findings indicate that no single coercive technique guarantees a threat's persuasiveness in every instance. However, I observed that threats involving the reputation or protection of citizens, territory, or a state's sovereignty often appeared more credible and had a greater impact in compelling opponents to comply.

Research Fellow: **Aby Metellus (2025)** **Concentrations:** **Women's Studies; English**
Faculty Mentor: **Rachel Amann-Burns** **Department:** **Upstate Institute**
Title of Project: **My Summer with Young Scholars**
Funding Source: **Upstate Institute**
Project Summary:

This summer, I had the privilege of working with the Young Scholars program located at Utica University.. I worked in the office observing day to day operations from 9 to 5, researching the advantages of internships for high school students. This project led me to getting more involved in the community and truly delving into the greater New York area, opening my eyes to what I didn't know. I interviewed past alums about their internships and the skills they gained as a result of the experience, and also asked about what this program meant to them.

The Young Scholars Liberty Partnership Program was founded in 1993 through a collaborative effort between Utica University and the Utica City School District. The Program was created to address the low high school graduation rates and to encourage students to pursue higher education. Specifically, the program was born out of a need to provide low-to-moderate income students with d social guidance through academic enrichment. Thete organization has now expanded into middle school, accepting incoming 7th graders and following them until graduation and sometimes beyond. The program is beautifully run and designed, providing internships to high school scholars and encouraging active community building all over the city in addition to providing student support within the middle and high schools. Students in this program have the opportunity to go to Utica University with financial support through the Utica Promise. Young Scholars Liberty Partnership Program provides a plethora of resources to shape the young minds of Utica.

By conducting interviews with various Utica-based partners and former Young Scholars, I was able to see the administrative side of education and to explore the Utica area and get to know the diverse people that call the city home. My research consisted of 10-20 minute interviews with a number of small businesses in Utica that have hosted Young Scholar's interns over the years. It was clear through these interviews what a huge impact the internship program has had not only on the interns themselves, but also on the businesses and business owners. Interviewees were full of praise and gratitude towards Young Scholars and the interns themselves, while also highlighting the intergenerational acceptance and collaboration that were a result of the internships. Many partners of Y.S. commented on how the ideas and understanding of Generation Z that came from the internship assisted in providing a pathway to expanding their clientele to younger groups while also delivering a stronger connection to the Utica community. Likewise, numerous former interns have commented on the internship process and how they were able to develop their communication and organizational skills because they were working in offices or elsewhere. The value of the Young Scholars program is tied to creating a community where students are able to thrive and grow soft skills at an early age, which impacts their lives as they grow. I was fortunate to be able to witness and record what has been cultivated for over 30 years.

By working with the Young Scholars Liberty Partnership Program, I've confirmed some of my own personal interests such as wanting to work with and protect children and women. While I'm not too keen on working in an office setting, the environment was very lighthearted and the Young Scholars team worked together to overcome intermittent moments of chaos. Despite this being my first time interacting with this organization, it was very nostalgic to speak with everyone and to realize how similar this program is to the ones of my past. I really connected with the focus of the organization: developing and supporting the minds of low-to-moderate income students.I joined the Upstate Institute because I wanted to be more community-oriented outside of Colgate and the village of Hamilton. Being in Utica has opened my eyes to the possibilities of the Mohawk Valley and upstate New York as a whole. This has been a fantastic opportunity that has shown me the importance of cultivating young minds regionally.

Research Fellows: **Ariza Meza (2027)** **Concentration: Undeclared**
Sahana Savarkar (2026) **Concentration: Applied Math**
Faculty Mentor: **Will Cipolli** **Department: Mathematics**
Title of Project: **Data Science Collaboratory Project**
Funding Source: **NASC Division**
Project Summary:

A defining factor of our work this summer was making the R Shiny apps available through the Data Science Collaboratory more comprehensive and consistent to the layperson while also finding and fixing bugs. We were dedicated to carefully assessing the inner workings of the apps, understanding how they relate to each other, and subsequently identifying errors and inconsistencies across the apps. This work has significantly improved the user experience, making the apps more user-friendly and error-free.

To find errors, we carefully and repeatedly evaluated the apps by exploring every aspect of their functionality under all possible conditions (e.g., missing data, small samples, etc.). For example, we tested the "Summarize Data" almost every week, and each week, we would open a new ticket pertaining to that app outlining necessary bug fixes or enhancements. Also, because this app also provided a framework for the more complex apps, any changes made to it would have to be propagated across other apps to ensure consistency.

After familiarizing ourselves with existing apps, we contributed to the development of a new app for testing independence between categorical variables (the Chi-Squared Test for Independence). This test is often used in social sciences and medical research, and the app provides a more accessible way to work with and analyze categorical relationships.

Our work on the apps has significantly transformed user experience, making it more intuitive and consistent. The impact of these changes on user experience is palpable, and we are proud of the improvements we have made.

Research Fellow: **Maddox Miller (2027)** **Concentration: Undeclared**
Faculty Mentor: **Mike Loranty** **Departments: Geography; Environmental Studies**
Title of Project: **Beaver Dam Presence Before and After Fires in Alaska's Boreal Forest Streams**
Funding Source: **National Science Foundation Grant**
Project Summary:

Beavers are ecosystem engineers. They alter the surrounding land to make a more suitable living habitat, building dams and lodges from trees they felled and collected. The formation of a beaver pond occurs when a dam almost entirely stops the flow of a stream and the runoff water expands outwards. These distinct features of beaver occupied regions can be clearly identified on a map using satellite imagery. After reading research articles written by today's top beaver scientists, and even meeting some of them in person, I found a topic to research that complemented the current ongoing research. I set out to quantify the number of beaver dams in small stream segments before and after a fire ravaged the boreal forest surrounding them. Beaver dams are thought to be havens in which animals can take shelter during a fire. Beavers are also thought to be attracted to burned areas where it is easy to build dams with an excess of new tree and shrub growth. My research was aimed at providing more data to possibly support these two claims.

I began my project by looking at megafires, which are loosely classified as having a burned area of 100,000+ acres, and mapping every dam within these areas using the National Hydrography Dataset Streamlines and an Alaska Fire Perimeter feature layer using ESRI's Geographic Information System (GIS) software. The criterion used to select fires was that they occurred five years apart. I had intended to look at the density of dams within each fire in order to conduct a time-based analysis comparing the density over time. I was surprised to learn, however, that the base map, or world satellite imagery displayed on the GIS software, was not entirely from the same year. Rather it was a patchwork of images, some having been taken over ten years apart. This made conducting a strictly time based analysis of beaver habitation impossible.

NAME	STREAM LENGTH (K)	DAMS BEFORE	DAMS AFTER	PERCENT CHANGE
Aggie Creek	2.781546			
Aggie Creek	6.529664			
Aggie Creek	2.839295			
Aggie Creek	1.309795			
		16	26	62.50%
Deepbank Creek	1.259			
Deepbank Creek	0.341			
Deepbank Creek	0.14			
Deepbank Creek	1.586			
Deepbank Creek	3.76			
		12	27	125.00%
Why Lake	4.517			
Why Lake	0.833672			
		6	12	100.00%
Baker	7.675			
Baker	1.322			
Baker	1.384			
Baker	0.796			
		5	6	20.00%

ESRI has an online archive of all their past versions of base maps called Imagery Wayback in which you can find the year a specific image was taken. Instead of looking at the number of beaver dams as a function of time after fire as I had been doing, I shifted focus to counting the difference in beaver dams before and after fires by using individual satellite images from the Imagery Wayback. I began by selecting stream segments from much smaller fires in areas that looked like they would be suitable for beaver activity based on vegetation and geography. These segments were small-ranging from .3-7.6km in length. Then I checked to make sure there was a singular clear satellite image from before and after the fire occurred for all these stream segments. Finally, I mapped the beaver dams using the line tool. It turns out that features such as downed trees and arctic beaded streams, which form from permafrost thaw, can very closely resemble beaver dams in lower resolution imagery. Therefore, I accounted for some of this uncertainty by rating each perceived dam on a confidence scale from one to three. A dam rated one could possibly just be a log blocking water flow that resembled a dam, whereas a three would certainly be an actual dam.

For the four fires and fifteen stream segments I mapped, I found each to have a significant increase in beaver dams after the fire. In one fire, the number of dams even doubled (Figure 1.) The post-fire imagery was taken between five and seven years after the fires occurred for all of the stream segments. This raises the question of how quickly beavers recolonize land after it burns. My next steps are to continue mapping fires in order to draw more definitive conclusions about beaver dams counts before and after fires, and to have others in my lab map these same segments to examine how our recognition of beaver dams differs.

Research Fellow: **Bailey Misken (2024)** **Concentration:** **History**
Faculty Mentor: **Dionne Bailey** **Department:** **History**
Title of Project: **"Daughters of Jim Crow's Injustice": African American Women, Mass Incarceration, and the Business of Black Women's Bodies at Parchman Penal Farm**
Funding Source: **SOSC Division**
Project Summary:

Mississippi's Parchman Penitentiary is the site of untold terrors, inhumane treatments, and forced labor. This notorious maximum-security prison opened in 1901 with 18,000 acres of land. While Parchman Penitentiary currently houses only men, for about 85 years, Parchman held young girls and women in its camps. Unfortunately, history has left the stories of these incarcerated young girls and women in Parchman untold, until now.

For eight weeks this summer, I worked as a research fellow for Professor T. Dionne Bailey as she researched and wrote her book, "Daughters of Jim Crow's Injustice": African American Women, Mass Incarceration, and the Business of Black Women's Bodies at Parchman Penal Farm, 1980-1980. This book not only furthers the history of Mass Incarceration, but this book also gives voices to the African American girls and women who have historically been silenced in the history of Mass Incarceration.

Professor Bailey, Amanda DeSantis, and I traveled to Mississippi to conduct essential archival research. We had the opportunity to visit two archives: The University of Mississippi Department of Archives and Special Collections in Oxford, MS, and at the Mississippi Department of Archives and History in Jackson, MS. While conducting archival research, we combed through various collections concerning the topics of civil rights, incarceration, voting, Freedom Riders, and segregation. Each box in a collection consisted of folders, each housing hundreds of sheets of paper. Our job was to read through each paper to find anything that would uncover the untold stories of the African American girls and women who were incarcerated in the most notorious prison in the country. Through this research, Professor Bailey, Amanda, and I worked to give these girls and women a voice in history.

End to Parchman cotton favored

By DIAL PARROTT, Special Writer

SCHLATER—State Sen. Corbett Patridge, vice chairman of the Senate Agriculture Committee, favors taking the state penitentiary at Parchman out of cotton farming. Instead Patridge would engage its 1,200 inmates in what he terms the more profitable enterprises of swine, beef and vegetable farming.

To maximize the farm's revenue-producing potential, Patridge recommends leasing out all of the prison's land with the exception of 2,500 acres where the three new enterprises would be conducted.

Patridge said that his proposal was based on two main factors, the current low financial yield of cotton production and the possibility that the U.S. Congress may put a $20,000 ceiling on federal payments to any one farm participating in soil conservation programs. Last year the state prison farm received $314,580 for not producing cotton and corn on its 15,000 acres. Thus, it stands to lose almost $300,000 in revenue if the Senate-passed measure is favorably received by the House.

'Few people who live in cities, even in the Delta, realize what a serious condition cotton farming is in. . .'

Patridge said he believes that the state could make more money from a consolidated farming operation without cotton as well as provide a better rehabilitation program for the inmates with the increased revenues.

"Cotton has gotten to be a dead crop," he said. "Few people who live in cities, even in the Delta, realize what a serious condition cotton farming is in." Parchman's 1969 revenue from cotton dropped $1 million from the previous year.

Patridge said he favors using the increased revenues to finance an upgraded vocational rehabilitation program. He was the author of the bill which led to the establishment of the initial program for 200 inmates in 1968.

"I can't see what the state has to gain by making a man pick cotton in the spring and chop cotton in the fall. He comes out ten years behind the free world, and he hasn't learned a thing," Patridge said.

Patridge sponsored a bill in the last session which died in committee. It would have leased all of Parchman's 15,000 acres to private farmers with the exception of 640 acres. The bill also proposed to consolidate inmate living quarters into a central compound. He has modified that original proposal.

"I talked to Tom Cook and some federal penal officials, and they told me that they thought consolidation into a central compound would be detrimental," Patridge said.

Cook, prison superintendent, has said that the transformation from 18 individual living camps for the inmates into one central dormitory structure "would be the worst thing you could do for the state of Mississippi." Cook said that although the present small-unit living arrangement was once thought outmoded, it is today considered the most progressive system.

Patridge says that a prison with about six camps spread over 2,500 acres might be best. This would allow enough land to support a profitable vegetable, beef and swine operation, he said.

Patridge also suggested the possibility of canning the produce at the prison. He envisioned providing canned goods to all state institutions at cost plus 15 per cent.

"By doing this we would not be competing with any existing industry in the state," he said. In the past, Cook has also suggested the merits of a canning operation.

Research Fellow: Ernie Nelson (2025) **Concentration:** Peace and Conflict Studies

Faculty Mentor: Teo Ballvé **Department:** Peace and Conflict Studies

Title of Project: The Anti-Trans Regime: An Apparatus of Queer Hate in Texas

Funding Source: UNST Division

Project Summary:

From 2021-2023 the Texas Legislature proposed 84 bills targeting transgender individuals' healthcare, legal recognition, and representation in education and sports. Six of these bills passed along with a governor's order, making Texas a hostile environment for trans youth and adults. This research examines the systems of power between these bills, anti-trans hate groups, and violence against transgender and queer communities in Texas. The anti-trans apparatus is a system of interconnected articulations in response to the problematization of 'transgender'. These responses take many forms in legislation, guides and statements from right-wing hate groups, media, and in physical and corporeal spaces with the effect of pathologizing transgender people and legitimizing overt and covert forms of violence towards them.

The Human Rights Campaign reports that 34 transgender people have been killed in Texas since 2013, finding that nationally 10% of all victims are from Texas, with 11 in Houston alone. While the state doesn't sanction physical violence against trans people directly, the legislation being debated and passed supports the destruction of transgender people as a social group. In Texas there is an executive order that makes supporting a trans kid's medical care child abuse (Opinion No. KP-0401) and a law that makes it illegal for physicians to administer any gender-affirming care or procedures, "for the purpose of transitioning a child's biological sex", describing them as surgeries "that sterilizes the child," and "drugs that induce transient or permanent infertility"; it also revokes the license of anyone who violates this (SB14). Other laws, such as SB12, criminalize public expressions of gender diversity by making it illegal to "[use] accessories or prosthetics that exaggerate male or female sexual characteristics" in the presence of children, posing a threat to any trans person in public. Conscience laws further enable direct violence by allowing medical professionals to refuse medical care based on moral beliefs. These legislative measures contribute to the migration and endangerment of trans people in Texas. The 2023 US National Trans Survey reports that nearly half (47%) of their 84,170 trans adult respondents considered moving to another state due to discriminatory laws, with Texas being one of the top ten states from which respondents moved.

Through coding the 84 bills, an executive order, and guides and statements from anti-lgbt hate groups for moments of justifications or "science" and moments of erasure, this research argues that Texas's anti-trans legislation seeks to eliminate transgender people by criminalizing their visibility, medical decisions, and access to infrastructure. Other themes coded in the bills include: child abuse, sexually inappropriate, eugenics themes, enabling outing, binary sex definitions, parental rights, and exempting intersex individuals from these laws. The rhetoric employed by the anti-trans regime pathologizes trans existence and pushes for assimilation into a traditional sex binary, thereby rhetorically erasing their existence. State-sanctioned laws legitimize the violence occurring in Texas and seek to erase transgender identities systemically. This study aims to shed light on the intricate relationship between legislative actions and the structural and physical violence they enable, offering a nuanced understanding of the anti-trans political movement in Texas.

Research Fellow: **Shadana Nepal (2026)** **Concentration:** **Physics**

Faculty Mentor: **Cosmin Ilie** **Department:** **Physics and Astronomy**

Title of Project: **Dark Stars: Searching for Dark Star candidates using Nelder Mead Algorithm**

Funding Source: **NASC Division**

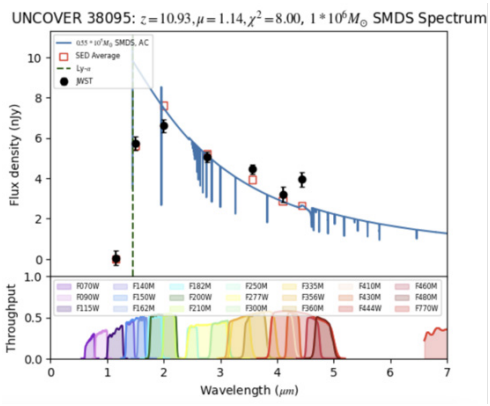
Project Summary:

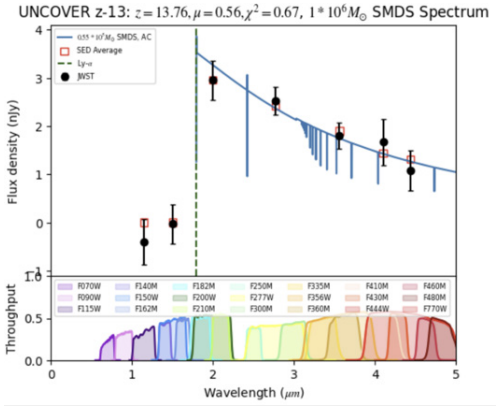
The first stars after the Big Bang are still a mystery. Our team is trying to uncover this mystery by looking for Dark Stars. Dark Stars are made with hydrogen and helium but are essentially powered by dark matter annihilation. These super massive Dark Stars could have been the early seeds for super massive black holes. JWST has identified many objects in the universe with high redshifts and three of the objects were previously identified as possible Dark Star candidates: JADES-GS-z13-0, JADES-GS-z12-0, and JADES-GS-z11-0. Our goal for this summer was to identify more candidates from other various survey missions.

The first few weeks, I focused on looking through more JWST data and identifying other objects with redshift greater than 8. Once that data was collected, I passed it through a set of codes that were created using the Nelder Mead algorithm, which output a graph and the very important values we were looking for. Towards the end of the summer, I also looked at the UNCOVER survey and followed a similar process. The data I examined was purely photometric. After the graph was created I looked at values such as mass, the radius, μ , the photometric redshift, and the chi square value to make sure each object was within the parameters. All of the objects were unresolved objects and were consistent with being point objects.

From the UNCOVER catalog, I was able to narrow the search to two really good candidates: UNCOVER-z11 and UNCOVER-z13. Both these objects were from the second UNCOVER data release and they both had a μ value of greater than 0.5, which is the scaling factor for the stars. We found an additional candidate from JWST: JADES 130158 which has a z spec of 11.62 and z phot of 11.67. Going forward, I would like to obtain the spectroscopic data for these objects and examine that through a finer mass grid to confirm that these are good candidates.

Name	Dat. Rel.	CAM ID	SPEC ID	z_{spec}	z_{phot}	RA	DEC	Refs
UNCOVER-z11	UNCOVER DR2	38095		10.22	10.56	3.59011	-30.35974	Catalog
UNCOVER-z13	UNCOVER DR2	14019		12.908	12.95	3.57087	-30.401585	Catalog





UNCOVER 38095: Using Nelder-Mead as an optimization algorithm, the best fitting parameters for this SED as SMDS has a mass of 10^6 solar masses with a redshift of 10.93, lensed with 1.14. The vertical drop is the Lyman alpha absorption line.

UNCOVER z-13: Using Nelder-Mead as an optimization algorithm, the best fitting parameters for this SED as SMDS has a mass of 10^6 solar masses with a redshift of 13.76, lensed with 0.56. The vertical drop is the Lyman alpha absorption line.

Research Fellow: **Zachary O'Donnell (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Amy Leventer** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Biogeography of Ross Sea Diatoms**
Funding Source: **Doug Rankin '53 Endowment - Geology Research**
Project Summary:

My research this summer focused on working with samples of Antarctic diatoms and mapping the biogeographical factors in which they are found. Diatoms are fossilized phytoplankton, single celled primary producers, with a shell of glass around them. There are many species of diatoms that all indicate characteristics of the climate in which they are found. My research focused on plankton that were found in the Southern Ocean off of the coast of Antarctica, specifically in the Ross Sea.

