Skidmore College

FACULTY STUDENT SUMMER RESEARCH PROGRAM

SUMMER 2021

FINAL PRESENTATIONS
AUGUST 5, 2021

Faculty Student Summer Research Program
Summer 2021

Index

Since 1989, Skidmore College's Faculty Student Summer Research Program has given students a singular opportunity to work one-on-one with a faculty member. For periods ranging from five to ten weeks, students work with faculty on original research in disciplines ranging from biology to management and business, including classics and geosciences. Hands-on research with a faculty member allows students to become part of the research enterprise in a way that both complements and informs regular class work. In some cases, the collaborative research forms the basis for a senior's honors thesis or can lead to published articles in a peer-reviewed academic journal. Long-term, participation can help students gain admission to graduate schools and research careers. Skidmore alumni who have continued their education in graduate school have reported that experience as researchers has given them distinct advantages as scholars. For summer 2021, there are 88 students and 36 faculty members engaged in 46 collaborative research projects in a wide range of disciplines funded by the Faculty Student Summer Research program, external grants, the S3M Program, indirect cost funds, start-up funds, and other funding sources.

Funding Sources for Faculty Student Summer Research Programs

ALUMNI, FAMILY, AND FRIENDS

Marlene Oberkotter Fowler ’61
Christy Johnson ’90
Jim Lippman and Linda Friedman Lippman ’82
Richard A. Mellon ’87
Margaret Williams Page ’43
Mr. and Mrs. Kenneth Woodcock, Parents ’96

Axelrod-Porges Scholars

Established in 2006 by Felicia Axelrod ’62 and Robert Porges to support faculty-student teams in the area of the sciences

Schupf Scholars

Established in 2008 by Sara Lubin Schupf ’62 to support summer faculty-student research with a preference given to students pursuing projects in the STEM disciplines. Schupf Scholars are selected beginning the summer after their freshman or sophomore year. Schupf Scholars may access additional funding for travel to meetings and conferences as well as for research supplies and expense during their continuing research with faculty during their academic career at Skidmore.

Weg Scholars

Established in 2010 by Carol Little Weg ’64 and Ken Weg and awarded with a preference for students pursuing projects in the sciences and social sciences.

FOUNDATIONS AND GRANTS

Arthur Vining Davis Foundation
Caney Fork Farms
The Charles Slaughter Foundation
Department of Energy/National Renewable Energy Lab
The GKV Foundation
The Howard Hughes Medical Institute
W.M. Keck Foundation
Jackson Family Wines
The Lake George Land Conservancy
MSA Safety
The National Institutes of Health
The National Science Foundation
The Nature Conservancy
Rathmann Family Foundation
The Skidmore Scholars in Science and Mathematics (S3M) Program
The Walton Family Foundation

The Schupf Scholars Program

Each year the Schupf Scholars Program funds students to participate in the Faculty Student Summer Research Program and to continue that research with their faculty mentor in the ensuing academic year. The Schupf Scholars Program focuses on science, technology, and mathematics, and pays special attention to interdisciplinary projects and to female students in fields where women are underrepresented. Each year these scholarships will provide students and a faculty partner with up to $10,000 for research beginning the summer after their freshman or sophomore year and continuing through the following academic year. Schupf Scholars will be able to use additional funding for travel to meetings and conferences as well as for research supplies and expenses during their continuing research with faculty during their academic career at Skidmore.

Trustee Sara Lee Schupf '62 established the $1.1 million scholarship fund for student research in an endeavor to inspire, cultivate, and support students' interest in science, because she sees it as an excellent avenue for exercising critical thought and shaping the progress of an idea from theory to practice. She says: this is what a Skidmore education is all about—getting involved in the process of discovery, which includes the satisfaction of success, failure, and mentorship. More broadly the Schupf Scholars Program seeks to help light an accessible pathway to science research and science career preparation. With such an early start on intensive research and continued work into their junior or senior year, Schupf Scholars will be well equipped to move on to graduate or professional school in the sciences.