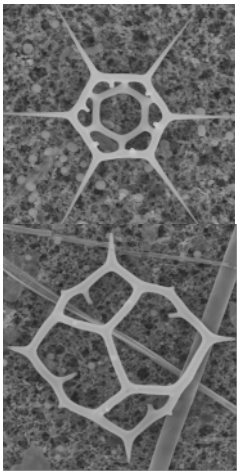


Figure 1. Six sided *Stephanocha speculum* (top) and a four sided *Stephanocha fibula* (bottom)

In the late austral summer of 2024, Professor Leventer collected surface water samples during a research cruise to the Ross Sea, Antarctica. My research focused on analyzing the phytoplankton assemblages on the filtered water samples. I looked at these samples using the Scanning Electron Microscope (SEM) to photograph and identify the diatoms and other microplankton. The other aspect of my research included making maps of the physical and chemical characteristics of the upper ocean during NBP2403 cruise to understand the controls on biogeographic distribution of phytoplankton. This was accomplished using Ocean Data View (ODV) software which allowed me to compare species distributions to oceanographic variables including sea surface temperature, salinity, transmittence, fluorescence, and CO_2 concentration.

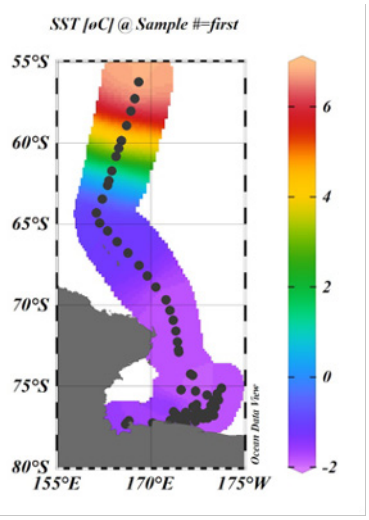


Figure 2. A contour map of the sea surface temperature (SST) as recorded on the NBP2403 cruise.

Microplankton that I specifically kept track of were silicoflagellates, coccolithophores, and diatoms. Silicoflagellates with different numbers of sides live at different ocean surface temperatures. The species *Stephanocha speculum* (six sided) were present in temperatures below 4°C, and the species *Stephanocha fibula* (four sided) were present only when the sea surface temperature was above 4°C. I also tracked the presence/absence of coccolithophores, phytoplankton with a calcium carbonate shell. They are found in warmer waters, which are less acidic. Cooler waters, that hold more CO_2, are more corrosive. Coccoliths were present only from 55°-60° S, where sea surface temperatures were warmer than 4°C. Finally, in samples from the southern part of the transit, in waters colder than 0 C, an increased abundance of the sea ice-associated species *Fragilariopsis curta* and *Fragilariopsis ritscheri*, was observed.

Research Fellow: **Chidinma Okafor (2025)** **Concentration:** **Neuroscience**
Faculty Mentor: **Rachel Amann-Burns** **Department:** **Upstate Institute**
Title of Project: **Tackling Youth Substance Use: Data Compilation with BRiDGES**
Funding Source: **Upstate Institute**
Project Summary:

This summer, I had the opportunity to work with BRiDGES, the Madison County Council on Alcoholism and Substance Abuse, Inc. (MCCASA). Established in 1985, BRiDGES is dedicated to addressing substance abuse through community education and advocacy. They offer various programs focused on alcohol and drug use prevention, problem gambling, tobacco control, and mental health services in Madison, Oneida, and Herkimer counties. My Fellowship focused on gathering and analyzing data to help BRiDGES develop an Evidence-Based Program (EBP) aimed at addressing youth substance use in Madison County.

Youth substance use is a growing concern in Madison County, and effective prevention requires a deep understanding of the factors contributing to it. Over the course of my Fellowship, I collected data from multiple sources, including the Madison County TAP survey, the New York State Youth Risk Behavior Survey, and community surveys on alcohol and marijuana use. This data was categorized into four key areas: consequences, consumption, risk factors, and protective factors.

Key findings from this research highlighted several important trends: In 2018, 42% of surveyed students (7th-12th grade) reported consuming alcohol, which decreased to 33% in 2022. While most youth understood the risks of alcohol consumption, 20% felt they lacked support from their school or community regarding substance abuse concerns. High availability of alcohol, cannabis, and vaping products among both youth and adults has contributed to increased substance use in the community.

The goal of this project was to identify service gaps and develop an actionable needs assessment that BRiDGES can use to create an EBP for local schools. My analysis uncovered critical areas where prevention efforts could be strengthened, particularly in offering more comprehensive support to students and increasing awareness of available resources. Although the implementation phase will continue after my Fellowship, my work has provided a solid foundation for developing targeted interventions and submitting the data to the New York State Office of Addiction Supports and Services (OASAS) registry.

Research Fellow: Robert Ozerdem (2026) **Concentration:** Chemistry
Faculty Mentor: Gongfang Hu **Department:** Chemistry
Title of Project: Synthesis of a Planar Bismuth Complex as a Potential Catalyst
Funding Source: NASC Division
Project Summary:

Transition metal catalysis has been at the forefront of organic and organometallic chemistry for over fifty years. These catalysts allow for some of the most important reactions in modern chemistry, such as Suzuki coupling and Olefin metathesis. Many of the elements used in these types of reactions, however, such as palladium and ruthenium, have problems. They are expensive and very toxic. We wanted to look into using less explored main-group metals such as bismuth, which is both cheaper and safer than transition metal catalysts, and find out what kind of chemistry it could do. Finding new ways to use safer complexes to do redox chemistry is an important field not only for advancing chemistry, but also for being able to sustain it in the future. We want to make different group 15 metal complexes and test their catalytic abilities in electrochemical systems. More specifically, we want to make planar main-group metal complexes and explore their chemistry.

We want to synthesize planar pnictogen complexes to use in electrochemical systems. Group 15 elements generally prefer to be in a trigonal pyramidal geometry, seen in compounds like ammonia and phosphine. With ligands that can coordinate to our metal centers, however, we can make complexes that are more similar to t-shaped molecules that are planar. This strained position of the metal center raises the HOMO (highest occupied molecular orbital), and thus lowers the HOMO-LUMO (lowest unoccupied molecular orbital) gap. This new energy difference can allow for easier electron transfers and more effective electrocatalysis. The synthesis of our proposed complex was challenging, however, as there were lots of reactions needed to reach our desired product GH46 (Figure 1). The first step of this synthesis was particularly challenging, as we were only able to get a 22% yield for the first step while following literature procedures (Figure 2).

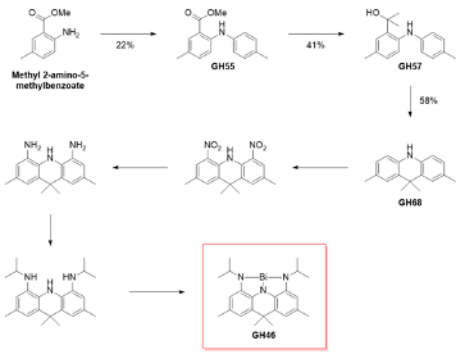
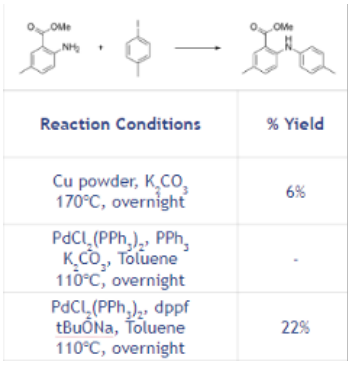


Figure 1: Synthesis scheme of GH46.



Reaction Conditions	% Yield
Cu powder, K_2CO_3 170°C, overnight	6%
$PdCl_2(PPh_3)_2$, PPh_3 K_2CO_3, Toluene 110°C, overnight	-
$PdCl_2(PPh_3)_2$, dppf tBuONa, Toluene 110°C, overnight	22%

Figure 2: Yield of GH55 under different conditions.

We are looking to experiment with more efficient and reliable syntheses to create new complexes using bismuth, as well as antimony.

Research Fellow: Robert Payne (2027) **Concentration:** Political Science
Faculty Mentor: Danielle Lupton **Department:** Political Science
Title of Project: Threat Construction During Crises: How Leaders Justify Coercion
Funding Source: SOSC Division
Project Summary:

Over the Summer, ten weeks were spent working on a project focused on figuring out how countries threaten each other and the justifications behind every threat. Most of the threats I looked at were involved in some sort of international conflict or war, and all of the threats that I did research for were compellent threats, meaning they were threats made to change the status quo, as opposed to a deterrent threat, which is a threat made in an attempt to maintain the status quo, or prevent some sort of conflict. Of the database that I was assigned to research, all of the threats within it were compellent threats made from one country to another, and occasionally by multiple countries in an attempt to change the status quo.

In 2013, University of Virginia Professor Todd S. Sechser compiled a dataset of military compellent threats, or the MCT dataset. With the dataset created, he intended to research each individual threat and find the narratives, but this next step in his project was never completed. The main goal of this research was to find those narratives. The questions that the project attempted to answer for all 210 threats in the database were "What was the demand made? Was it a general statement or did it delineate specific consequences?"; "How did the issuing state present the demand? Was it made publicly? Privately? Directly by the primary leader?"; "What justifications did they use to explain their threat?"; "How was the threat stated?"; it was also encouraged to find primary sources and a transcript of the direct statement if possible. This task often proved difficult. WIth the dataset going back to 1918, many of the sources and transcripts of threats that were made before World War II proved difficult to find. For the threats that were able to be cataloged, it was often found that the nations threatening each other had long standing conflicts. Most threats from 1918 into the 1930s were remnants of conflicts which had arisen from World War I. Another case of many threats issued back and forth were during the second Sino-Japanese War, when China and Japan issued many threats against each other in the span of a few years in the mid-1930s. These were the threats that proved most difficult to be researched, considering there would be multiple threats issued per year, making it nearly impossible to discern whether or not each threat being researched in a given year qualified for whichever threat was meant to have been researched.

If threats were not the result of a long standing conflict, they were often made by a country who could overpower the recipient of their threat. Italy made many threats against Albania in an attempt to gain access to resources in the country, along with the Allied Powers threatening Germany and Italy in the wake of World War I. These threats were often made jointly by the League of Nations to attempt to demilitarize the countries that had lost the war, therefore changing the status quo as a compellent threat is supposed to do. The most striking part of these threats is the threat of military action against countries which are already at a disadvantage in many ways. In their threats against Germany, Britain and France often delineated aggressive military measures and even coups if the Germans did not comply with their reparation schedule. For a country already in economic ruin because of the war, it was striking to see the Allied Powers acting with such force against a weaker power.

Research Fellow: Neerusha Phuyal (2027) **Concentration:** Undeclared
Faculty Mentor: Anthony Chianese **Department:** Chemistry
Title of Project: Finding New Epoxide Hydrogenolysis Catalysts
Funding Source: NASC Division
Project Summary:

In the pursuit of enhancing chemical sustainability and efficiency, our research under the guidance of Professor Chianese focuses on the optimization of epoxide hydrogenation reactions. This project addresses the critical need to improve the efficiency of chemical processes. By minimizing chemical waste and reducing reliance on expensive and rare catalysts, the research aims to develop a more sustainable and cost-effective approach to chemical synthesis.

The core objective of this project is to refine epoxide hydrogenation processes by either developing new reaction pathways or enhancing existing ones to achieve optimal performance. The fundamental chemistry involves the addition of hydrogen to epoxides, resulting in the replacement of specific carbon-oxygen bonds and the selective formation of desired products. The challenge lies in achieving high selectivity for specific isomers among the various possible products, while using minimal amounts of catalysts.Various catalysts, including Ruthenium (Ru), Iridium (Ir), Manganese (Mn), and specifically RuBPYOH and OMe, were tested to assess their effectiveness. The research involved a comparative analysis of these catalysts, evaluating their performance in terms of activity, selectivity, and efficiency. Initial trials following the procedure outlined in the Papish paper which yielded limited success, prompting adjustments to catalyst ratios and reaction conditions. Despite these efforts, some reactions did not proceed to completion, resulting in by-products.

Among the catalysts investigated, the OMe catalyst showed promising results but required further optimization. A significant breakthrough was achieved with the OH catalyst. The process involved scaling up the reaction, extracting a clean product from the solid gathered, and performing analytical tests such as Nuclear Magnetic Resonance (NMR) and Gas Chromatography (GC). The OH catalyst demonstrated effective catalytic activity, with high purity and satisfactory yields. The crystallization of the catalyst was also explored to assess the quality of the crystals, contributing to a better understanding of the catalyst's properties.

In evaluating different reaction conditions, the research found that varying the concentration of the base and catalyst significantly impacted the results. The most successful conditions were identified as having a base and 0.5% catalyst, which resulted in low catalyst activity but medium branched selectivity and low retention of the product. In conclusion, my work has successfully demonstrated the potential of the OH catalyst for epoxide hydrogenation, highlighting its catalytic activity and efficiency. The research addresses the importance of continuing efforts with the OMe catalyst and exploring new catalysts to further advance the field. The project's contributions offer a step forward in achieving more sustainable and efficient chemical processes, aligning with broader goals of reducing waste and optimizing resource use in chemical synthesis.

Research Fellow: **Mary Thomas Powell (2026)** **Concentrations:** **Biology; Environmental Studies**
Faculty Mentor: **Catherine Cardelús** **Department:** **Upstate Institute**
Title of Project: **How do different soybean varieties perform in New York?**
Funding Source: **Upstate Institute**
Project Summary:

Cornell Cooperative Extension (CCE) provides a variety of important services for local communities including regional agricultural programs, outreach and education, insect pest monitoring, plant variety trials, as well as other agricultural and sustainability-related initiatives. In addition to the county offices located across the state, Cornell Cooperative Extension has five regional Dairy, Livestock, and Field Crop teams. The regional teams offer expert advice to farmers about managing their farms. CCE fills an important gap in the community to ensure that farmers have access to unbiased information about how to manage their crops.

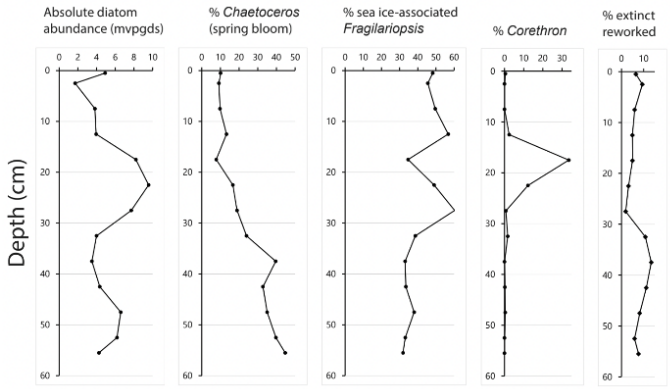
The Central New York Dairy, Livestock, and Field Crop team covers eight counties: Madison, Fulton, Chenango, Herkimer, Montgomery, Otsego, Saratoga, and Schoharie. This summer I worked directly with the Central New York Field Crop specialist, meaning I spent a lot of time conducting fieldwork and farm visits. The fieldwork was primarily centered around insect pest monitoring, a soybean variety trial, and miscellaneous farm visits. We monitored insect pests to inform farmers if pests on their fields were above an economic threshold and if they should spray an insecticide. Preventing unnecessary insecticide spraying saves farmers money and reduces chemicals in the environment. The soybean variety field trial will help inform farmers what soybean varieties produce the most profitable plants, or in other words, the plants with the highest yield and lowest production cost. This research benefits farmers, who often live close to the margins and small price changes can be the difference between making a profit or not. The most important part of the trial is the harvesting that will occur in September after I have left. Harvesting will tell the participating companies what the final yield of each variety was.

Throughout the summer I have also helped with data collection that was sent out in a weekly newsletter to farmers to keep them informed of regional trends. This newsletter included weather reports, crop growth status, and pest levels. Additionally, I helped with data and sample collection for field trials in response to New York's Birds and Bees Act which bans neonicotinoid insecticides.

Research Fellow: **Carolina Quirke (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Amy Leventer** **Department:** **Earth and Environmental Geosciences**
Title of Project: **Diatom-based reconstruction of the Mawson Bank, Ross Sea Antarctica**
Funding Source: **Doug Rankin ’53 Endowment - Geology Research**
Project Summary:

Diatoms, photosynthetic primary producers, are glass-shelled algae. They are informally known as the “grass of the sea”, responsible for 20% of the oxygen we breathe. Their fossil shells are well preserved in Antarctic marine sediments and record the oceanic environment in which they lived, for example, surface water temperature, presence/absence of sea ice, and nutrient concentration. Quantitative analysis of diatom assemblages in sea floor sediment cores is a tool to reconstruct ancient ocean environments. Our knowledge of the past allows a better understanding of changes ahead as the world continues to warm.

Most paleo records in Antarctic sediments are from deep water cores where sediment is relatively undisturbed. This study, in contrast, focused on a core collected from a water depth of 313, from the Mawson Bank in the westernmost Ross Sea. Shallow banks, like the Mawson Bank, serve as pinning points for glacial ice, often the final contact point between the ocean floor and the ice. They are understudied due to their complexity, as bank sediments can be disturbed by current winnowing and deep icebergs. However, they hold the key to understanding the final stage of ice stability before it recedes. The diatom data presented in Figure 1 illustrate diatom abundance and assemblage changes over time. Diatom abundance ranges from 2 - 10 million diatom valves per gram dry sediment. These data indicate that the entire sediment column was deposited under open water conditions, as diatoms are unable to live underneath glacial ice due to the lack of sunlight. Two of the major contributors are species in the genera *Chaetoceros* and *Fragilariopsis*, indicative of spring bloom and sea ice-associated productivity. A distinct peak in *Corethron*, a diatom associated with highly stratified waters, indicates a single-year bloom likely characterized by unusually warm and lower salinity surface waters. Finally, the presence of up to 15% extinct species indicates the occurrence of reworking from older underlying sediments.



Research Fellow: **Leila Ribeiro (2025)** **Concentration:** **Sociology**

Faculty Mentor: **Janel Benson** **Department:** **Sociology & Anthropology**

Title of Project: **Career Development at Selective Liberal Arts Colleges**

Funding Source: **SOSC Division**

Project Summary:

My summer research centered on three complementary projects investigating "Career Development at Selective Liberal Arts Colleges." These projects aim to uncover the nuanced obstacles that low-income first-generation (LIFG) students face at selective liberal arts colleges and universities throughout their academic and career development pathways, both during and after college. Our objective is to strategize and implement improvements in college programming, integrating career development more deeply into the curriculum and support systems to maximize the success and career integration of these students and young adults.

The first project examines post-college transitions for LIFG-origin young adults, leveraging longitudinal data to track their experiences both during college and as they transition into the labor market. This research focuses on the various touch points where LIFG students navigate their academic and career pathways, exploring their use of informal and formal support structures and the impact of these on their career trajectories post-college. Key questions include how formal support structures, such as career services, informal networks like mentorship and peer relationships, and social networks (types, size, and tie strength) influence the career outcomes of LIFG students. All analysis and insights are framed within the context of the "campus geographies" (Benson & Lee 2020) each respondent fits into: (a) work-hard, (b) play-hard, (c) multisphere, and (d) disconnected. Work on this project will continue over the next year.

The second project expands on the first by examining how the unique challenges faced by LIFG young adults have been further exacerbated by the COVID-19 pandemic. However, the data suggests that the root challenges lie in the students' LIFG backgrounds rather than solely the pandemic's impact. This project employs extensive literature reviews and qualitative analysis of long-form interviews using MAXQDA and will also continue into the next year.

The third project focuses on improving the experiences of QuestBridge scholars at its 52 partner universities. This ongoing research employs both qualitative and quantitative methodologies, including data analysis via SPSS and MAXQDA, alongside interviews and outreach to enhance data collection. Work on this project continues throughout the year.

Research Fellow: **Ethan Riggs (2025)** **Concentration: Biochemistry**
Faculty Mentor: **Jenny Peeler** **Department: Chemistry**
Title of Project: **Functional Analysis of SelenoproteinO**
Funding Source: **NASC Division**
Project Summary:

Selenocysteine (Sec) is the 21st naturally occurring amino acid. Proteins that incorporate Sec are classified as selenoproteins. There exist homologs of many selenoproteins that contain a cysteine (Cys) in place of a Sec, but still successfully catalyze the same reaction. Questions remain about the difference in functionality between Cys- and Sec-containing enzymes. Our lab studies selenoproteinO (SelenoO) which contains Sec in humans and Cys in *E. coli*. One of our goals is to analyze the role of the Sec residue in human SelenoO by comparing it to the Cys homolog.

SelenoO functions by catalyzing AMPylation reactions in both humans and *E.coli*. This involves cleaving adenosine triphosphate (ATP) and adding an adenosine monophosphate (AMP) molecule to target proteins. This process protects cells from oxidative stress. We have successfully expressed and purified the Cys-containing E. coli SelenoO protein through recombinant protein expression. We are evaluating enzyme function through a quantitative assay of AMPylation kinetics. Work is currently underway to optimize the assay protocol.

Additionally, our lab is working towards generating Sec-containing human SelenoO in mammalian cells (HEK293) by utilizing genetic code expansion (GCE). GCE is a technique that incorporates non-canonical amino acids, such as Sec, into proteins. We successfully incorporated Sec into a green fluorescent protein (GFP) model in mammalian cells through GCE. Afterward, we advanced to cloning a GFP-SelenoO plasmid and hope to directly integrate Sec into human SelenoO through GCE.

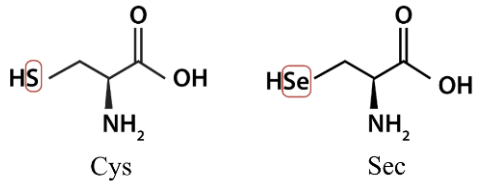


Figure 1: Comparison between the amino acids Cys and Sec.

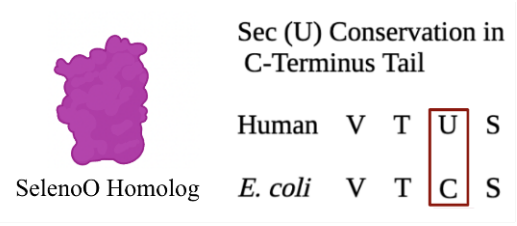
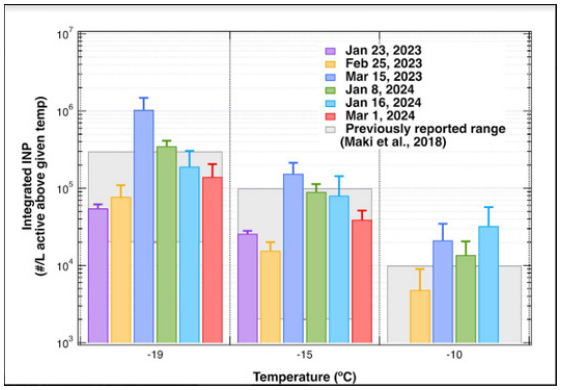


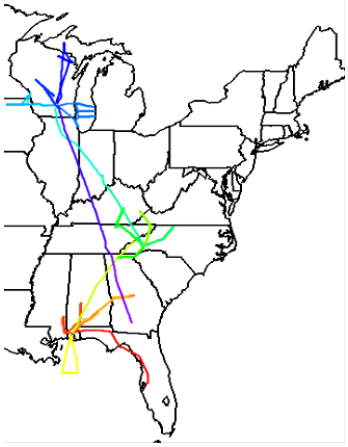
Figure 2: SelenoO is homologous across humans and E. coli but human SelenoO encodes a Sec (U) while bacterial

Research Fellows: **Marina Rizk (2026)** — **Concentration: Chemistry**
Connor Rogers (2027) — **Concentration: Undeclared**
Jeremy Stoll (2027) — **Concentration: Undeclared**
Faculty Mentor: **Anne Perring** — **Department: Chemistry**
Title of Project: **Biological Ice Nuclei**
Funding Source: **Miller-Cochran Fund; NASC Division**
Project Summary:

Water in the atmosphere freezes homogeneously only at temperatures below -35 C°. Freezing at warmer temperatures only occurs in the presence of ice nuclei (IN), particles that facilitate crystallization. Primary Biological Aerosols (PBAs), which include pollen, spores, and bacteria, are unique in their ability to initiate freezing at the warmest temperatures, but there is a paucity of observational data about their atmospheric concentrations. We had two PBA-related projects this summer; one looking at warm temperature IN in snow samples from Hamilton, and the other looking at concentrations of PBA from the ground to 18,000 feet over the Eastern US.

For the IN project, we analyzed a series of snow samples collected between January of 2023 and March of 2024. IN concentrations were determined using a drop-freeze assay on melted samples. To perform an assay, 80-100 2.5 µL drops were placed on a copper plate covered in a thin layer of vaseline using an acid-washed autopipette. The plate was cooled at 1-2°C per minute, while pictures were recorded at defined intervals. A MATLAB interface was then used to manually detect freeze events, and to calculate corresponding IN concentrations. We analyzed 6 snow samples, in triplicate (shown at R), and found that samples from different storms had varying levels of IN activity, while samples from the same storm had similar IN activity, despite being run on different days by different people. We also spent considerable time eliminating background contamination in the measurement and evaluating different campus water sources that might be appropriate for blanks.





For the second project, we analyzed data from a Wide-Band Integrated Bioaerosol Sensor (WIBS), that flew aboard a Twin Otter aircraft in June of 2016. Twenty flights (map at R) covered regions from the southeastern US (not in pollen season) to the midwest (end of pollen season). We examined fluorescent particle concentrations, size, and spectroscopic signature as measured by the WIBS. We found the highest concentrations of fluorescent aerosol at the surface in all locations, with signatures similar to those of bacteria and fungal spores. Contrary to model assumptions, surface concentrations at higher latitudes were comparable to those in the south, and fluorescent aerosol often accounted for ~30% of total supermicron aerosol volume. At high altitudes, we found higher day to day variability in fluorescent concentrations, especially at the northern latitudes, possibly indicating episodic vertical transport of regional aerosol. Above the surface in the north, we saw increased concentrations of pollen-like signals, possibly indicating broad dispersal of sub-pollen particles.

Research Fellow: **Patti Rizzo (2026)** **Concentrations:** **Applied Math; Chemistry**
Faculty Mentor: **Eric Muller** **Department:** **Chemistry**
Title of Project: **Infrared Tip-Enhanced Spectroscopy and Nanoscale Imaging of Polymers**
Funding Source: **NASC Division**
Project Summary:

Polymer mixtures or copolymers can be tuned to create a broad range of structures, with applications to control chemical reactivity, to influence materials properties, or for design of electronic devices. We aim to establish fundamental structure-function relationships through nanoscale imaging at the intrinsic length scales of ordering and through spectroscopic measurements of intermolecular and intramolecular coupling. We focus on observing nanoscale patterning of the block copolymer poly(styrene)-block-poly(methyl methacrylate) or PS-b-PMMA. We use infrared *scattering*-scanning near-field optical microscopy (IR s-SNOM) to obtain the necessary nanometer spatial resolution (Fig. A), overcoming the optical diffraction limit through near-field enhancement at the tip of an atomic force microscope (AFM). Corresponding vibrational spectroscopy of carbonyl bonds measures chemical identity and interactions at the nanoscale.

During the summer of 2024, we fabricated samples of PS-b-PMMA that we expected to show phase segregation and ordering on nanometer length scales. Using IR s-SNOM, we measured nanoscale (10 nm resolution) chemically-resolved images of PS-b-PMMA (Fig. B). These images showed polymer self-assembly into lamellae (layered structures) with separate PS and PMMA regions. To improve our sensitivity, we implemented a novel Mach-Zehnder interferometer in our IR s-SNOM apparatus that removes background signals in both imaging and spectroscopy, improving our signal-to-noise ratio. We demonstrated that we are able to measure both amplitude and phase of the optical signal in imaging (Fig. C) while simultaneously reducing optical noise by two orders of magnitude.

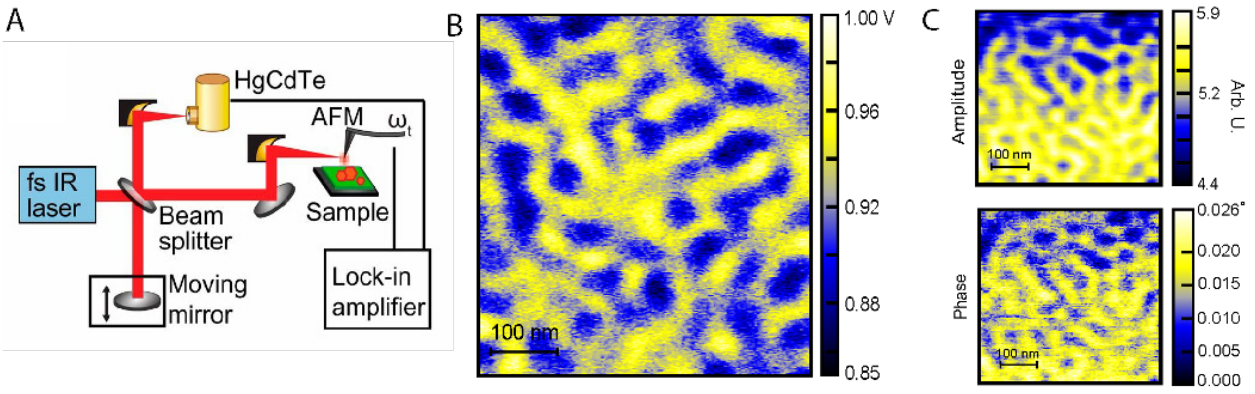


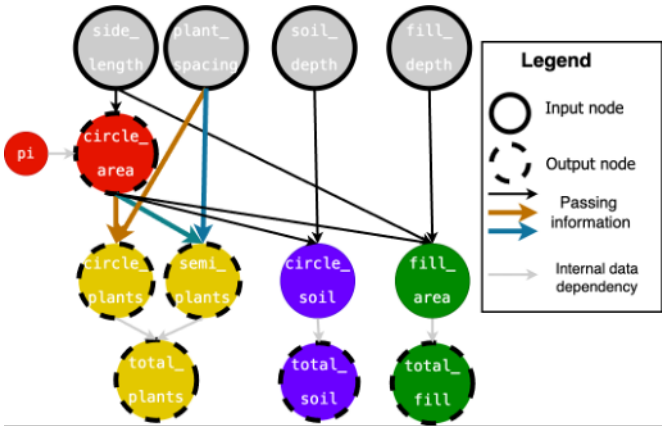
Figure: (A) Schematic of IR s-SNOM apparatus showing the IR laser, atomic force microscope (AFM), and interferometric detection. (B) IR s-SNOM image of self-assembled lamellar PS-b-PMMA sample. (C) Amplitude and phase images of PS-b-PMMA measured with our new detection scheme.

In the future, we plan to image additional PS-b-PMMA samples displaying better self-assembly to demonstrate the spatial resolution and sensitivity of our new method. We also aim to extend our approach to frequency-resolved spectroscopy of molecular vibrations using a femtosecond broadband laser.

Research Fellows: Judah Robbins Bernal (2027) — **Concentration:** Undeclared
Alec Wydra (2027) — **Concentration:** Undeclared
Faculty Mentor: Georgiana Haldeman — **Department:** Computer Science
Title of Project: Teaching Program Decomposition in CS1: A Conceptual Framework for Improved Code Quality
Funding Source: Holden Endowment Fund
Project Summary:

Despite decades of research on the importance of code-quality, it remains a critically underserved element of computing education. As increasing focus within the research and teaching communities has been placed on teaching and measuring holistic code quality, the majority of effort has been targeted towards the specific paradigm of object-oriented design. Because many universities' introductory courses are taught in a procedural paradigm, students are often not exposed to code-quality within their introduction to computer science, delaying the maturation of their ability to incorporate code quality within their problem-solving and design processes.

Throughout the summer our research was divided into roughly three working periods. Within each period we investigated a different topic, tool, or approach related to procedural decomposition in computer science education. In the first period, we designed and implemented a metric suite with the intention of automating the evaluation of student python code within a CS1 assignment for the quality of the decomposition. Our metrics were designed through a combination of (1) our review of existing literature related to code quality and (2) correlational analysis between manually generated scores and the output of our automated system on a small case study of student submissions to one homework assignment from the Spring 2024 semester. Our metric suite was primarily implemented through static analysis methods applied to the Abstract Syntax Tree generated by Python code. Abstract Syntax Trees are intermediate representations of computer programs generated during the compilation process. They contain all necessary algorithmic and structural information about a program without additional syntactic sugar.



During this development process we refined our metric suite to more closely align with the principles of decomposition that we had extracted from the literature. To further develop this tool, experimentation and deployment in a classroom environment is necessary, and thus we chose to delay further development to the fall semester.

Following this, we began preliminary work on a conference paper based on the pedagogical methods of procedural decomposition, transitioning away from the evaluation focus we had originally taken. The foundation of this paper was the pedagogical method of variable dependency graphs as a way of informing students' decomposition process. The paper fell under the category of "curricula initiatives" and aimed to provide a comprehensive, approachable method to introducing procedural decomposition, and more broadly code quality, into an introductory course.

After the submission deadline for the selected conference (SIGCSE), we began work on the development of an online learning environment where students could interact with variable dependency graphs created from their submitted code. This stage of the project was once again heavily focused on static analysis of code, as well as web development. As of the final week of our research we are still undergoing development of the visualization component of the learning environment.

Research Fellow: **Alexa Russo (2025)** **Concentration:** **Geology**

Faculty Mentor: **Amy Leventer** **Department:** **Earth and Environmental Geosciences**

Title of Project: **Antarctic Holocene Diatoms as a Climate Proxy**

Funding Source: **Malcolm ’54 and Sylvia Boyce Endowed Fund in Geology**

Project Summary:

The Sabrina Coast, located in East Antarctica, is an understudied area which is potentially prone to mass biodiversity loss and sea rise due to climate change. One way to predict future responses to modern climate change is to look at past responses to climate change. One proxy for climate and environmental change that has been proven reliable and consistent is the use of diatoms. Diatoms are single celled primary producers that exist in many different environments around the world, including both marine and freshwater environments. The abundance of certain species can be used to reconstruct past environments.

Over the summer, I focused on observing Holocene (~11.5k years ago - present) diatoms from the Sabrina Coast. I photographed and counted these diatoms to gather data on the abundance of different species of diatoms at various depths in three locations along the Sabrina Coast. I prepared slides to be observed using a light microscope and counted at least 400 diatoms for each slide. I then used an equation to determine the absolute abundance of diatoms for a given depth and location. The most abundant species in my samples was Fragilariopsis kerguelensis (figure 1), a species which indicates a permanent open ocean zone (POOZ). There were also many Thalassiosira lentiginosa (figure 2), a species which also indicates an open ocean environment.

This data will continue to be collected over the fall semester as I begin writing my thesis on this topic. The data will be used to reconstruct the past oceanographic conditions and environments of the Sabrina Coast, and will eventually be projected by age to determine the timing of changes. All percentage data will eventually be uploaded to the Australian Antarctic Database for easy access.

Fig. 1 Fragilariopsis kerguelensis

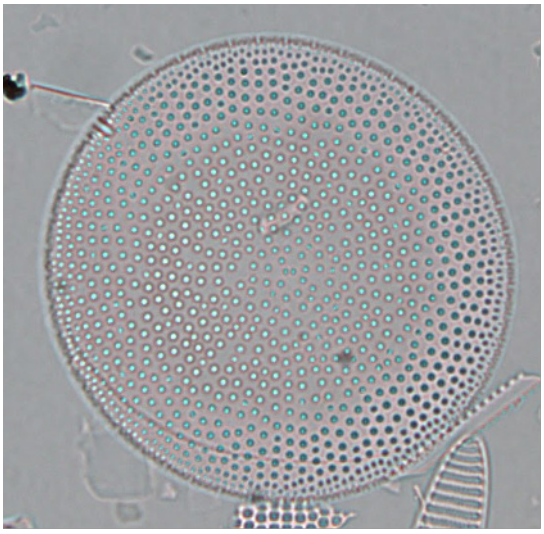


Fig. 2 Thalassiosira lentiginosa

Research Fellow: Andrew Savage (2026) **Concentrations:** Computer Science; Physics

Faculty Mentor: Ramesh Adhikari **Department:** Physics and Astronomy

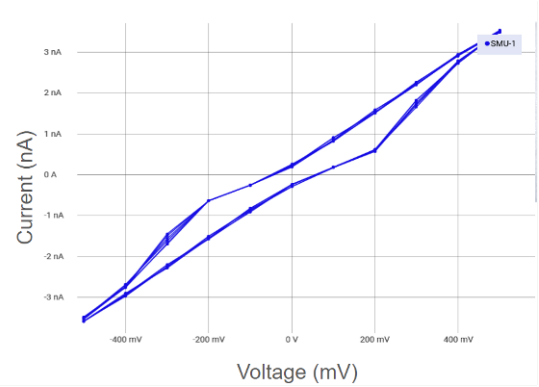
Title of Project: Development of Leaf and Tryptophan Based Memristors

Funding Source: Justus '43 and Jayne Schlichting Student Research Fund

Project Summary:

As electronics become more and more prevalent in society, concerns about their environmental impact need to be addressed more seriously. One way to accomplish this is through the use of biological materials, this project focused specifically on the creation of memristors using both leaves and tryptophan (an amino acid). This electrical component is being researched for its uses in both data storage as well as artificial intelligence. Given that it is still in the early stages of development compared to other electrical components such as transistors, this is the opportunity to make them more sustainable from the start. We made our memristors by creating thin films of our two bio-derived materials as a dielectric sandwiched between two electrodes. We formed the thin films made from tryptophan or dried leaves on top of a silver electrode either by using a spin coater or by applying as a paste in a thin layer before letting it dry. We then used nickel paint to create a conductive top electrode.

The theory behind these memristors is that as a voltage is applied to the device, silver ions from the bottom electrode will move through the dielectric due to the materials and form channels creating a lower resistance state which can then be reversed by simply flipping the voltage. After making our memristors, we tested them by creating an I-V curve of the devices. These curves showed us hysteresis behavior in the testing of our memristors, which showed that our samples were memristive.



In this I-V Curve made from one of our tryptophan samples, the two paths caused by the changing presence of the silver ions in the dielectric can be clearly seen, one when increasing from low to high voltage while the other from decreasing the voltage. This graph also showcases one of the more promising applications of memristive technology, data storage. By applying a high voltage, in this case 500mV, one can turn the memristor into the "ON" state, so that when a voltage of 200mV is applied, a higher current will be outputted than if a low voltage, or the "OFF" state were to have been previously applied as it would then be on the lower of the two paths. This then makes it a complete bit of data as it has an 1 and a 0 state.

Current vs Voltage graph of tryptophan memristor

Research Fellow: **Jordan Shapiro (2026)** **Concentration:** **Japanese**
Faculty Mentor: **Yukari Hirata** **Department:** **East Asian Languages & Literatures**
Title of Project: **Gesture and emotional affect: Do they play a role in L2 Japanese pitch accent acquisition?**
Funding Source: **J. Curtiss Taylor '54 Endowed Student Research Fund**
Project Summary:

Colgate's Center for Language and Brain (CLB) has oriented research around the relationship between gesture and language learning. This summer, my research acted as an extension of this, aiming to bridge the gap between a previous study on Mandarin lexical tones, hand gesture, and learner emotion with a new experiment investigating the learning of the pitch accent system present in Tokyo dialect Japanese. Additionally, the role of anxiety/stress will be explored; where the previous study focused entirely on teacher enthusiasm and the effect on students, this experiment seeks to isolate the experience of the language learner. To accomplish this, research completed this summer was divided into two categories: research on emotion, with an emphasis on anxiety, and research on the Japanese pitch accent system. An in depth reflection on the previous study was followed up by a thorough analysis of extant literature on both topics. This review of relevant literature was then utilized to design an experiment that will be tested over the course of the 2024-25 academic year. Details on learner anxiety and the Japanese pitch accent system will be further explained.