2021-22

Emily Luo, '23
Elizabeth Miller, '23
Nich Nearyrat Phalkun, '24
Elizabeth Scholer, '24
Sarah Varua, '24

2020-21

Selina Almasarwah, '23
Sarah Finnegan, '22
Heather Ricker, '22

2019-20

Anna Carhart, '22
Rachel Carrock, '22
Katie Rinaolo, '22
Jiayue Hong, '21
Saana Teittinen-Gordon, '22
Molly Cole, '21
Katie Yan, '22

2018-19

Acadia Connor, '21
Katherine Johnson, '20
Angelina Leonardi, '20
Claudia Mak, '20
Julia Danischweski, '20
Ella Long, '20
Jazmin Sepulveda, '20

2017-18

Beatriz Chavez, '18
Gabriella Gerlach, '19
Kyla Johnson, '20
Samantha Kenah, '19
Yutong Li, '19
Suzanne Zeff, '20

2016-2017

Claudia Bennett-Caso '19
Alexandra Cassell '19
Erin Mah '19
Erin Maloney '18
Emily O'Connor '19
Kari Rasmussen '18

2015-2016

Kelly Cantwell, '18
Jillian Greenspan, '17
Katherine Shi, '18
Deborah Kim, '18
Talia Stortini, '18
Hannah Schapiro, '17
Meggie Danielson, '17

2014-2015

Jaya Borgatta, '16
Meti Debela, '16
Glenna Joyce, '16
Jenny Zhang, '16
Stephanie Zhen, '16

2013-2014

Melanie Feen '16
Michele Fu '15
Kelly Isham '16
Angelica Newell '15
Rafaella Pontes '15

2012-2013

Jennifer Harfmann ‘14
Rafaella Pontes ‘15
Kara Rode ‘15
Carol Wu ‘14

2011-2012
Tim Brodsky ‘13
Andrea Conine ‘13
Brenda Olivo ‘14
Kathryn Stein ‘13

2010-2011
Rebecca Connelly ‘12
Ava Hamilton ‘12
Caroline Loehr ‘12
Taylor Moot ‘13

Faculty Student Summer Research Program

Schedule of Final Research Presentations

Thursday, August 5, 2021

9:00 am – 9:25 am Coffee and Muffins

9:30 am – 10:30 am Oral Presentations

ROOM A

***Zoom* MYSOC - SOIL SAMPLING IN THE HUDSON RIVER VALLEY**
Olivia Hunt, 2023; Sage Ganshirt, 2022
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

MYSOC - SOIL SAMPLING ON VINEYARDS IN NAPA AND SONOMA COUNTIES
Eliana Colzani and Morgan McClure, 2022
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

HIGH-RESOLUTION 3D MAPPING OF DOME ISLAND
Christina Lindstrom, 2022; Sophia Rubien, 2022; Roger Mercado, 2022; Mya Carter, 2024
Charlie Bettigole, Director of the GIS Center for Interdisciplinary Research, GIS Department
Kurt Smemo, Associate Professor, Environmental Studies and Sciences Program
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

STRATEGIC CONSERVATION PLANNING IN THE LAKE GEORGE WATERSHED AND BEYOND
Addison Braver-Walsh, 2021
Charlie Bettigole, Director, GIS Center for Interdisciplinary Research

ROOM B

MAPPING MAYA AGRICULTURAL AND HYDRAULIC FEATURES IN GUATEMALA
Sarah Baker, 2021
Heather Hurst, Associate Professor, Anthropology Department
Charlie Bettigole, Director, GIS Center

ANTI-EMPIRE IMPERIALISM? THE IDEATIONAL FOUNDATIONS OF US AND USSR GLOBAL HEGEMONIES

Samantha Hotz, 2022
Yelena Biberman-Ocakli, Associate Professor, Political Science Department

ADDRESSING SUCKER AVERSION
Rachel Dentler, 2023
Sandra H. Goff, Associate Professor, Economics Department

FRAMING EXTERNALITIES
Jeremy Budner, 2023
Sandra H. Goff, Associate Professor, Economics Department

ROOM C

UNDERSTANDING FACTORS THAT AFFECT TRUST IN DIGITAL TECHNOLOGIES FOR CONTACT TRACING AND IMMUNITY PASSPORTS
Zoë Bilodeau, 2023
Aaliyah Lawrence, 2024
Aarathi Prasad, Assistant Professor, Computer Science Department

ECOMAPPING AS A PRACTICE FRAMEWORK FOR WORKING WITH LGBTQ YOUTH
Minghuang Wang, 2023
June Paul, Assistant Professor, Department of Social Work