The Japanese pitch accent system functions upon a syllable-like unit known as the mora. Each mora in a Japanese word is assigned either a high (H) or low (L) pitch mapping, e.g., ha-shi with the first mora 'ha' accented (HL) means 'chopsticks,' while the same word ha-shi with an opposite pitch pattern (LH) means 'a bridge.' Pitch accent is crucial because improper pitch accent can confuse the meaning of the words, hence, neglecting pitch accent reduces one's intelligibility by native Japanese speakers. Acquiring proper pitch accent, however, is often one of the most difficult aspects of learning Japanese (Sakamoto, 2011; Hirano-Cook, 2011). This is partly because pitch accent can often be difficult to perceive for native speakers of languages which do not have a pitch accent system like Japanese. Furthermore, the pitch pattern of each word needs to be learned alongside the word itself, increasing the amount of information a learner must process in their working memory.

One solution that has been proposed in aiding the acquisition of pitch accent for L2 Japanese learners is the addition of metaphoric hand gestures to represent the contour of pitch patterns. Previous studies have explored this through tests implementing hand gesture training phases but results have been unfruitful (Hirata et al., 2024). To build upon this, I developed six different pitch accent gesture-mapping methods that will be presented to subjects in the upcoming experiment. Through providing more choice to learners, they will be able to pick a gesture system that is ideally more effective and systematized than previous studies have explored.

Lastly, anxiety has been cited as a significant inhibitor towards outcomes in language learning, and many experiments have sought to minimize the effects it has on the second language learner. Until now, foreign language anxiety has not been examined in conjunction with Japanese pitch accent. The goal of the designed experiment is to determine whether different methods of mapping pitch accent to hand gesture will help identify an optimal method that students can utilize moving forward, and if a reduced anxiety condition will yield participants' better performances. Literature from emotional psychology has assisted in developing an artificial "high anxiety" learning condition alongside a control group. Traits that categorize the anxiety condition are social evaluation and uncontrollability (Dickerson & Kemeny, 2004). Ultimately, findings will improve our understanding of multimodal pedagogical methods for teaching and learning pitch accent languages, with relevant application to Japanese language classrooms and learners moving forward.

Research Fellow: **Jenavieve Sherwood (2026)** **Concentrations:** **Spanish; Molecular Biology**
Faculty Mentor: **Engda Hagos** **Department:** **Biology**
Title of Project: **Investigating the role of Krüppel-like Factor 4 in Cancer Metabolism**
Funding Source: **Michael J. Wolk '60 Heart Foundation**
Project Summary:

Krüppel-like factor 4 (KLF4) has been widely studied as an effective tumor suppressor gene in colorectal cancer cells. It has been found to be linked to genomic stability, as cells lacking KLF4 have higher levels of apoptosis, DNA damage, etc. (Hagos et al., 2009). Furthermore, cells lacking KLF4 have also been seen to have higher levels of unregulated proliferation, making it an excellent gene to study to investigate how cancerous cells metabolize and divide. Cancerous cells have been shown to metabolize through a pathway coined as the Warburg effect, wherein they will divide regardless of oxygen levels within the cell. Cancerous cells can produce anti-apoptotic byproducts, and create a build up of lactate inside the cell, a known hallmark of cancer (Blum et al., 2021). Higher expression of critical metabolic proteins has also been associated with higher levels of cancer. Protein kinase M2, or PKM2, is understood to catalyze the final, rate determining step in glycolysis: the conversion of phosphoenolpyruvate to pyruvate to be further processed in the mitochondria, or converted to lactate. Additionally, ACSLs (acyl-coA synthetase long chain family members) are found to be overexpressed in many cancer types. Cancerous cells specifically abuse fatty acid metabolism, while ACSLs modulate lipid metabolism in cancerous cells. Specifically, ACSL1 breaks down fatty acids into acetyl-CoA to aid in ATP generation.

In order to determine the role of KLF4 in cancer metabolism, we compared cells expressing KLF4 (MEF +/+) and lacking KLF4 (MEF -/-). Additionally, protein expression was measured on RKO cells treated with DMSO as a solvent control, and pon A, a drug that activates the KLF4 gene (Fig 1). Western blot results showed that a 10μM dosage of ponasterone A leads to increased expression of both PKM2 and ACSL1, indicating that higher levels of KLF4 lead to higher expression of these proteins (Figures 2&4, A&B). In higher doses, 2DG appears to have higher impact on KLF4 null (-/-) cell lines in regards to both PKM2 and ACSL1 expression levels.

RESULTS

Expression of KLF4 utilizing Ponasterone A

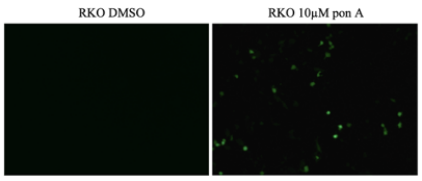


Fig 1. KLF4 expression is induced by Ponasterone A (Pon A) in RKO cells. KLF4 expression is induced by Ponasterone A (Pon A) in RKO cells. After a 3-day treatment of 10μM pon A against DMSO as a control, RKO cells were visualized utilizing GFP and fluorescent microscopy. The cells fluoresced green if KLF4 was detected, indicating that pon A lead to KLF4 expression.

Expression of PKM2

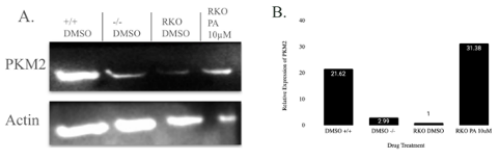


Fig 2. KLF4 leads to increased PKM2 expression. PKM2 expression is higher in 10 μM pon A treated RKO cells. PKM2 expression was measured against the loading control of actin. (A) Western blot results of PKM2 expression in KLF4 wild type and null MEFs, treated with DMSO, a solvent control, and RKO cells treated with DMSO and 10μM pon A treatment, a drug that activates KLF4. (B) Quantitative analysis of western blotting measuring PKM2 expression in KLF4 expressing (MEF +/+) and KLF4 lacking (MEF -/-) cells, as well as RKO cells treated with 10μM pon A and DMSO.

Expression of ACSL1

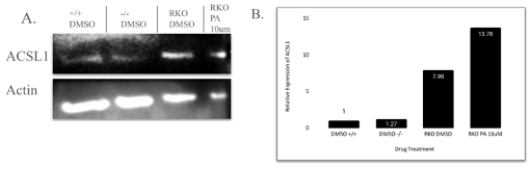


Fig 3. KLF4 leads to increased expression of ACSL1 in RKOs. (A) Western blot results of ACSL1 expression in KLF4 wild type (+/+) and null (-/-) MEFs treated with DMSO, and RKOs treated with both DMSO and a 10μM dosage of pon A. ACSL1 expression was measured against the loading control of actin. (B) Quantification of western blot results, showing higher ACSL1 expression in cells expressing KLF4.

Research Fellow: **Ayden Simpson (2025)** **Concentration:** **Environmental Geography**
Faculty Mentor: **Julie Dudrick** **Department:** **Upstate Institute**
Title of Project: **Picturing the Chenango Heritage Rail Trail**
Funding Source: **Upstate Institute**
Project Summary:

This summer, I have had the opportunity to work with the Chenango Greenway Conservancy (CGC) based out of Norwich, NY through the Upstate Institute's Summer Field School. The Chenango Greenway Conservancy aims to establish a 60-mile multi-use rail-trail along the current New York Susquehanna & Western (NYS&W) railway corridor from Chenango Forks to just South of Sangerfield. The Chenango Heritage Rail Trail would connect the communities of the Chenango Valley in a transformative way that stimulates future growth and community development, while also honoring the history of the people, river, canal and railroads that have shaped our communities.

We are assembling a diverse group of Chenango County municipalities and community members along the proposed trail line to come together via the Chenango Heritage Rail Trail coalition. United under the same vision, we are working together to see the Chenango Heritage Rail Trail come to fruition. The coalition will work with the Chenango County Industrial Development Agency, the NYS&W railway, and relevant local, state, and federal entities to facilitate the trail-making process.

For the bulk of my summer project, I created various maps showing the trail network surrounding the railway corridor and different historical, commercial, and natural destinations along the line. These maps provided clarity to the project's vision moving forward and were designed to be intuitive for the general public. Additionally, I researched the history of this corridor and organized multiple clean-up days in communities along the railway. My final product for the summer was somewhat untraditional – a virtual StoryMap that outlined the project's history, current state, and future goals. Using this format, I was able to pitch the project in a concise and informative manner while also providing the CGC with a resource that they can now use and update as they continue to build on the rail-trail project. Meeting the vast network of CGC volunteers was a privilege that I looked forward to every day and one that will continue to help me as I write my Geography honors thesis on rail-trail proposals.

Research Fellow: **Joseph Slama (2027)** **Concentration:** **Undeclared**

Faculty Mentor: **Ewa Galaj** **Department:** **Psychological and Brain Sciences**

Title of Project: **Neuroscience of Addictions Lab**

Funding Source: **NASC Division**

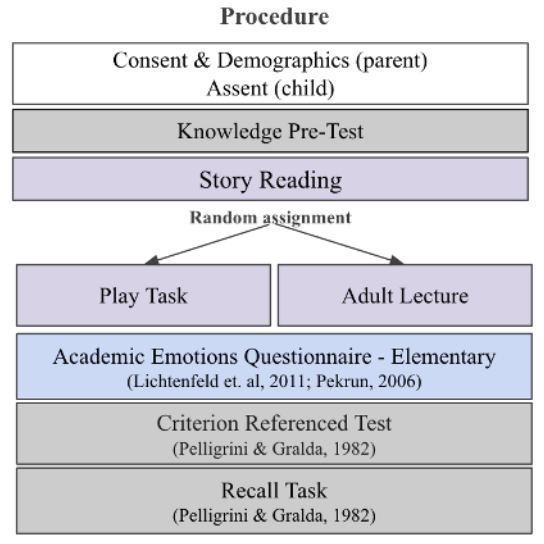
Project Summary:

During the summer we worked on various projects on the broad topic of neurosciences of addiction. After learning how to perform RNA-scope assays, I worked on the confocal microscope, imaging the dopamine expression in cholinergic neurons traveling from the PPT to the SN. I also performed many Western Blot assays, finding the expression of ghrelin receptors in rats who have become dependent on heroin. I also learned how to work with live rats in the laboratory, gavaging them with alcohol to perform a study on the effects of adolescent alcohol abuse.

Research Fellow: Charlotte Smith (2026) **Concentration:** Psychological Science
Faculty Mentor: Allison Zengilowski **Department:** Psychological and Brain Sciences
Title of Project: The Effects of Play-Based Learning on Achievement Emotions and Outcomes
Funding Source: NASC Division
Project Summary:

Play is widely regarded as a central tenet in the experience of childhood worldwide. However, its value and role within early educational settings have been highly contested. Despite evidence of socioemotional and academic benefits of learning through play, recent heightened academic demands in primary and elementary schools have led to increases in teacher-led instruction (Pyle & Alaca, 2018), leaving little space for child-directed play in classrooms. Nevertheless, many educators integrate play-based learning (PBL) practices into their classrooms to promote active engagement and positive academic outcomes (Pyle & Alaca, 2018). My proposed study will discern how play-based learning and adult-guided structures influence young students' emotional experiences and comprehension through an experiment.

This study will assess the implications of play-based learning on academic emotions and performance. I will recruit 60 8-year-old elementary students from local communities. Working in sessions, small groups of 20 students will read a developmentally appropriate story. Consulting with teachers, the story will revolve around novel concepts children have yet to cover in class. Upon completion, participants will be randomly assigned to either the unstructured play condition or the structured adult lecture condition. In the play condition, children will be prompted to play together, using role-play, toys, and art materials to represent the story with minimal adult guidance. In the lecture condition, children will undergo a highly structured verbal lesson with limited student participation or peer interaction. Following the learning conditions, the emotion and story comprehension measures will be administered individually. Scores will be compared between conditions to discern any differences in emotional experiences and academic performance.



The conventional classroom structures and curricula within early education tend to overemphasize rigid academic standards, teacher-directed instruction, and student passivity while devaluing or redirecting opportunities for play. Despite substantial evidence that play-based learning environments promote positive academic emotions and performance outcomes (Pyle & Daniells, 2017; Taylor & Boyer, 2019), most classrooms situate play and learning as mutually exclusive. Classrooms where student autonomy and collaboration are prioritized over direct instruction support pleasant emotional experiences, heightened motivation, and flexible learning strategies (Pekrun, 2017). I hypothesize that integrating play with learning will elicit more positive emotions and comprehension compared to structured, adult-driven activities. My findings would have significant implications for teachers and students, strengthening justifications for integrating play-based learning into the classroom. Over the summer, I worked to compile a comprehensive literature review, formulate a proposed study design and methods, and adapted measures.

Research Fellow: Salem Sokpoli (2026) **Concentration:** Africana and Latin American Studies
Faculty Mentor: Rachel Amann-Burns **Department:** Upstate Institute
Title of Project: The Importance of Historical Preservation for Community Building
Funding Source: Upstate Institute
Project Summary:

This summer I had the honor of working with the Oneida County History Center (OCHC) in Utica, New York. OCHC is a small, but mighty, non-profit organization focused on preserving and sharing the history of Oneida County and the greater Mohawk Valley. Since 1876, OCHC has been a prominent part of Oneida County. The Center has only three staff members, and dozens of volunteers helping them serve the community. OCHC has a research library with hundreds of documents, records, books, and pictures that researchers all over the country have perused. OCHC researchers help the public search for anything they need. They also have an ever-growing artifact collection with items spanning centuries and often donated by the local community. Exhibits on various pieces of local history occupy the gallery, which is also used for public programs and lectures that engage the community.

This summer I was tasked with three projects. Firstly, I was to create a panel for a plaque outside OCHC's front entrance. This panel was to commemorate the addition of their building to the National and State Registers of Historic Places. Secondly, I was to organize the Center's attic, which serves as an archive for their organizational and business records. Lastly, I was to create content for their social media to increase engagement. These three projects hope to help the Center and Community engage in a fruitful relationship and ensure efficiency as the organization grows.

Through my work at the Oneida County History Center, I have learned that preserving history and sharing it with the community is an everyday action. Throughout my research for my first project, I discovered the extensive history of OCHC. Founded in the late 19th century, OCHC has moved homes three times as it expanded. OCHC has a great legacy of deep community involvement and prestige behind it. The addition of their building to the National and State Registers of Historic Places continues this legacy. They have now protected this historic building from urban renewal, as well as created a place of historical emphasis in the community. By creating this commemorative panel, I hope that the community will be drawn into the Center. OCHC holds steadfast in its mission of serving the local community and preserving history for all.

My work on my second project in the attic illuminated the great work OCHC has done. The work may sound vague, but every day I learned something new about OCHC and was often inspired. In sorting through documents, I saw the various ways in which they have organized for the community. Initiatives like the Hall of Fame & Living Legends honor local community leaders and important figures.

Lastly, it was a great excitement creating a Summer video series for OCHC's Instagram and Facebook called "Tid-Bit Thursdays" where I shared fascinating pieces of Oneida County History. This project broadened my historical perspective and enhanced my skill set in social media and marketing. Through my projects, I have become informed on the various responsibilities and privileges of a community-based organization like OCHC.

Research Fellow: **Madison Steele (2026)** **Concentration:** **Computer Science**

Faculty Mentor: **Janel Benson** **Department:** **Sociology & Anthropology**

Title of Project: **Integrating Career Development into the Classroom and Examining Questbridge Satisfaction**

Funding Source: **SOSC Division**

Project Summary:

This summer, I worked with Professor Benson to research the integration of career-related content into the college curriculum. There is currently not much literature on this topic. Still, the existing research emphasizes the benefits of adding career exploration to classes or adding a separate career-related course to major requirements. Professor Benson teaches Sociological Research Design and Methods (SOCI 250) at Colgate. This course integrates aspects of career development into the course, such as visits from career services, a LinkedIn workshop in class, and alumni interviews. Our research aims to discover the impact of the SOCI 250 curriculum on students who took the course compared to students who did not. We developed a survey and distributed it to all SOAN majors and minors at Colgate, as well as all students who have taken SOCI 250 with Professor Benson. This survey aimed to determine if integrating career development into the curriculum is beneficial to students as they begin or continue on their career discovery journey. We were interested in learning more about if and how students utilize the career resources on campus, and if the students who took SOCI 250 with Professor Benson are more likely to use these resources. We use SPSS, a software program for quantitative data, to help analyze the results of our survey. Preliminary results find that our initial hypothesis is correct, though we are continuing to collect responses from students. Throughout the coming school year, we hope to continue processing the data and using our findings to publish an article.

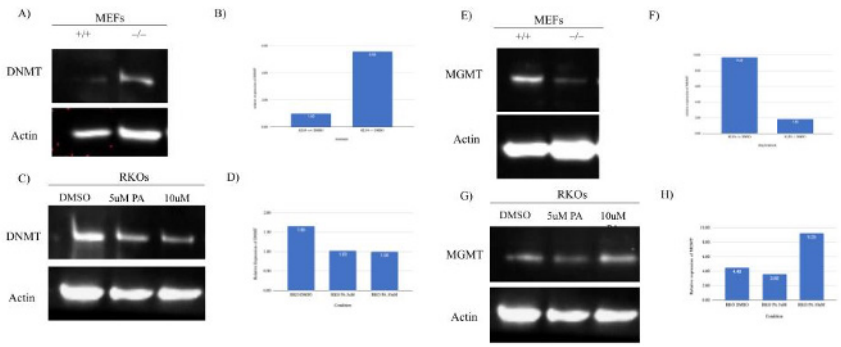
I also worked on another project with Professor Benson and her other research assistants to examine Questbridge student satisfaction with both their campus and the Questbridge program. This project builds on the senior thesis of a graduated Colgate student and their research into Questbridge. This summer, we analyzed and coded interviews using MAXQDA, a software program designed to help analyze qualitative data. The interviewees are Questbridge students enrolled at several Questbridge partner schools. This research intends to help understand students' satisfaction with Questbridge and their university. We are looking at a multitude of factors that influence a student's satisfaction both with their campus and with Questbridge. This research will also continue into the school year as we continue to analyze the data.

Research Fellow: **Megan Sullivan (2026)** **Concentration:** **Molecular Biology**
Faculty Mentor: **Engda Hagos** **Department:** **Biology**
Title of Project: **Investigating the Role of KLF4 in Epigenetics**
Funding Source: **NASC Division**
Project Summary:

Kruppel-like factor 4 (KLF4) is a zinc finger transcription factor involved in cellular processes that function to maintain genomic stability. KLF4 acts as a tumor suppressor in human colorectal cancer cells (RKOs), possibly by reducing DNA damage, inhibiting uncontrollable rates of cell proliferation, and stopping the presence of aneuploidy, as observed in mouse embryonic fibroblast cells (MEFs). However, how KLF4 achieves genomic stability is not fully understood. One possibility includes KLF4's involvement in epigenetic modifications such as DNA methylation.

DNA methylation is an epigenetic modification that can have various effects on the cell. For example, hypermethylation on a tumor suppressor gene can block transcription, leading to tumorigenesis. DNA methylation is carried out through a family of proteins called DNA methyltransferases (DNMTs). These proteins establish and maintain methylation patterns on DNA through the addition of methyl groups. This study aimed to understand KLF4's relationship with DNMT to understand if epigenetic factors contribute to genomic instability without KLF4. Several proteins are correlated with DNMT levels, one of which is O-6-methylguanine-DNA methyltransferase (MGMT). MGMT is a DNA repair protein that has a hypermethylated promoter in about 40% of colorectal cancers, resulting in the gene being silenced. This suggests the opportunity for a relationship between KLF4, DNMT, and MGMT. This project aims to understand if KLF4 is regulating MGMT through its regulation of DNMT, or if KLF4 regulates both DNMT and MGMT directly (and therefore separately). In both RKOs and MEFs, I observed levels of DNMT and MGMT in the presence and absence of KLF4. In RKOs, a drug called Ponasterone-A induced KLF4, while DMSO served as a solvent control. We found that KLF4 downregulates DNMT expression (Fig.1 A-D), while KLF4 upregulates MGMT expression (Fig.1 E-H). These results were seen in both cell lines.

Fig 1. KLF4 downregulates DNMT and upregulates MGMT in RKOs and MEFs. (A) Western blots of +/+ and –/– MEFs with DNMT antibody (184 kDa) compared to actin antibody as a control. (B) Quantification of MEF western blot with DNMT. (C) Western blots of RKO cells treated with DMSO, 5uM PonA, and 10uM PonA with DNMT antibody compared to actin antibody as a control. (E) Western Blots of +/+ and –/– MEFs with MGMT antibody (50 kDa) compared to actin antibody as a control. (F) Quantification of MEF western blot with MGMT. (G) Western blots of RKO cells treated with DMSO, 5uM PonA, and 10uM PonA with MGMT antibody compared to actin antibody as a control. (H) Quantification of RKO western blot with MGMT antibodies.



Research Fellow: **Sara Tabibian (2026)** **Concentration:** **Environmental Geography**

Faculty Mentor: **Adam Burnett** **Departments:** **Geography; Environmental Studies**

Title of Project: **Analyzing the Isotopic Composition of Winter Precipitation in Central New York State**

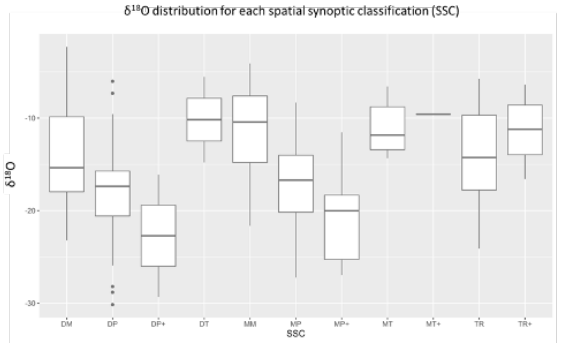
Funding Source: **SOSC Division**

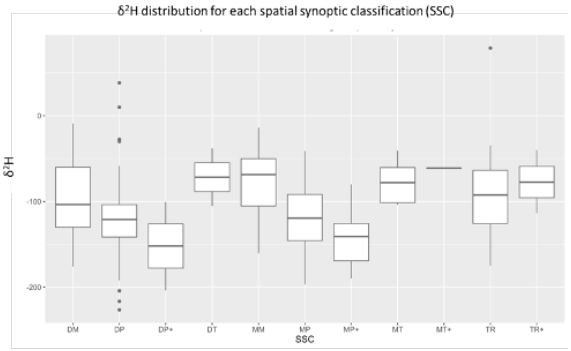
Project Summary:

Stable isotopes serve as crucial proxies for reconstructing past climates through various records such as ice cores and lake sediments. Specifically, precipitation's isotopic composition of oxygen and hydrogen provides insight into historical air temperatures and the hydraulic processes influencing water vapor sources. The goals of this research were twofold: first, to measure the oxygen and hydrogen isotopic composition of 287 archived daily samples of winter precipitation collected over the last seven years in Cazenovia, NY. The second is to determine whether the isotope values in these precipitation samples are associated with the synoptic-scale circulation during the precipitation events. Utilizing the Los Gatos Research Liquid Water Isotope Analyzer (LWIA), a device used to calculate hydrogen (^{1}H and ^{2}H) and oxygen (^{16}O and ^{18}O) isotope ratios, we explored the connection to synoptic-scale atmospheric circulation patterns using the Sheridan (2002) Spatial Synoptic Classification (SSC).

Our research aimed to determine the correlation between isotopic values and specific weather types, hypothesizing that Dry Polar (DP) and Moist Polar (MP) conditions would yield the most depleted isotopic values. Conversely, we hypothesized that Moist Tropical (MT) conditions would produce the most enriched isotopic values. The SSC, instrumental in our analysis, uses a 6-hour temperature, dew point, cloud cover, wind, and pressure to classify each day into a particular weather type.

As hypothesized, our results indicated that the most depleted values are associated with DP and MP events. The most enriched values occur with DT, MM, and MT. An analysis of variance (ANOVA) statistical procedure was used to determine whether any statistically significant differences in mean $\delta^{18}O$ and $\delta^{2}H$ exist among the weather types. The ANOVA indicates significant differences between some groups based on SSC (P=2.7e-12 for $\delta^{18}O$ and P=2.2e-7 for $\delta^{2}H$). Pairwise t-tests between all SSC groups were used to find those SSC pairs that feature statistically significant differences in mean isotopic composition. The significant differences for $\delta^{18}O$ involve DP and MM, with DP being the most depleted and MM the most enriched. This result is consistent with our hypotheses. We also found strong differences between DM and MP+, MM and MP+, MP+ and MT, and MP+ and TR. The pairwise comparisons for $\delta^{2}H$ show fewer significant differences. DP and MM are as hypothesized, as are MM with MP and MP+. The boxplots for $\delta^{18}O$ and $\delta^{2}H$ are shown in Figs. 1 and 2 for each weather type.





Research Fellow: **Joy Tang (2026)** **Concentrations:** **Sociology; Biology**

Faculty Mentor: **Rachel Amann-Burns** **Department:** **Upstate Institute**

Title of Project: **Developing Interactive Learning Modules For Students At The National Abolition Hall of Fame (NAHOF)**

Funding Source: **Upstate Institute**

Project Summary:

Just 25 miles southeast of Syracuse is the small hamlet of Peterboro, NY. Though the community of Peterboro may be small, its history is anything but. In the center of the community is the National Abolition Hall of Fame and Museum (NAHOF), located on the second floor of the historic Presbyterian church. NAHOF "honors anti-slavery abolitionists, their work to end slavery, and the legacy of that struggle, and strives to complete the second and ongoing abolition–the moral conviction to end racism."

The history of Upstate New York includes the story of relentless abolitionism, and Peterboro is at the heart of that fight. Through the guidance of NAHOF's Dorothy Willsey and her husband and historian Norman Dann, I was able to delve into this history and greatly expand my knowledge of this area of New York state's history. The historical content taught in school is often diluted, so being able to interact with primary and unfiltered sources this summer greatly expanded my appreciation for this topic. Because I was able to host daily tours at the museum, I interacted with the material daily and practiced my presentation skills. I learned how to cater the museum experience depending on the guest and their interest level in the material, which is an important skill that I was able to improve through this experience.

As a Field School Fellow with NAHOF this summer, my main research project was to develop three interactive learning modules for 11th graders. These three modules focused on slavery, abolition, and emancipation, with an emphasis on Upstate New York history. The main goal for these lesson modules was for them to be interactive and engaging, unlike the traditional "memorize facts" approach to learning. The modules included an educational background slideshow, three DBQ questions (document-based questions), and a final interactive discussion activity. Sources for the questions often included political cartoons, primary political documents, and newspaper clippings. Conflicting sources were also used for students to develop their own stance on a given problem, and to encourage critical thinking. Interactive activities at the end included small group peer discussions, role-playing historical figures, and even scavenger hunts. Through several meetings with my supervisor Dorothy Willsey and history teacher Jessica Harney, I was able to troubleshoot and produce a product that can soon be released to the public.

Research Fellow: Riley Taylor (2026) **Concentrations:** Geology; Natural Sciences

Faculty Mentor: Joe Levy **Department:** Earth and Environmental Geosciences

Title of Project: Studying the Alvord Desert as a Martian Analog

Funding Source: Doug Rankin '53 Endowment - Geology Research

Project Summary:

This project was conducted by NASA JPL and Colgate University as the preliminary study in the multiyear PSTARS Helihabitable mission. As the first year of the study, this field season aimed to better establish the mission's science, technology, and operations goals.This mission has two primary scientific objectives, the first being to better understand recurring slope lineae (RSL) on Mars, using the Alvord Desert plume (located in eastern Oregon, USA) as an analog. As RSL are always observed at the same time, any daily changes have gone unobserved. If these RSL are indeed water tracks, as some research points to, studying the Alvord Desert plume's changes over short periods of time may help discern the nature of the RSL. The second scientific objective is to identify and study the presence and detectability of plagioclase in basalts as this has also raised questions about the origins of felsic material possibly found on Mars. Technologically, the mission aims to investigate the possibility of autonomous drone flights and landings on martian environments using the mountains (Steens Mountain and Mickey Butte) surrounding the Alvord Desert as an analog. Doing so will help determine the feasibility of the long term Helihabitable mission goals. This first year of studying was helpful in identifying optimal study sites and operation conditions for future field seasons.

To compare the Alvord Desert plumes to RSLs and the region's topography to Valles Marineris on Mars, we spent several days studying the region through the use of drones. Drone work included measuring surface temperature and soil moisture using a drone mounted radiometer. This data was supplemented by additional soil moisture information received from ground probes we placed at the start of our study. Infiltromoter measurements revealed that the playa has an extremely low infiltration rate of 10-5 cm per second. The content of the surface was analyzed using a drone mounted spectrometer. This allowed us to further evaluate the presence of water in and surrounding the plumes. Spectroscopy was carried out multiple times each day in order to account for differences in soil moisture that may have occurred within a short time period due to evaporation, infiltration, or discharge. A smaller drone was used for imaging the region to create an RGB photo mosaic and digital elevation model, allowing for more detailed and accurate flight plans for this and future missions. An RTK GPS survey was conducted for more precise mapping of flight plans and radiometry and spectrometry results.

The analysis of this data revealed notable changes to the plume over the period of the study. Radiometry revealed a temperature and moisture gradient with the highest moisture and lowest brightness temperature being at the center of the plume. We observed the highest quantity of standing water in the mornings with evaporation increasing later in the day. Our observations were reflected in radiometry data, which showed the plume retreating and advancing over time. The extremely low measured infiltration rate indicates that changes in water level are essentially entirely due to discharge and evaporation, not infiltration. Spectral data also reflected the presence of water following a gradient around the plume. The most absorption occurred on the plume due to the spectral absorption of water.

Research Fellow: Felicite Tien (2025) **Concentration:** Neuroscience

Faculty Mentor: Anzela Niraula **Department:** Psychological and Brain Sciences

Title of Project: The Role of Microglia in Metamorphic Remodeling of the Brain

Funding Source: NASC Division

Project Summary:

Microglia are the resident immune cells of the central nervous system that constantly survey the brain. They play a crucial role in brain remodeling and development through synaptic pruning, where mature synaptic connections are created by reinforcing responsive synapses and removing inefficient synapses (Schafer et al., 2012). A particularly robust example of brain circuit remodeling occurs during metamorphosis. In amphibians, this consists of physical changes including the growth of limbs and lungs, gill and tail reabsorption, and intestinal remodeling. During metamorphosis, the frog model Xenopus laevis undergoes extensive behavioral changes, such as a switch in feeding behavior and diet. Tadpoles are voracious feeders and largely lack feedback control of food intake regulated by the hypothalamus, but during metamorphosis this circuitry for appetite control develops (Bender et al., 2018). These controls are carried out by POMC neurons in the hypothalamus, which send signals promoting satiety.

Our research aimed to investigate the role of microglia during this robust period of metamorphic brain development. It remains unclear whether circuitry remodeling is regulated by microglia, especially at the level of microglia-neuron interactions during metamorphosis. It is also unknown whether the involvement of microglia is uniform temporally and spatially across different brain regions throughout this period. Furthermore, the effects of microglial remodeling of circuits on Xenopus behavior and physiology during metamorphosis remains unexplored. We explored these questions by examining the localization of microglia to neurons in two distinct brain regions during three stages of metamorphosis. These are representative of the three stages of metamorphosis; premetamorphosis (NF54), prometamorphosis (NF58/59), and metamorphic climax (NF66), each of which are characterized by distinct developments in tadpole to frog morphology.

Utilizing RNAscope to label individual copies of mRNA, cd74 expression as a representation of active microglia was visualized in the optic tectum and POMC neuron population within the hypothalamus. Images of the basal hypothalamus were analyzed for the percentage of cd74 expressing microglia that were localized near POMC neurons (Fig. 1). Reactive microglia, carrying out functions such as phagocytosis, express higher levels of cd74. We identify temporal and region specific differences in microglia activity markers throughout metamorphosis, indicating stages 54 and largely 58/59 as periods of significant developmental activity, and stage 66 where activity largely settles down (Fig. 2). In addition, we find regional differences between the optic tectum and basal hypothalamus as both overall microglia activity as well as expression changes throughout metamorphosis differ (Fig. 4). These findings are the first report of microglia dynamics in the brain during metamorphosis, and open up further exploration of the spatiotemporal role of microglia throughout metamorphic development.

Fig 1: POMC (green) and cd74 (red) expression in hypothalamus (NF58)

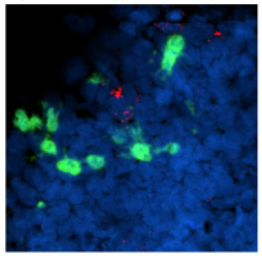


Figure 2

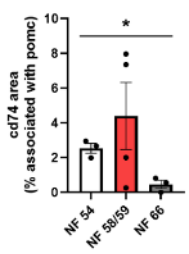


Figure 3: cd74 expression in optic tectum (DAPI in blue)

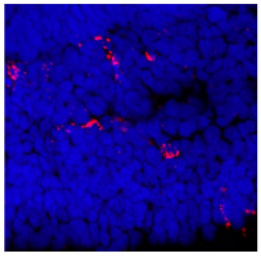
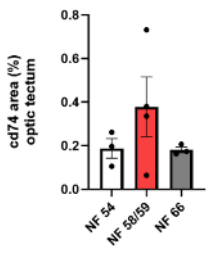
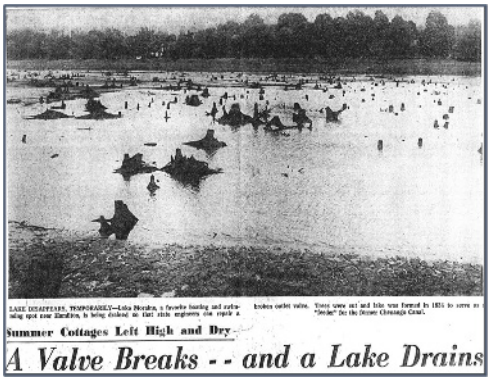


Figure 4



Research Fellow: K'Cyee Toma (2026) **Concentration: History**
Faculty Mentor: Catherine Cardelús **Department: Upstate Institute**
Title of Project: Archiving the Legacy of the Lake Moraine Association
Funding Source: Upstate Institute
Project Summary:


Summer Cottages Left High and Dry
A Valve Breaks - - and a Lake Drains

As part of the Upstate Institute Summer Field School, I spent this summer working with the Lake Moraine Association (LMA) in Hamilton, New York. Established in 1950, the LMA is a nonprofit organization dedicated to preserving Lake Moraine's ecological health and natural beauty. The association focuses on improving water quality, addressing environmental challenges, and protecting the lake for future generations. My role this summer was centered on a major research project: archiving the association's historical records, which span decades of the LMA's efforts to maintain the lake. The archival portion of my work involved sorting, scanning, and digitizing historical documents such as meeting minutes, reports, and newsletters. Using Google Drive and Adobe software, I organized the files into labeled folders by date and subject for easy access. Though scanning fragile materials presented challenges, processing everything in bulk allowed me to efficiently label and categorize the files.

As I worked through the archival materials, I analyzed key environmental challenges repeatedly mentioned, with water quality being a primary concern. According to the 2020 Citizens Statewide Lake Assessment Program (CSLAP), Lake Moraine's water clarity has improved, shifting from mesotrophic to oligotrophic, a positive sign of reduced nutrient levels and less algae growth. This is crucial for supporting healthier fish and aquatic life.

Another challenge is the ongoing presence of invasive species, particularly Eurasian watermilfoil. The LMA has implemented several strategies to control it, including herbicide treatments, manual removal, and biological controls like native weevils. While these efforts have had mixed success due to environmental factors, they have helped slow the spread. Since 1997, the LMA has also used copper sulfate to manage algae. Additionally, the dam, built in 1836 and classified as high risk, is critical for preventing flooding that could impact nearby towns, including Hamilton and Colgate University. Maintaining the dam ensures safety and stability for the surrounding areas, with major repairs scheduled for 2026.

Through my archival research and analysis, I not only contributed to preserving the LMA's history but also gained a deeper understanding of the ongoing environmental challenges that Lake Moraine faces. This project enhanced my skills in archival methods, research, and documentation while offering valuable insights into how historical records can inform and shape the association's ongoing work to protect the lake.

Research Fellow: Mia Toribio Lantigua (2026) **Concentration:** Physics
Faculty Mentor: Ramesh Adhikari **Department:** Physics and Astronomy
Title of Project: Leaf-Based Triboelectric Nanogenerators
Funding Source: National Science Foundation Grant
Project Summary:

A Triboelectric Nanogenerator is a device that transforms the friction caused by mechanical energy into electricity. The project employs the process of triboelectrification, which involves bringing two dissimilar dielectric materials into momentary frictional contact. This results in a potential difference that allows for the exchange of electric charges between the surfaces involved.

During the summer, we worked on creating a leaf-based film using grass fibers. The process began with collecting grass clippings from the campus area and meticulously cleaning them to remove dirt residues. Once clean, the grass was blended and soaked in a 20% Sodium Carbonate water solution, heated to 100 degrees Celsius, and allowed to cool. This method helped break down the lignin to work with the cellulose, resulting in a strong and durable film.

After preparing the cellulose pulp, it was transferred to a mold and deckle and left to dry in cotton sheets. The film was pressed overnight with a 5-pound weight to drain any remaining liquid residue. Following this, the sheets were placed in a vacuum oven at 140 degrees Celsius to absorb the remaining moisture and complete the drying process.

The next step involved assembling the dielectrics using a copper layer to cover the entire 8x9 cm grass film, topped with a Polyamide Film layer to insulate the dielectric materials.

In operating the Leaf-Based Triboelectric Nanogenerators (L-TENGs), a stepper motor-driven linear actuator controlled by a microcontroller unit (MCU) maintained consistent and periodic contact between the dielectrics. The linear actuator station was carefully refurbished to ensure efficient insertion and removal, as well as effective dielectric contact and insulation from external variables such as humidity, temperature, and external charges that could impact the experiment's performance.

Our project proved the feasibility of creating a durable leaf-based film from grass fibers for a Triboelectric Nanogenerator (L-TENG). The experiment yielded a significant increase compared to the experiments performed in the lab the previous year, with an improved output open-circuit voltage of 375% (8V to 30V) and up to three significant figures in the current (800nA to 3uA). Totaling to a power density of 120uW/m^2. We are currently dedicated to enhancing these results to make a more significant impact.

Research Fellow: **Charlie Tourbaf (2025)** **Concentration:** **Environmental Economics**
Faculty Mentor: **Catherine Cardelús** **Department:** **Upstate Institute**
Title of Project: **Upstate Institute Summer Fellowship: The B-Team**
Funding Source: **Upstate Institute**
Project Summary:

The B-Team is an ongoing project at the Friends of Rogers Center in Sherburne, New York. Senior educator at Rogers, Ellen Rathbone, started the project a few years ago to identify the status of native bees in the area. This past summer, I worked as a Field School Fellow with the Upstate Institute to clarify the project objectives and establish a path toward achieving those objectives through different initiatives. Last year's Field School Fellow found that the Rogers Center property has a low to inadequate quantity of flowers and has low flower diversity. This means that native bees' ecological health is negatively impacted by their food source because it is a constraining factor for species richness and abundance. I took this information and determined that the Rogers Center must take action to increase food accessibility. Using funds from a grant that the Center received, I ordered a specialized mix of wild grasses, shrubs, and flowers to provide over 9.5 acres of new habitat space over the next three years that is better suited for native bees. This is important for multiple reasons. This new habitat space will benefit native bees' ecological health and will provide a good area in which to teach students and community members about native plants, the importance of bees and how ecosystems work. This space also educates by demonstrating to the community how to help the cause in a tangible way that, in my opinion, is more impactful and digestible than a pamphlet.