CARMEN ET ERROR: GAMING THE LATIN CLASSROOM
Nicky Kiernan, 2021
Dan Curley, Associate Professor, Classics Department

10:35 am – 11:45 am Poster Presentations #1

ROOM A

PERIL OR PROMISE: A CASE STUDY OF WIND ENERGY EQUITY IN UPSTATE NEW YORK
Finn Weber, 2023; Kara White, 2024
Karen Kellogg, Associate Professor, Environmental Studies and Sciences Program

DEVELOPMENT OF A RAPID AND INEXPENSIVE TOTAL WATER HARDNESS TEST
Mary Kate Palleschi, 2022
Kimberley A. Frederick, Professor, Chemistry Department

DETERMINING STARCH-GLUCAN PHOSPHATASE INTERACTION USING IN-VITRO SEDIMENTATION ASSAY
Eliana Wolpaw, 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

DO RACIAL DIFFERENCES EXIST IN PERIPHERAL AND CENTRAL BLOOD PRESSURE AND VASCULAR STIFFNESS IN OTHERWISE HEALTHY YOUNG MEN?
Abena O. Gyampo, 2023, Kendall S. Zaleski, 2022
Stephen J. Ives, Associate Professor, Health and Human Physiological Sciences Department

EXPRESSIONS OF EMPATHY IN END-OF-LIFE EDUCATION
Claire Slattery, 2022
Kelly Melekis, Associate Professor, Social Work Department

EXAMINING THE CATALYTIC ACTIVITY AND REDUCTION POTENTIAL OF A LOW MOLECULAR WEIGHT, BIOMIMETIC MANGANESE(II) COMPOUND
Katheryn Rinaolo, 2022
Steven Frey, Associate Professor, Chemistry Department

ROOM B

SALT ION INTERACTIONS WITH AN SH3 DOMAIN
Anna Carhart, 2022
K. Aurelia Ball, Assistant Professor, Chemistry Department

ANALYSIS OF THE STABILITY OF THE VIF-A3F INTERFACE OVER TIME
Elizabeth Miller, 2023
K. Aurelia Ball, Assistant Professor, Chemistry Department

SIMULATING A DISORDERED ENCOUNTER COMPLEX BINDING PATHWAY IN THE PRESENCE OF SALT
Frida Anguiano; Gabriella Gerlach; Anna Carhart; Elliot J. Stollar
K. Aurelia Ball, Assistant Professor, Chemistry Department

DESIGN OF LASER BASED EXPERIMENTS FOR PHYSICAL CHEMISTRY COURSES
Jing Wang Ou Yang, 2023
Juan G. Navea, Professor, Chemistry Department

OXIDATIVE CLEAVAGE OF AN INDOLE USING AN IRON PORPHYRIN CATALYST
Emma Straton, 2022
Anna Brezny, Assistant Professor, Chemistry Department

ROOM C

LIGHT HAS COLOR-DEPENDENT EFFECTS ON SLEEP IN *DROSOPHILA MELANOGASTER*
Sam Bond, 2023; Aaliyah Peralta, 2024
Christopher G. Vecsey, Associate Professor, Neuroscience Program

OPTICAL PROPERTIES OF MODEL SYSTEMS FOR ENVIRONMENTALLY RELEVANT PHOTOSENSITIZERS
Onita Alija, 2021; Natalia Karimova; R. Benny Gerber
Juan Navea, Professor, Chemistry Department

SCREENAWARE: AN IOS APP TO MANAGE SMARTPHONE USE
Zoe Beals, 2022
Aarathi Prasad, Assistant Professor, Computer Science Department

SPECIFYING THE ROLE OF NPF IN SLEEP INDUCTION OF LARVAL AND ADULT *Drosophila melanogaster*
Elizabeth Roy, 2022
Debra Possidente, Lab Technician, Neuroscience Department
Christopher Vecsey, Associate Professor, Neuroscience Department

BIOCHEMICAL CHARACTERIZATION OF POTATO STARCH EXCESS-4
Juan Carlos Cruz, 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

11:45 pm – 12:50 pm Lunch, Murray Aikins Dining Hall

1:00 pm – 2:10 pm Poster Presentations #2

ROOM A

IT SHORE BLOWS: A SYSTEMATIC LITERATURE REVIEW AND SURVEY OF ONSHORE AND OFFSHORE BARRIERS TO WIND ENERGY IMPLEMENTATION IN THE UNITED STATES
Chloe Faehndrich, 2023; Paige Karl, 2023
Karen Kellogg, Associate Professor, Environmental Studies and Sciences Program