Most of the project was centered around the production of media for conducting outreach to teach the community about the project and encourage them to engage with the project. The goal is to make what seems like a complicated and niche topic interesting and fun. To that end, I hosted B-Team meetings and events this summer to teach people about the topic and to advance certain projects. These events consisted of informational sessions, habitat restoration projects, invasive species removal, and bee documentation field work. I found that fostering community was the best way to maintain people's involvement with the project, which is why I made T-shirts to be given to members so that the B-Team actually feels like a team.

Finally, I worked to formalize the B-Team's webpage so that those who are interested can learn more about native bees and interact with the project. I also started an effort to gain political support for native bees and create new contract requirements that benefit native bees and do not hinder productivity in farm land leases on the Rogers Center property.

Research Fellow: Talia Troy (2025) **Concentrations:** English; Philosophy

Faculty Mentor: Valerie Morkevičius **Department:** Political Science

Title of Project: Just War Theory and Practice in Eastern Orthodox Christianity

Funding Source: Center for Freedom and Western Civilization

Project Summary:

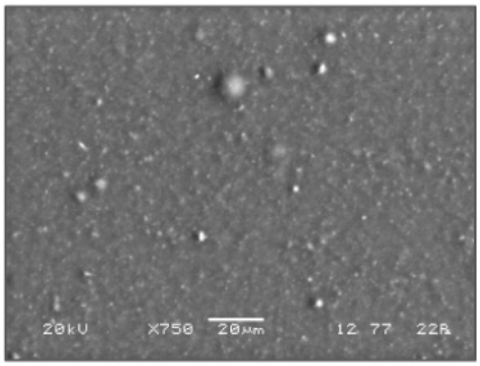
The concept of just war suggests there is a possible situation where war is justified. This way of thinking is not foreign to us, and within a secular scope of understanding, it is intuitive. Our understanding, as a society, of what it means to kill changes when the act is committed in a way we deem ethical or justified, i.e., to prevent a greater evil, in some kind of self-defense, or based on the intention of the actor. But how might the introduction of Christianity complicate this perspective? How might we reconcile war, which anticipates violence and killing, with Christianity which teaches turning your cheek and loving your enemy as yourself?

My research this summer focused on the way Christianity and war, as two things that seem necessarily inconsistent and contradictory are yet, throughout history, put into dialogue with each other. I spent the summer looking specifically at how Eastern Orthodox Christianity and one of her autocephalous heads, the Moscow Patriarchate, handles this issue. From pre-Christian attitudes towards war to the Christianization of Rome under Constantine and the veneration of military Saints in Orthodoxy, the Eastern Church has never established an official just war tradition, leaving room for different perspectives on the issue– whether philosophical, political, or theological. This project contemplates the pacifist and non-pacifist views, considering arguments and objections for both sides, finds a strong relationship between faith and the contemporary political stage, and ultimately favors a third empathetic perspective. This perspective redirects our focus by recognizing the moral and spiritual complexities of war and looking to pastoral care. This perspective accepts that while war cannot be justified or endorsed by the church, it should be addressed with understanding and compassion.

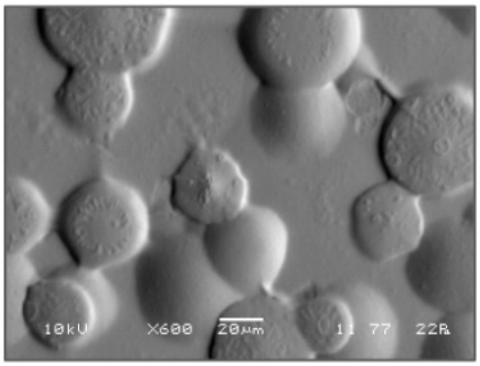
Research Fellow: **Jonathan Van Magness (2026)** **Concentration:** **Physics**
Faculty Mentor: **Ramesh Adhikari** **Department:** **Physics and Astronomy**
Title of Project: **Morphological and Electrical Properties of L-Phenylalanine Doped PEDOT:PSS Thin Films**
Funding Source: **NASC Division**
Project Summary:

In the world of biological electronics, conductive polymers are often complex chemicals that can conduct electricity through their chemical backbone. One such polymer, PEDOT:PSS (short for poly(3,4-et hylenedioxythiophene):poly(styrenesulfonate)), is commonly used for its stability, flexibility, and biocompatibility in a wide range of electronic devices. While using PEDOT:PSS for devices has its aforementioned upsides, the main drawback to PEDOT:PSS is that it is not as conducting as other common alternatives. Therefore, finding a way to make PEDOT:PSS more conductive, while also maintaining its other useful properties, would be highly advantageous in creating new bioelectronic devices.

While many different studies have found ways to treat PEDOT:PSS to make it more conductive, one particularly intriguing solution involves adding an amino acid, L-Phenylalanine (Phe), to PEDOT:PSS solution. This method has been proposed in recent years to improve the conductivity of PEDOT:PSS, however many of the physical properties of the films have not been tested. Additionally, the modified charge transport mechanisms of the PEDOT:PSS-Phe films are still not fully understood. As such, by mapping the surfaces of different PEDOT:PSS-Phe films with methods such as atomic force microscopy (AFM) and scanning electron microscopy (SEM), we can get a better sense of the morphological changes that the addition of different concentrations of Phe catalyzes. Also, by taking electrochemical impedance spectroscopy (EIS) measurements of the different films, we can get a better understanding of how the films can conduct alternating electrical signals at different frequencies.



Close up SEM image of 0% Phe (100% PEDOT:PSS) film. Note the relatively smooth surface morphology.



In 50% Phe films, globular structures form on the surface. The presence of these structures could be crucial in the enhanced charge transport in the films.

One important morphological characteristic that we explored extensively is the presence of globular structures on the surface of films with certain Phe concentrations. In particular, films made with a 1:1 ratio of PEDOT:PSS and Phe solution were typically covered with these structures. In general, this concentration of Phe was also the best conducting, suggesting that these structures may be involved with enhanced charge transport. While we do not yet fully know what these globules are made of or how they exactly form, visuals such as the SEM images above are a crucial start towards understanding the structural changes that Phe incurs in PEDOT:PSS films.

Research Fellow: **Vivian Viacobo (2027)** **Concentration:** **Undeclared**
Faculty Mentor: **Priscilla Van Wynsberghe** **Department:** **Biology**
Title of Project: **Understanding the Role of LIN-42 Regions in KIN-20 Mediated Effects**
Funding Source: **NASC Division**
Project Summary:

C. elegans is an ideal model organism for biological research due to its small size (up to 1.5 mm), transparency, rapid life cycle, and well-annotated genome. Approximately 40% of its genes are conserved in humans, which facilitates comparative studies and enhances our understanding of gene function. Additionally, the presence of both hermaphroditic and male reproductive systems simplifies genetic research, making *C. elegans* a valuable tool for exploring various biological processes, including the interplay between circadian and developmental rhythms. Throughout this summer, our lab has focused extensively on investigating the role of the circadian clock in *C. elegans* and its impact on developmental processes. We have studied how the internal circadian clock influences developmental timing and physiological functions. Moreover, our research has involved examining specific regions of the *C. elegans*genome to assess the importance of conserved genetic regions across different strains. This exploration aims to uncover how these conserved regions contribute to the circadian and developmental mechanisms within the organism, furthering our understanding of the genetic underpinnings of these processes.

C. elegans express homologs of multiple different circadian clock proteins. These homologs are important in development and other processes. Central to the circadian clock is the Period protein, LIN-42, which oscillates in accordance with the molts. This oscillation is controlled in part by KIN-20, a double-time and a CK1ε homolog which phosphorylates LIN-42. The lab developed a CRISPR tag to analyze LIN-42 levels. Further, an OLAS tag was used to analyze the KIN-20 levels. This summer, we were able to explore an important region of LIN-42 that impacts KIN-20, known as the 3Sdel region. The 3Sdel region is a highly conserved region of Serines within amino acids 604-629 that plays a key role in PER function in *Drosophila*. The lab used CRISPR to delete this conserved region within *C. elegans* creating the 3Sdel mutation.

We grew the wildtype and 3sdel *C. elegans* to different timepoints in the L3 and L4 stages and extracted protein from these samples. We then analyzed LIN-42 protein using a Western blot method in which we were able to visually see the protein being expressed and then able to quantify the levels within the time points. Although the results were varying across the different trials, our preliminary results show that removal of the 3Sdel region resulted in higher levels of protein expression. These results suggest that the 3Sdel region plays a crucial role in the regulation of LIN-42. In the future we would like to more closely examine the phenotypes of *C. elegans* when this region is being deleted. Additionally, we would like to mutate the amino acids of the 3Sdel region from Serines to Alanines. This will allow us to explore the possibility if either the Serines are affecting protein expression or regulation of LIN-42. Further, we hope to in the future use immunoprecipitations to determine if Lin-42 and KIN-20 interact and if 3Sdel perturbs this interaction. Altogether these studies will help us better understand how this essential conserved protein is regulated in *C. elegans*.

Research Fellow: Neha Viradia (2025) **Concentration:** Physics

Faculty Mentor: Ramesh Adhikari **Department:** Physics and Astronomy

Title of Project: Development of Leaf-based Hydro-voltaic Devices

Funding Source: National Science Foundation Grant

Project Summary:

With the increasing demand for electronics for a growing number of applications, electronic waste created after discarding these devices continues to grow. This poses a growing threat to environment and public health as most of the electronic devices are discarded releasing heavy metals and other chemicals into the soil and water sources.. Therefore, using bio-based materials for electronics could be an alternative for minimizing the environmental footprint of electronic devices. Here, we present our work on the development of a leaf-based hydr-voltaic power generator that can generate power from the movement of moisture due to the concentration gradient of water. Using microporous leaves developed using chemical treatment, and sandwiching them between metal/carbon electrodes as current collectors, we have been able to generate substantial current and voltage over time. In order to create the device, leaf samples were soaked in NaOH at 85 degree C for two hours in order to create micropores in the leaf and add -OH groups to the leaf. This functionalization makes the leaf more hydrophilic, increasing the tendency for water to move through the leaf. Voltage and current are created as water ions move through the leaf along a concentration gradient. A concentration gradient is created as water ions collect on the bottom carbon electrode, travel through the leaf, and evaporate through the aluminum mesh electrode on the top of the device. In conclusion, these devices show great potential for power generation. The highest voltage generated from our device is 1.4 V and the highest current generated from our device is 30 mA. In the future, we hope to test these devices with load resistances, take SEM images of the leafs, charge capacitors, and more. We hope to gather more data in order to look into the nuances of how exactly our device works.

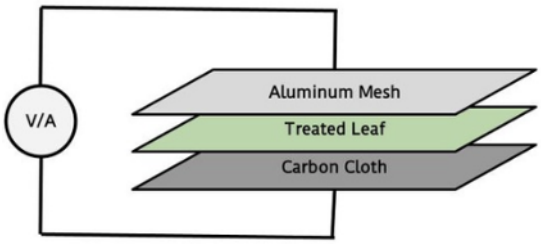


Figure 1. (left) Schematic of device

Figure 2. (right) Photograph of assembled device

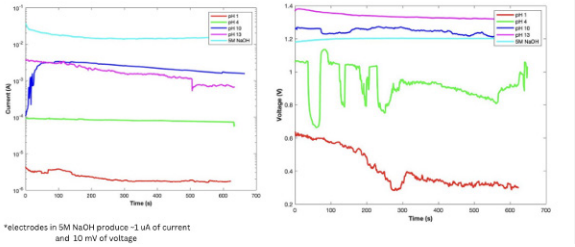


Figure 3. Current (left) and voltage (right) vs time for a treated leaf device where the leaf (post treatment) was soaked in different pH solutions. Solutions were made with NaOH and HCl.

Research Fellow: **Matt Walinski (2026)** **Concentration:** **Environmental Biology**
Faculty Mentor: **Myongsun Kong** **Department:** **Geography**
Title of Project: **Creation of a Pathway Database for ITS Using GIS**
Funding Source: **Information Technology Services; SOSC Division**
Project Summary:

The communication conduits and fiber pathways across Colgate's campus are essential for the university's internet, telephones, televisions, and more to work correctly. Colgate's ITS department manages these pathways and are constantly modifying them with recent developments to campus. This project was aimed to organize and consolidate the locational information about these conduits and fiber pathways with the creation of a database using GIS (Geographical Information Systems) that allows for organizing current data as well as additions of new pathway information.

Current information on these communication pathways were provided by ITS such as master maps and spreadsheets. This information was sorted through and transferred onto ArcGIS Pro and ArcGIS Online in order to develop a map and database that efficiently stores this data. Information such as the active status of these lines, their use, size, quantity, material, and more were stored into tables that corresponded to pathways on the map. Pull boxes, junctions, blue lights, telephone poles, data centers, data closets, and press box locations throughout the campus and downtown Hamilton area were added onto the GIS map, adding their specific information into tables that will fit into the database.

At the end of the summer research period, all information provided by ITS has been formatted into a map with tables of information that correspond to such lines, allowing for the future development of a complex, integrated database that displays not only more information but more accessible information for infrastructure planners and ITS, allowing for campus planning and advancements in technology.

Pictured: Screenshot of the current map of communications pathways with legend on right. In the GIS, each line and symbol are able to be selected, with specific information to that item being displayed nearby.

Research Fellow: Anzi Wang (2025) **Concentrations:** Philosophy; Computer Science

Faculty Mentor: Grusha Prasad **Department:** Computer Science

Title of Project: Using (adaptation to) uncertainty expressions as a tool to study confirmation bias

Funding Source: Mind, Brain and Behavior Scholars Award

Project Summary:

We often talk about uncertain events in our day-to-day conversations, and we converse about such events with expressions that indicate varying degrees of uncertainty like "might" and "probably". In this work, we examine whether our usage of uncertainty expressions is influenced by confirmation bias, namely our tendency to interpret information in a way that confirms what we already believe to be true. Do people become more confident when the data aligns with their preference and less confident when the data doesn't? If a Democratic voter, who tends to use "might" for events of 60% probability, sees a prediction where the Democratic Party has a 60% chance of winning, will they be more confident and say something like "the Democratic Party will probably win"? If a Republican voter sees the same prediction, will they become less confident when using uncertainty expressions, as the predicted outcome denies their preference? To answer these questions, we set up a psycholinguistic experiment where participants decide how to use uncertainty expressions under different contexts.

In our study, we designed two scenarios where participants are presented with events of uncertain outcomes. Using sliders, participants are asked to indicate how likely they are to use different sentences to describe possible outcomes. One scenario is where participants are shown a gumball machine filled with purple and orange gumballs before a random one being dispensed; the other scenario is where participants are shown a simulation of possible election outcomes between the Democratic Party and the Republican Party. In each scenario, there are 9 conditions where probability of events varies from 10% to 90% with increments of 10% (e.g., the probability of a purple gumball being dispensed is 10%; the probability of the Democratic Party winning is 10%). For each condition of both scenarios, participants answer how likely they are to use "probably" and "might" for possible outcomes, i.e., a purple/orange gumball being dispensed, or the Democratic/Republican Party winning the election.

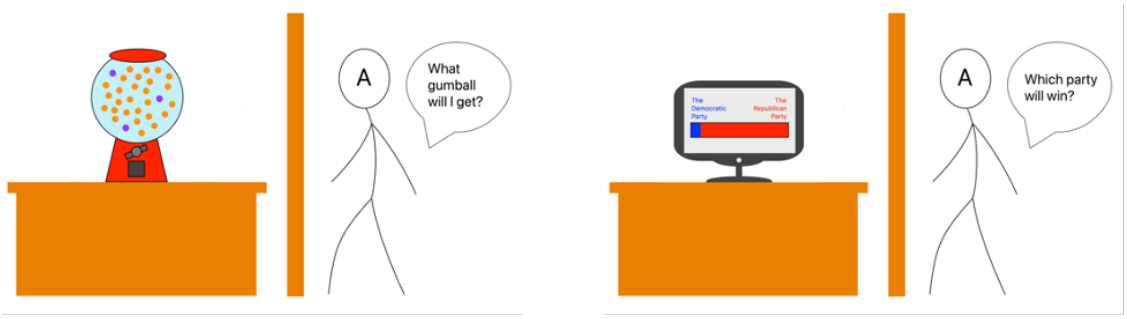


Figure 1: Sample trials of gumball and election conditions

Our hypothesis is that participants who hold strong political preference will show confirmation bias towards the party they support and little or no bias towards the colors of gumballs. In other words, we predict that Democrats will use uncertainty expressions more confidently in sentences like "The Democratic Party will probably/ might win" in the election condition, as compared to sentences like "You will probably/ might get a purple gumball" in the gumball condition. Affected by strong desires to see the Democratic Party win, their perception of how likely the Democratic Party will actually win in given stimuli will become distorted. When the objective probability of getting a purple gumball and the Democratic Party winning are both 60% in two separate trials, Democrats will speak more confidently about the latter. We also expect to observe a similar pattern in Republicans affected by confirmation bias.

This summer we refined our hypothesis and our experiment design, published a pilot experiment on Prolific where we recruited 32 participants in the US, and established a pipeline for data analysis needed for this experiment. In the academic year, we will publish a finalized version of the current experiment, and conduct follow-up studies on how adapting to a speaker that holds no or opposite preference towards election outcome would change a participant's usage of uncertainty expressions. We will also build computational models under the Rational Speech Act (RSA) framework to lay down theoretical foundations for our hypotheses, and compare different models' predictions with empirical data collected from future experiments.

Research Fellows: Victor Wang (2025) — **Concentrations:** Mathematical Economics; Computer Science
Yabesi Witinya (2026) — **Concentration:** Computer Science
Faculty Mentor: Joel Sommers — **Department:** Computer Science
Title of Project: Analyzing the Domain Name System Graph
Funding Source: National Science Foundation Grant
Project Summary:

The Domain Name System (DNS) can be likened to an internet phonebook, mapping domain names like google.com to IP addresses, the unique identifiers of all internet-connected devices. Unlike a traditional phonebook, DNS can map one name to multiple IP addresses, and vice versa, or even multiple names to multiple addresses. In our research, we focused on the largest category of DNS mappings: singletons, where one name maps to one IP address. By analyzing DNS records collected by the Rapid7 Sonar project, we discovered that many names previously classified as singletons were, in fact, not, raising questions about the data collection methods. However, the most intriguing finding was that approximately 80% of true singletons embed the IP address within their names. This breakthrough enhances our understanding of singletons and paves the way for generating new domain names. Initial tests show promising results, suggesting that informed guessing could significantly expand our DNS dataset and improve the accuracy and richness of our records.

Validating the Singletons

In our research, we compared the A record singletons collected in January 2023 against the reverse DNS (rDNS) records. We identified approximately 106 million records whose singleton status was uncertain. By employing zDNS to retrieve PTR records and comparing these with the initial A records, we discovered that around 37 million of these records were not singletons. This finding calls into question the data collection methods used by Rapid7 and underscores the need for a more reliable DNS record source. We replicated this validation process with singleton records collected in March 2024, obtaining similar and significant results. This consistency strengthens our confidence that the discrepancies observed in the 2023 data are not attributable to time differences.

Analysing the naming conventions of the singletons

Using regular expressions (regexes), we analyzed the naming conventions of singletons to identify patterns where IP addresses are embedded within names. By breaking down names based on effective Top Level Domains (eTLDs) and eTLDs + 1, we were able to match and classify a portion of these names into distinct categories. Notably, 80% of these names embed the IP address in some form. This embedding can occur as a complete IP address, a complete reverse IP address, or occasionally two to three segments of the IP address within the name. Names with the entire IP address embedded constitute about 75% of all singletons in both the March 2024 and January 2023 datasets. This analysis enhances our understanding of the structural patterns within singleton names and provides a foundation for generating new domain names through informed guessing.

Research Fellow: Alexa Watson (2026) **Concentrations:** Philosophy; Political Science
Faculty Mentor: Hibi Pendleton **Department:** Philosophy
Title of Project: Uncovering the Ethical Challenges and Implications of AI to the US Judiciary and Legal Profession
Funding Source: Center for Freedom and Western Civilization
Project Summary:

The integration of Generative Artificial Intelligence (GenAI) into the legal field offers both remarkable opportunities and significant ethical challenges. While GenAI can enhance efficiency by automating routine tasks and allowing lawyers to focus on complex legal reasoning, it also poses serious ethical risks. The aim of this paper is twofold. The first section provides an overview of the ethical worries raised by the use of AI in law. Understanding these issues, including confabulations and breaches of information integrity, is crucial as they highlight the importance of addressing practical challenges to upholding the ethical standards outlined in the ABA Model Rules. The second section of this paper explores the deeper ethical implications of the use of AI in law. It ultimately reveals the implicit threat that the technology poses to prevent what Tocqueville, Montesquieu, and Hamilton identified as one of the greatest dangers to constitutional democracy: the tyranny of the majority. Exploring these deeper implications shows how the use of AI systems can violate core legal values by perpetuating existing biases, marginalizing minority perspectives, and compromising the fairness of legal processes overall.

The philosophical insights of de Tocqueville, Montesquieu, and Hamilton set the foundational ethical requirements that legal professionals must follow. To uphold their principles and moral values when using GenAI, there is a need for rigorous scrutiny, transparency, and adherence to ethical guidelines to prevent the tyranny of the majority and secure justice and fairness in legal processes. Concrete examples involving pivotal legal cases, as well as popular AI tools, highlight the real-world impact of AI on legal proceedings. These examples demonstrate the ethical risks of AI and the necessity of taking steps to mitigate these risks so that the legal profession can better uphold the core values expressed by our founders. By acknowledging and understanding the problems and implications raised in sections one and two of this paper, legal professionals can equip themselves to harness AI's potential without undermining foundational constitutional commitments as they advance into an increasingly technological future.

Marr, Bernard. How Generative AI Will Change The Jobs Of Lawyers ADOBE STOCK. 2024. https://www.forbes.com/sites/bernardmarr/2024/03/14/how-generative-ai-will-change-the-jobs-of-lawyers/.

Research Fellows: Ellen Weinstock (2026) **Concentrations:** Religion; Political Science
Natalie Yale (2026) **Concentration:** Religion
Faculty Mentor: Megan Abbas **Department:** Religion
Title of Project: Religion and US Foreign Policy in Indonesia
Funding Source: J. Curtiss Taylor '54 Endowed Student Research Fund
Project Summary:

As part of on-going research for the professor's new book, this project examined the intersection between religion and U.S. foreign policy in Indonesia from 1950 to 1960. While the larger book will investigate how American governmental institutions like the State Department, the CIA, and the United States Agency for International Development (USAID) and major non-governmental organizations like the Rockefeller, Ford, and Asia Foundations, this summer focused on American relationships with Muslim actors as a way to counter the rising popularity of Communism. The two students were assigned two distinct time periods to individually work on. One student reviewed the period of 1950-1955 and the other student looked at the rise of a rebellion in the region of Sumatra from 1956-1958 and how the United States was deeply tied with this rebellion. The first six weeks of the project were devoted to reading and annotating over 5,000 pages of declassified documents from the National Archives in College Park, Maryland. In the seventh week of the project students shifted their focus from engaging with primary sources to compiling notes and considering existing scholarship. The final week of the project began with scheduled travel to Cornell University's Carl A. Kroch Library where one student retrieved additional primary sources housed in the Division of Rare and Manuscript Collection and the other utilized the Cornell databases to complement their previous archival research with secondary material unavailable through the Colgate library. Overall, the students were successful in learning about their respective periods and producing summations of their documents to allow the professor to effectively assess next steps in their research and begin analyzing material.

1950-1955
Material from this time period consisted largely of communication between the Department of State and U.S. embassies in Indonesia. With particular attention to efforts by the United States to mobilize Muslims against Communism, the student compiled notes from these documents into three broad categories: Islamic dissident activity, Elections, and Anti Communism. From these categorizations the student produced three timelines charting U.S. involvement in Indonesia and then three written reports intended to support and direct the professor's future inquiry. In addition, this student traveled solo to the National Archives in College Park, Maryland where they scanned over 500 pages of archival material.

1956-1958
The other student looked at the time period of 1956-1958 in the region of Sumatra in Indonesia which was defined by a period of rebellion against the Central Government of Indonesia. During this time period the student looked at the relationship between defected Colonels of the Indonesian Army and members of the Islamic political party "Masjumi" with the United States Government. After reading the declassified documents from this time period, the student organized chronologically the events of the rebellion in order for the professor to effectively analyze this information in the future.

Research Fellow: Teagan Williams (2025) **Concentrations:** Neuroscience; Molecular Biology

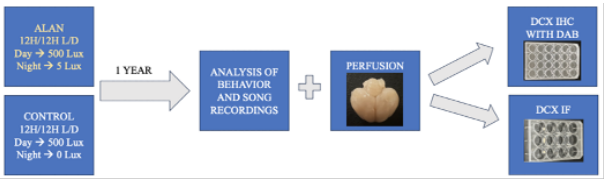
Faculty Mentor: Wan-chun Liu **Department:** Psychological and Brain Sciences

Title of Project: Investigating the effect of chronic light pollution on adult neurogenesis in the vocal learning circuit of male zebra finches

Funding Source: NASC Division

Project Summary:

Light pollution has become a major problem across the world, especially in big cities in which the streets are always lit. Chronic light exposure has been shown to create a variety of issues in humans including disruption of the circadian rhythm, increased risk of several cancers, and sleep disorders (Chepesiuk, 2009). This project uses a songbird (zebra finch) model to understand how light pollution impacts vocal learning and the neural circuits involved. We asked the question: Does chronic light exposure disrupt adult neurogenesis in a cortical song nucleus "the High Vocal Center (HVC)" of male zebra finches? Adult neurogenesis is an important measure of environment-induced brain plasticity because the environmental stressors can reduce the recruitment and addition of new neurons in adults which can lead to changes in neural circuits, wiring and associated learning and memory (Brenowitz, 2015). The HVC in male zebra finches plays a nearly identical role as Broca's area does in humans; it controls motor output, speech production, and speech learning by integrating auditory information. It is essentially the command center for bird song (Mello, 2014). We exposed the birds to chronic light for their entire lives. This condition was called Artificial Light at Night (ALAN). We used two different techniques to measure new neurons in the HVC of zebra finches. BRDU immunofluorescence and DCX immunohistochemistry. BRDU is a synthetic thymidine analog which inserts into DNA during replication, marking proliferating cells. Doublecortin is a protein that is present in neural precursor cells (Kubikova, 2020). This protein was labeled through two different techniques: DAB IHC and IF. The DAB IHC was the initial protocol, however we ran into issues of debris and had to troubleshoot. We used several different protocols to eliminate the debris, but they were all inconsistent. I was not able to obtain any quantifiable results due to the time restraints of the summer, however, we now have two potential tools available to study neurogenesis in songbirds. Along with continuing this project, future studies can also be done to quantify the neuronal density in the song nuclei to help us understand a potential mechanism by which ALAN disrupts the neural circuits that control song learning.



Research Fellow: George Wilson (2025) **Concentrations:** International Relations; French

Faculty Mentor: Jill Harsin **Department:** History

Title of Project: Lampert Institute for Civic and Global Affairs

Funding Source: Center for Freedom and Western Civilization

Project Summary:

French secularism, known as *laïcité*, reflects a unique approach to the separation of church and state, shaping the country's laws on religious expression in public spaces, including schools. Originating in the late 19th and early 20th centuries, *laïcité* aimed to curb the Catholic Church's influence over politics, solidifying with the 1905 Law on the Separation of Church and State. Initially a tool to reinforce state neutrality and protect freedom of conscience, laïcité has evolved over time, particularly as France's religious landscape has diversified. Recent interpretations, however, have brought scrutiny, with critics arguing that secular laws disproportionately restrict certain Muslim religious practices. This essay examines the historical context, legal precedents, and the shifting applications of *laïcité*, exploring how this principle has morphed from a check on clerical power into a more complex regulatory framework for religious expression. Understanding these shifts sheds light on France's evolving identity, civic values, and electoral dynamics in a multicultural society.

Research Fellow: Natalie Woodson (2026) **Concentration:** Psychological Science
Faculty Mentor: Julie Dudrick **Department:** Upstate Institute
Title of Project: Empowering Voices: Self Advocacy at Pathfinder Village
Funding Source: Upstate Institute
Project Summary:

This summer I had the opportunity to work with Pathfinder Village through the Upstate Institute Summer Field School. Pathfinder Village is a community that provides support for individuals with Down syndrome and other developmental disabilities. Their mission is to promote a healthy, progressive environment that respects the individual and supports a life of value and independence. They were originally established in 1922, and are located in Edmeston, NY. They are now a 300-acre organization, including a private school, summer camp, residential and clinical facilities, and a research center. Pathfinder is a national leader in their community-based services. I worked directly with the Kennedy-Willis Center (KWC), which is Pathfinder's center for advocacy, research, and education. The KWC serves as an independent advisor for Council Rock, which is a self-advocacy group run by adult men and women who live at Pathfinder. Members of this group meet weekly to discuss equal access, independence, and volunteerism.

My project focused on raising awareness and building community bonds for the Council Rock group. I worked with Pathfinder Village's head of marketing to rework the Council Rock website. This included adding photographs that I took at meetings and reorganizing the information to better communicate the message and achievements of the group. I compiled a mailing list of 125+ local businesses, civic organizations, and schools. This list was used to send out a Council Rock postcard to spread awareness about the group and encourage future volunteerism. Finally, most of my work this summer centered around planning a community-wide event using grant money awarded from the Community Foundation of Otsego County. I conducted research into the best venues and activities to facilitate building community bonds and stay within the grant budget. I encountered several barriers in the planning process, but eventually executed a rock painting event at a local coffeehouse. This was built around Pathfinder's existing #DsRocks campaign, a global celebration where people can show support for those with Down syndrome through positive messages on handpainted stones. The event's ultimate goal was to raise awareness of the abilities of children and adults with Down syndrome and their roles in our communities, while also connecting Council Rock members more personally with their surrounding area. Finally, I presented my work to the KWC Executive Board, in a reciprocal exchange of feedback about my accomplishments and experience this summer.

I hope my work this summer has helped to communicate to the local population about the importance of self-advocacy and Council Rock's mission. As the group continues to operate, I hope my contributions will serve as a platform for more collaboration, awareness, and support for self-advocacy in the future. I have personally learned and grown a lot from this experience. Primarily, I have learned about Pathfinder's important role in their community and the importance of inclusivity and self-advocacy. I have also gained valuable skills in effective communication and problem-solving. I used this summer experience to explore different ways of using my Psychology degree to help others. These skills will be invaluable as I finish my time at Colgate and focus on my future career.

Thank you to Pathfinder Village and the Upstate Institute for this incredible opportunity.

Research Fellow: Katrina Wright (2026) **Concentration:** Environmental Geography

Faculty Mentor: Mike Loranty **Departments:** Geography; Environmental Studies

Title of Project: Uncertainty in Beaver Dam Identification from High Resolution Satellite Imagery

Funding Source: SOSC Division

Project Summary:

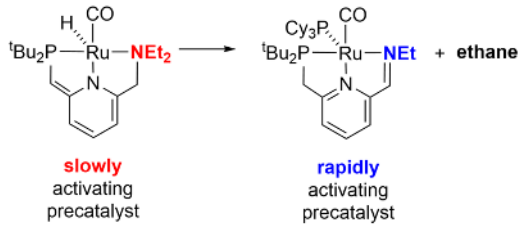
Observed increases in beaver activity in the Arctic has driven research surrounding changes in the distribution of beaver dams and wetlands. As ecosystem engineers, beavers alter landscapes in ways that influence ecological responses to climate change. Mapping changes in beaver dam distributions and densities allows us to visualize the increase in beaver activity. In order to spatially analyze the changing distribution of beavers and beaver dams, accurate maps must be produced. Most beaver dam maps are currently derived from manual interpretation, and any mapping derived from machine learning methods still requires manual training data. Lack of a systematic approach to beaver dams and wetlands digitization introduces uncertainty into the mapping process.

To evaluate the accuracy of digitized dams, multiple analysts identified and digitized beaver dams at a series of set locations in Alaska using a variety of readily accessible sources of high-resolution imagery. Analysts also rated how confident they were in their dam identification. Along some stream segments where each analyst identified a similar number of dams, over half were commonly identified. However, accuracy varied between stream segments and in some cases fewer dams were identified by all analysts. Dams with higher confidence ratings were not more likely to be commonly identified by multiple analysts. Using maps of land cover and related variables, we explore the landscape factors likely to influence uncertainty in beaver dam identification. This analysis demonstrates the variability in dam identification between analysts and highlights the need for structured identification protocols.

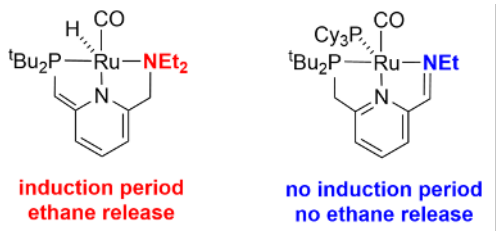
Research Fellow: David Ye (2027) **Concentration:** Undeclared
Faculty Mentor: Anthony Chianese **Department:** Chemistry
Title of Project: Identifying the Active Catalyst in Ru-PNN Complexes Catalyzed Hydrogenations and Dehydrogenations
Funding Source: National Science Foundation Grant
Project Summary:

This project aimed to investigate how a precatalyst is activated to become the active catalyst that can accelerate hydrogenation and dehydrogenation reactions. Hydrogenation stands for a substrate reacting with hydrogen to form the product with the presence of catalysts, and dehydrogenation is the reverse side of it. The precatalyst, $RuPNN^{dearom}$, will release ethane after heating to become the active catalyst for ester hydrogenation (a category of hydrogenations). We want to find out whether this activation process is also essential for other hydrogenations and dehydrogenations.

Ruthenium complexes bearing PNN-pincer ligands with diethyl side groups, which have previously been reported to be active precatalysts for ester hydrogenation, undergo dehydroalkylation on heating in the presence of tricyclohexylphosphine to release ethane, giving five-coordinate ruthenium(0) complexes containing a nascent imine functional group. Thus, it's significant to find out whether there are observable induction periods in other hydrogenation and dehydrogenation reactions occurring concomitant with ethane release. We quantified ethane release over time and did detailed mechanistic analysis with the data obtained from Gas Chromatography and Hydrogen Nuclear Magnetic Resonance instruments.



(1) Precatalyst Structure and Formation



(2) Precatalyst Hypothesis

Preliminary results show that ethane is also released under the conditions of catalytic ester hydrogenation, carbonate hydrogenation, alcohol coupling dehydrogenation, and amine-alcohol coupling dehydrogenation. Interestingly, time-course studies show that this release is concomitant with the onset of catalysis for all hydrogenations, but dehydrogenation reactions started immediately without an induction period. The alcohol-ester coupling, amine-ester coupling, CO2 hydrogenation, and amide hydrogenation are not done due to time limit but will be done in the future. Future works will also be done to understand the difference between hydrogenations and dehydrogenations.

Research Fellow: Yuki Yuan (2025) **Concentration:** Educational Studies

Faculty Mentor: Meg Gardner **Department:** Educational Studies

Title of Project: Fostering STEM Teacher Identities Through Engagement in the Virtual Galápagos (VG) Program

Funding Source: SOSC Division

Project Summary:

My research project this summer was to study the efficacy and effectiveness of the Virtual Galápagos (VG) program, which is a web-based, interdisciplinary project (Geology, Biology, and Educational Studies) that aims to create interactive scientific lessons and activities for upper elementary education. This program, centered on the study of the Galápagos Islands, also aims to enhance participants' teaching skills and deepen STEM knowledge. My role in the project was to observe the participants, paying close attention to their perceptions of the formation of teacher identity. Thus, the central research question guiding my investigation was: How does participation in the interdisciplinary curriculum design program (VG) help support the formation of teacher identities?

To explore this question, I employed a qualitative research design with Professor Gardner. Data were collected through semi-structured entrance interviews and exit interviews from all participants, video recordings of group activities and discussions, weekly journals written by all members, and transcriptions of all materials. For the entrance interviews, 700 open codes were derived from all participants, which were then categorized into 5 distinct themes through step-by-step qualitative analysis. This comprehensive approach provided me with a deep understanding of participants' experiences and perspectives. During the annual poster session, I also presented my research findings to different audiences.

I found that participants from both 2023 and 2024 emphasized the importance of hands-on activities, which were often missing in their previous educational experiences. This practical engagement is crucial for their development as educators. As one participant noted, ---"Probably if I had more hands-on in high school and college. I mean, I like science. But if I had more hands-on, I probably would enjoy science like a lot more." Collaborative learning was also highly valued, with participants highlighting previous teamwork experiences and the supportive environment of the VG program. This collaboration fostered a sense of community and shared goals, essential for teacher identity formation. Furthermore, participants had varied levels of confidence with technology but recognized its importance. The VG program's focus on technology helped bridge this gap, developing essential digital skills. For example, participants were taught to make videos through Canva, which is new to nearly all participants from this year. Finally, creativity and innovation were also highly valued, with participants seeking to develop engaging teaching methods. The VG program's focus on innovative curriculum design helped develop creative problem-solving skills. As one participant expressed, ---"The creativity we are encouraged to use here is amazing. It's refreshing to be able to try new things and see what works."

As an observer, I noticed that participating in the VG program is a valuable experience, significantly supporting pre-service teachers and the formation of STEM teacher identity. The program's emphasis on hands-on activities, collaborative learning, technology integration, and creativity enhanced participants' confidence and competence as potential educators. One of the most profound realizations was seeing how the learning mirrored our teaching goals. This parallel between being taught and teaching methods reinforced the importance of reflective and adaptive teaching practices. The support and collaboration within the program created a nurturing environment that encouraged growth and innovation. Overall, I concluded that the Virtual Galápagos program demonstrates its effectiveness in preparing future STEM educators. This comprehensive approach not only enhances participants' STEM identities but also equips them with the skills needed to succeed in modern educational environments.

Research Fellow: **Marisa Zarcone (2025)** **Concentration:** **Mathematics**
Faculty Mentor: **Bruce Moseley** **Department:** **Upstate Institute**
Title of Project: **United Way of Mid Rural New York**
Funding Source: **Upstate Institute**
Project Summary:

This summer, I had the opportunity to join the United Way of Mid Rural New York (UWMRNY) as a Field School Fellow with the Upstate Institute. My experience was nothing short of transformative, providing me with a deeper understanding of the region in which Colgate sits. In just ten weeks, I grew immensely as a community member, a researcher, and a rising senior seeking to integrate my academic knowledge with practical experience in order to address local, real-world issues.

There is no such thing as a typical day at the United Way. The fall season is set aside for campaign, the annual period in which UWMRNY conducts intensive fundraising efforts aimed at supporting various local programs. The campaign season consists of community events, such as an August cornhole tournament, and coordinating workplace giving programs, where employees opt to make tax-deductible donations via automatic payroll deduction. UWMRNY also raises funds through corporate partnerships, individual donations, and grants. Money raised locally stays local and is reallocated to nonprofit organizations in the four-county region through the Request for Proposal (RFP) application process.

Funds are raised in the fall, RFP review and allocation extends into the winter, and relationships with local businesses and community organizations are nurtured throughout the spring and summer. Year-round, UWMRNY acts as the lead agency of the Chenango-Delaware-Otsego Community Organizations Active in Disaster (CDO COAD), distributes books to young children through the Dolly Parton Imagination Library, and spearheads initiatives such as the Chenango Microloan Project and the Regional Dental Task Force. They also help operate and fund 211, the three-digit number that individuals can call to obtain social services. It is the constant commitment to addressing the diverse and evolving needs of the community that makes every day in the Norwich office different.

When I was not participating in committee meetings or working with my supervisors to learn about UWMRNY's existing processes, I focused my time on two main projects. The first project involved expanding the CDO COAD, the umbrella organization that brings together agencies and groups that want to assist during an emergency but are not part of the formal response system. I worked with the COAD Membership Committee to identify gaps in services and, in an effort to fill those gaps, invited government officials, nonprofit agencies, corporations, and faith-based organizations to join the COAD. I organized member contact information by service provided in a spreadsheet and directory. My second project entailed preparing technical assistance materials for United Way partners to reference as they apply for RFP funding. For the first time since the merger in 2023, nonprofit agencies in Madison, Chenango, Delaware, and Otsego counties will be applying for UWMRNY dollars through one common application. In order to provide support to community organizations in the four counties, I created FAQ sheets and one-pagers that outline the process and highlight the United Way's funding priorities for the upcoming two-year funding cycle (2025-2026). These projects provided me with valuable insights into nonprofit operations and the importance of collaborative efforts in emergency response and resource allocation.

Research Fellow: Leyi Zhang (2026) **Concentration:** Educational Studies

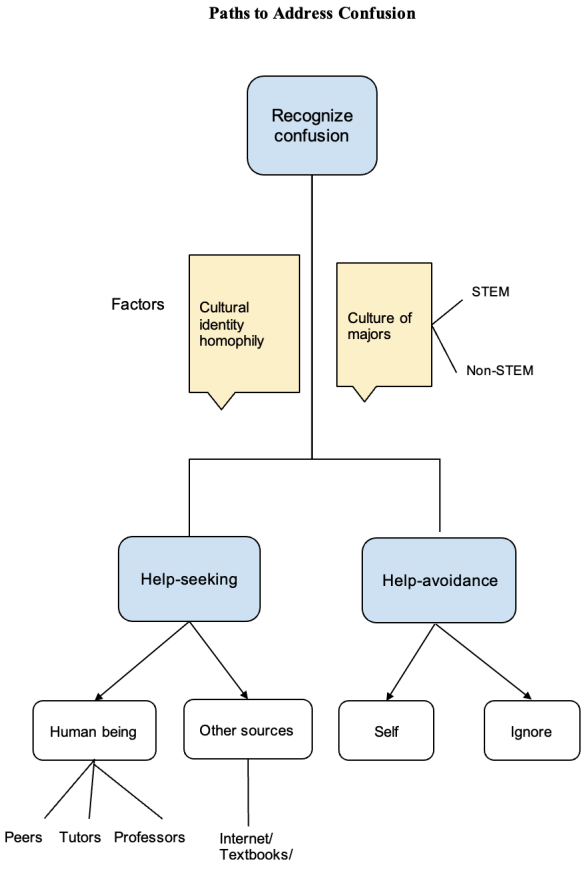
Faculty Mentor: Allison Zengilowski **Department:** Psychological and Brain Sciences

Title of Project: International Undergraduates' Responses to Academic Confusion: How Culture Homophily and Discipline Culture Inform Academic Help-Seeking Behaviors

Funding Source: NASC Division

Project Summary:

Academic confusion is so commonly encountered during learning that we often overlook the factors that prompt confusion and inform how people respond. Oftentimes, learners respond to confusion in two general ways: seek help from other resources, and avoid asking for outside help — including resolving confusion on their own or ignoring the confusion (Aleven, 2013; Zengilowski, 2021). Decisions about whether to seek help and how to respond to confusion can be impacted by several internal and external factors, such as whether they share cultural identities with professors or what the disciplinary culture is for their course (Chen & Kizilcec, 2020; Oh et al, 2024; Zusho & Barnett, 2011). In particular, international students might face additional challenges when encountering confusion due to cultural differences (Yeh & Inose, 2003). In the current era, investigating international students' learning experiences and the potential motivations behind their actions could provide useful information to assist in improving pedagogical practices for the growing population of international students in U.S. higher education (BestColleges, 2023).



In this study, I will examine confusion through one-on-one, in-depth interviews, aiming to identify potential factors that impact students' decision-making in responding to confusion. I will first investigate if shared cultural identity between instructors and students informs students' active help-seeking behaviors for addressing confusion before considering the role of the broader disciplinary culture. During the summer, I conducted a literature review which I used as a foundation for preparing the interview protocol. Different from using quantitative methods, I aim to figure out patterns and phenomena from students' stories, taking account of their unique characteristics and personal in/external factors. I also did a pilot interview to test the availability of the interview protocol, and continually make revisions on interview questions. I am compiling an IRB proposal so that I can collect data next semester. Data will be analyzed utilizing reflexive thematic analysis to seek social patterns of specific populations by identifying themes from coded data. A close review of the effects of the instructor-learner shared cultural identities could further provide implications for teacher training, and skills improvement. If I find varying patterns of confusion coping for students in different academic disciplines, this study could provide recommendations for how to better support students depending on their majors, and suggest more adaptive pedagogical and socioemotional strategies targeting specific disciplines.

Research Fellow: Joyce Zheng (2026) **Concentrations:** English; Psychological Science

Faculty Mentor: Meg Gardner **Department:** Educational Studies

Title of Project: Exploring Group Consensus During STEM Curriculum Content Selection: A Case Study of the Virtual Galápagos (VG) Program

Funding Source: SOSC Division

Project Summary:

The Virtual Galápagos (VG) Program is a joint two-year summer program involving the collaboration between the Educational Studies and Geology departments. It employs students from varying backgrounds and concentrations as pre-service teachers. This program aims to create an engaging web-based curriculum focused on a new "mystery" on the Galápagos islands for students in grades four through six. This summer, the pre-service teacher participants researched, collaborated, and created curriculum content revolving around the mystery of the Vampire Finches through various lesson modules in the form of videos, lesson plans, and worksheets on science topics such as islands, adaptations, ancestry, and ecosystems. To generate high-quality curriculum materials, participants must constantly engage with each other in a group setting to generate, select, and refine content to achieve the program's goals. An important phase of this shared effort is the ideation process, the third stage of the Stanford D. School Design Thinking Process. My role as an Educational Studies research assistant was focused on observing the participants as I actively collected and analyzed qualitative data to examine how they navigated through the ideation phase of the design thinking process.

The primary objective of my section of the VG project was to understand the mechanisms through which participants select content in group settings such as brainstorming and storyboarding sessions. A research question was proposed to explore this topic: "How do participants in an interdisciplinary curriculum design program such as Virtual Galápagos (VG) select STEM content during episodes of group consensus building?" A qualitative research approach was employed to achieve these goals. Video recordings of group ideate sessions from 2023 that a previous research assistant had already collected were transcribed using Otter.ai; meanwhile, 2024 VG group ideate sessions had to be recorded and transcribed this year by me with the help of a current fellow research assistant. There were 156 minutes of recorded ideation sessions from participants in the 2023 and 2024 groups. The transcriptions of the recordings were coded for specific tasks and activities related to the ideation process using Atlas.ti. Pictures of brainstorming sessions in different stages were also taken into account, they were analyzed and displayed as word clouds as visual aids to show the process of these group consensus sessions along with the frequency and co-occurrence analysis of the ideation activities (codes).

This project has produced data and findings that contribute to the limited research base on how pre-service teachers negotiate curriculum decisions within the design-based thinking framework and was presented at the annual poster symposium in July. Participants were most comfortable proposing, adding on, and clarifying ideas which sparked further conversations. Findings from this study suggests that explicit time for proposing idea statements, elaboration and posing questions are needed when organizing design based development sessions which help leverage educators and students to effectively leverage these techniques to generate and select ideas.

Research Fellow: **Elaine Zhou (2025)** **Concentrations:** **Biology; Geography**

Faculty Mentor: **Mike Loranty** **Departments:** **Geography; Environmental Studies**

Title of Project: **Do Beaver Dams have Buffering Effects in streams in Interior Alaska?**

Funding Source: **Walter Broughton '63 Research Fund**

Project Summary:

Increasing temperature has shown more impacts in higher latitudes where it used to be adapted to colder climate and ecosystems. Fires are observed to be more frequent and severe in these high latitudes, and results in great changes in local vegetation of species types and population. Meanwhile, dams that American beavers built create wetlands that store water locally that is proven by scholars in water-limited areas in Western United States. I applied a similar approach in interior Alaska to learn if beaver dams have a local effect to improve vegetation's ability against fire threats.

Regardless of the importance of both fire and beavers in boreal forests, there is little research to examine whether beaver wetlands improve vegetation resilience to fire. Vegetation resilience is important for post-fire recruitment and subsequent forest composition. Understanding whether beaver wetlands promote similar riparian fire buffering effects in boreal forests will aid efforts to manage wildlife and wildfires in a changing climate. Interior Alaska has constant beaver populations and an intensifying fire regime in recent years. We examined burn severity of vegetation in riparian area (30 m) buffer along the stream networks in dammed (30m) and undammed areas (buffer mask). We utilized differenced Normalized Burn Ratio (dNBR), fire perimeters extracted from Monitoring Trends in Burn Severity (MTBS) database, National Hydrography Dataset (NHD) flowlines, and beaver dam manuallyself-digitized using ESRI satellite basemaps in ArcGIS. We identified stream segments within fire perimeters and digitized beaver dams along for our analysis. For each segment, we examined dNBR within a 30m riparian buffer, and that with beaver wetlands and those without.

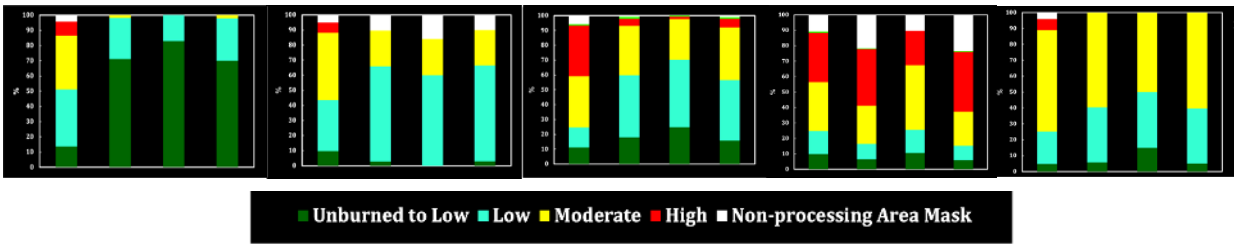


Fig. Percentage of Different Normalised Burn Ratio of vegetations in Firescars (from left to right): Black River, Bergan Creek, Bering Creek, Blind Creek, Little Mud River for different areas (from left to right): Total FIre, Riparian Area, Dammed Riparian Area, Undammed Riparian Area.

We found the riparian areas (30m buffer) have a distinct fire buffering effect than other areas within the fire. However, there is no substantial difference in dNBR between riparian areas with and without beaver dams. The result here suggests that beaver-dam-construction does not have a distinct buffering effect in interior Alaska than that in arid ecosystems in Western United States.

Research Fellow: **Angie Zhu (2026)** **Concentration:** **Applied Math**
Faculty Mentor: **Catherine Cardelús** **Department:** **Upstate Institute**
Title of Project: **Visualizing the Impact of Road Salt Application on Stream Conductivity in the Adirondacks**
Funding Source: **Upstate Institute**
Project Summary:

While road salt application is critical for driving safely on treacherous winter roads, it is also a serious environmental threat. The Adirondack Park has over 3,000 lakes and 30,000 miles of rivers and streams. Its inhabitants rely heavily upon clean freshwater for consumption, recreation, and flourishing wildlife. Yet, 38 tons of salt is applied per state road lane mile every winter in the Adirondacks. When temperatures rise and road salt dissolves into melting snow, salt travels into surface waters and groundwater. Road salt contamination can leach heavy metals into drinking water, damage and corrode water infrastructure, endanger or kill wildlife, increase soil erosion, and decrease fish survivability and reproduction. Thus, it is important to monitor road salt pollution and determine its impacts on local communities.

During my summer with the Ausable Freshwater Center, I analyzed collected water data across 30 streams in the Ausable region. Data visualization is important for engaging community members and potential donors. Thus, my project focused on providing a holistic understanding of how road salt impacts stream conductivity (the amount of dissolved ions/salts in the water). To do this, I cleaned and organized nine years of stream data using Excel and Python, calculated sample statistics, plotted time series, and created an interactive map of sample sites using Python and the Plotly library.

My work resulted in an animated, interactive map of the Ausable region highlighting the sampling locations and showing how stream conductivity levels change over time. We found that sample sites located near towns and state roads had the highest average stream conductivity levels and the most volatile measurements. There exists a direct relationship between road coverage and measured stream conductivity levels. Moreover, conductivity levels peak during snow melt in the spring and baseflow in the fall. We observed a trend of higher conductivity levels during baseflow, suggesting that more salt is being stored and trapped in groundwater. However, more analysis is needed to understand this phenomenon.

Statistics

Please note the total number of participating students is the number of student projects. Students working on two different projects with different faculty are counted twice. Students with double-majors are counted twice in the Distribution of Students by Concentration table.

In addition, the total number of participating faculty is the number of faculty supervising student research projects. In the individual department counts, faculty holding joint appointments are counted twice, once for each department affiliation. 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: **233**

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

Africana and Latin American Studies	2
Anthropology	2
Applied Math	8
Art and Art History	1
Asian Studies	1
Astrogeophysics	3
Astronomy/Physics	5
Biochemistry	12
Biology	17
Chemistry	10
Chinese	1
Classical Studies	1
Classics	1
Computer Science	12
Computer Science/Mathematics	2
Economics	5
Educational Studies	5
English	9
Environmental Biology	4
Environmental Geography	4
Environmental Geology	1
Environmental Studies	6
Film and Media Studies	1
French	4
Geography	3
Geology	8
History	8
International Relations	7
Japanese	2
Mathematical Economics	3
Mathematics	5
Molecular Biology	8
Music	2
Native American Studies	1
Natural Sciences	1
Neuroscience	10
Peace and Conflict Studies	3
Philosophy	8
Physics	17
Political Science	10
Psychological Science	16
Psychology	1
Religion	3
Russian and Eurasian Studies	3
Sociology	5
Spanish	1
Undeclared	34
Women's Studies	2

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

Arts and Humanities	**33**
Art and Art History	1
Chinese	1
Classical Studies	1
Classics	1
English	9
French	4
Japanese	2
Music	2
Philosophy	8
Religion	3
Spanish	1
Natural Sciences and Mathematics	**135**
Applied Math	8
Astrogeophysics	3
Astronomy/Physics	5
Biochemistry	12
Biology	17
Chemistry	10
Computer Science	12
Computer Science/Mathematics	2
Geology	8
Mathematics	5
Molecular Biology	8
Natural Sciences	1
Neuroscience	10
Physics	17
Psychological Science	16
Psychology	1
Social Sciences	**48**
Anthropology	2
Economics	5
Educational Studies	5
Geography	3
History	8
International Relations	7
Mathematical Economics	3
Political Science	10
Sociology	5
University Studies	**27**
Africana and Latin American Studies	2
Asian Studies	1
Environmental Biology	4
Environmental Geography	4
Environmental Geology	1

Environmental Studies	5
Film and Media Studies	1
Native American Studies	1
Peace and Conflict Studies	3
Russian and Eurasian Studies	3
Women's Studies	2
Undeclared	**34**

Distribution of Students by Faculty Division and Department:
(Number is greater than total number of participating students due to jointly supervised projects and joint faculty appointments)

Arts and Humanities	**9**
Classics	1
East Asian Languages and Literatures	3
English	2
Philosophy	1
Religion	2
Natural Sciences and Mathematics	**152**
Biology	26
Chemistry	30
Computer Science	7
Earth and Environmental Geosciences	23
Mathematics	13
Neuroscience	4
Physics and Astronomy	27
Psychological and Brain Sciences	22
Social Sciences	**37**
Economics	5
Educational Studies	2
Geography	7
History	7
Political Science	11
Sociology and Anthropology	5
University Studies	**20**
African and Latin American Studies	2
Asian Studies	3
Environmental Studies	4
Peace and Conflict Studies	8
Russian and Eurasian Studies	3
Other	**52**
Center for Freedom and Western Civilization	11
Lampert Institute for Civic and Global Affairs	9
Upstate Institute	32

Distribution of Students by Funding Source:

Internal	**157**
Center for Freedom and Western Civilization	11
Division of the Arts and Humanities	2
Division of Natural Sciences and Mathematics	75
Division of Social Sciences	24
Division of University Studies	3
Information Technology Services	1
Lampert Institute for Civic and Global Affairs	9
Upstate Institute	32
Endowed	**52**
Bob Linsley/James McLelland Fund	1
Doug Rankin ’53 Endowment-Appalachian Research	1
Doug Rankin ’53 Endowment-Geology Research	3
Hackett-Rathmell 1968 Memorial Fund	2
Holden Endowment Fund	2
J. Curtiss Taylor ’54 Endowed Student Research Fund	4
John C. Cochran Endowed Fund for Undergraduate Research	3
Justus ’43 and Jayne Schlichting Student Research Fund	10
Malcolm ’54 and Sylvia Boyce Endowed Fund in Geology	2
Michael J. Wolk ’60 Heart Foundation	7
Miller-Cochran Fund	2
Mind, Brain and Behavoir Scholars Award	2
Mind, Brain and Behavoir Summer Grant	2
Norma Vergo Prize	2
Oberheim Memorial Fund	2
Stickles Fund	1
Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science	2
Walter Broughton ’63 Research Fund	2
Warren Anderson Fund	2
External	**27**
NASA New York Space Grant	2
National Science Foundation Grant	25

Total Number of Participating Faculty: **89**

(Numbers below may be greater than total number of participating faculty due to faculty joint appointments)

Distribution of Faculty by Division and Department:

Arts and Humanities	**7**
Classics	1
East Asian Languages and Literatures	3
English	1
Philosophy	1
Religion	1
Natural Sciences and Mathematics	**55**
Biology	9
Chemistry	11
Computer Science	4
Earth and Environmental Geosciences	7
Mathematics	5
Neuroscience	1
Physics and Astronomy	9
Psychological and Brain Sciences	9
Social Sciences	**24**
Economics	3
Educational Studies	1
Geography	5
History	5
Political Science	7
Sociology and Anthropology	3
University Studies	**8**
African and Latin American Studies	1
Asian Studies	2
Environmental Studies	2
Peace and Conflict Studies	2
Russian and Eurasian Studies	1
Other	**19**
Center for Freedom and Western Civilization	11
Lampert Institute for Civic and Global Affairs	4
Upstate Institute	4

Distribution of Faculty by Funding Source:
(Faculty with more than one funding source are counted multiple times)

Internal	**75**
Center for Freedom and Western Civilization	11
Division of the Arts and Humanities	1
Division of Natural Sciences and Mathematics	38
Division of Social Sciences	15
Division of University Studies	2
Information Technology Services	1
Lampert Institute for Civic and Global Affairs	3
Upstate Institute	4
Endowed	**48**
Bob Linsley/James McLelland Fund	1
Doug Rankin ’53 Endowment-Appalachian Research	1
Doug Rankin ’53 Endowment-Geology Research	2
Hackett-Rathmell 1968 Memorial Fund	2
Holden Endowment Fund	1
J. Curtiss Taylor ’54 Endowed Student Research Fund	3
John C. Cochran Endowed Fund for Undergraduate Research	3
Justus ’43 and Jayne Schlichting Student Research Fund	9
Michael J. Wolk ’60 Heart Foundation	7
Malcolm ’54 and Sylvia Boyce Endowed Fund in Geology	2
Miller-Cochran Fund	2
Mind, Brain and Behavoir Scholars Award	2
Mind, Brain and Behavoir Summer Grant	2
Norma Vergo Prize	2
Oberheim Memorial Fund	2
Stickles Fund	1
Tom and Liz Brackett Endowed Fund for Diversity, Equity, and Inclusion in Computer Science	2
Walter Broughton ’63 Research Fund	2
Warren Anderson Fund	2
External	**14**
NASA New York Space Grant	1
National Science Foundation Grant	13

COLGATE