SEX DIFFERENCES IN ESTIMATES OF CARDIAC AUTONOMIC FUNCTION USING TIME DOMAIN BASED METHOD OF HEART RATE VARIABILITY: EFFECTS OF ORAL CAPSAICIN
Kendall Zaleski, 2022; Abena Gyampo, 2023
Stephen Ives, Associate Professor, Health and Human Physiological Sciences Department

DETERMINATION OF PHOSPHATE AND NITRATE LEVELS IN WATER AND SOIL
Emily Luo, 2023; Sarah Varua, 2024
Kim Frederick, Professor, Chemistry Department

STRUCTURAL CHARACTERIZATION OF CORN GLUCAN PHOSPHATASE
Marissa Frenett, 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

BRINGING TO LIGHT THE OXIDATION OF SEA SPRAY AEROSOLS: A STUDY OF MODEL SYSTEMS FOR MARINE PHOTOSENSITIZERS
Grace Freeman-Gallant, 2021; Emily Davis, 2023; Onita Alija. 2021, Syafira Nurlita, 2023, Anthony Peraza, 2022
Juan G. Navea, Professor, Chemistry Department

MILLENNIAL STRONG: BLAVITY ADDRESSING THE NEEDS OF BLACK COMMUNITIES
Hana Sadoff, 2022
Elzbieta Lepkowska-White, Professor, Management and Business Department

ROOM B

SH3 DOMAIN BOUND TO ARKA17 IN THE PRESENCE OF KCL
Oluebube Onwuzulu, 2024
K. Aurelia Ball, Assistant Professor, Chemistry Department

INVESTIGATING HOW EACH SEGMENT OF A DISORDERED PEPTIDE CONTRIBUTES TO BINDING ITS SH3 DOMAIN PARTNER
Raymond East, 2023
K. Aurelia Ball, Assistant Professor, Chemistry Department

AEROBIC EPOXIDATION OF ALKENES
Elizabeth Scholer, 2024
Anna Brezny, Assistant Professor, Chemistry Department

OPTIMIZING THE OXIDATIVE CLEAVAGE OF INDOLES IN THE PRESENCE OF MANGANESE PORPHYRIN CATALYST
Oscar Fischer, 2022
Anna Brezny, Assistant Professor, Chemistry Department

COMPUTATIONAL MODELLING OF THE DAYTIME FORMATION OF NITROUS ACID IN THE MARINE ATMOSPHERE
Syafira Nurlita, 2023
Juan Navea, Professor, Chemistry Department

DEVELOPMENT OF A MICROFLUIDIC DEVICE FOR THE ANALYSIS OF SUGARS
Kaelan Young, 2022
Kimberley A. Frederick, Professor, Chemistry Department

ROOM C

EFFECTS OF OPTOGENETIC STIMULATION OF SHORT NEUROPEPTIDE F AND PIGMENT DISPERSING FACTOR NEURONS ON SLEEP IN *DROSOPHILA MELANOGASTER*
Casey Koochagian, 2023; Matthew Grega, 2023
Debra Possidente, Lab Technician, Neuroscience Department
Christopher G. Vecsey, Associate Professor, Neuroscience Department

PROCESSING SH3 DOMAIN BINDING NMR DATA WITH PYTHON
AJ Adkins, 2021
K. Aurelia Ball, Assistant Professor, Chemistry Department

ATMOSPERIC PROCESSING OF COMBUSTION PARTICLES: IRON MOBILITY AND EFFECTS IN THE MARINE ENVIRONMENT
Cecily Szady and Abby Schlinger, 2022
Juan Navea, Professor, Chemistry Department

DESIGNING A GOLD-LABELED ANTIBODY FOR FASTER WESTERN BLOT
Haru Kato, 2024
Mayuri Roca, Senior Teaching Professor, Chemistry Department

STABILITY STUDIES OF AN ANTIOXIDANT MANGANESE(II) COMPLEX IN AQUEOUS SOLUTION
Rat Phalkun, 2023
Steven Frey, Associate Professor, Chemistry Department

PROJECT ABSTRACTS

Project:

HALAL FOOD CONSUMPTION AMONG MUSLIM AMERICANS IN THE CAPITAL DISTRICT, NY

Brook Heston, 2022
Nurcan Atalan-Helicke, Associate Professor, Environmental Studies and Sciences Program

There are roughly 3.45 million Muslims living in the United States, and over10,000 Muslims in the Capital District of NY. In the next two decades, Muslim population in the U.S. is expected to double. Halal means permissible under Islam, and there is a strong link between food and identity. The halal food markets, catering to the dietary concerns of Muslims, have grown worldwide. In 2017 alone, the U.S. consumers spent $20 billion on halal food, 33% more than they did in 2010. In this research, we examine what halal food signifies to American Muslim consumers, and the markers American Muslim consumers seek in their food choices, through ethnographic research methods (participant observation, a pilot study involving semi-structured interviews) and document analysis.

Project:

Simulating a disordered encounter complex binding pathway in the presence of salt

Frida Anguiano; Gabriella Gerlach; Anna Carhart; Elliot J. Stollar
K. Aurelia Ball, Assistant Professor, Chemistry Department

Protein-protein interactions are involved in a wide range of cellular processes functioning for cell proliferation, differentiation, cytoskeleton modification and cellular communication. Intrinsically disordered proteins (IDPs) and protein binding domains are often involved in these interactions. However, the details of IDP binding pathways are hard to characterize using experimental approaches, which can rarely capture intermediate states present. AbpSH3 domains are common protein interaction domains which are negatively charged that typically bind proline-rich disordered segments like ArkA which is positively charged. Previous experimental studies revealed that the addition of sodium chloride to the complex decreases the binding affinity of ArkA and AbpSH3. Molecular dynamics simulations in the absence of salt reveal that ArkA enters a flexible encounter complex before forming the fully engaged bound complex. In the encounter complex, transient nonspecific hydrophobic and long- range electrostatic contacts form between ArkA and the binding surface of SH3. To further investigate the steps of binding between the SH3 domain and ArkA, we have begun to simulate ArkA-AbpSH3 binding in the presence of sodium chloride, which serves to screen electrostatic interactions. While the encounter complex forms quickly, the slow step of binding is the transition from the disordered encounter ensemble to the fully engaged state. We can expect the addition of sodium chloride to destabilize the encounter complex, slowing down its formation through an interference of electrostatic interaction present in the AbpSH3- ArkA complex. This will lead to an overall slower binding rate for the complex. Simulating the binding between ApbSH3 and ArkA in the presence of salt can also provide insight into the formation of the encounter complex intermediates and nonnative hydrophobic interactions for other SH3 domains and IDPs in general.

Project:

SALT ION INTERACTIONS WITH AN SH3 DOMAIN
Anna Carhart, 2022
K. Aurelia Ball, Assistant Professor, Chemistry Department

SH3 domains are common interaction domains in the human body that foster cellular communication through protein-protein interactions. SH3 domains bind to flexible regions of proteins referred to as intrinsically disordered. The mechanisms of these interactions are difficult to study experimentally, so Molecular Dynamics simulations support experimental data. Our lab looks at AbpSH3, a protein interaction domain found in yeast, and the disordered peptide, ArkA. ArkA contains several positively charged residues and AbpSH3 has a highly negative charge, attracting ArkA to bind. Our lab used simulations to investigate how salt influences binding at the atomic level. We looked at how different salts, specifically cations, screen electrostatic interactions within the domain. In the future we will investigate how salt affects the binding process, including the binding rate.

Project:

PROCESSING SH3 DOMAIN BINDING NMR DATA WITH PYTHON
AJ Adkins, 2021
K. Aurelia Ball, Assistant Professor, Chemistry Department

Our lab uses molecular dynamics simulations to research the interactions of molecular complexes, specifically those involving intrinsically disordered proteins. While the use of simulations provides an extraordinary level insight into the dynamics of biomolecular structures, experimental results are needed to complement the simulations to provide a real-world point of comparison. Our lab primarily uses two-dimensional NMR to provide this necessary experimental data. I have created a set of programs written in Python that are able to convert, process, and plot NMR data for study by our lab. The use of these programs is in contrast to methods involving outdated and complicated software. We have used this NMR data to study how the AbpSH3 protein domain is affected by binding of the intrinsically disordered peptide ArkA.

Project:

INVESTIGATING HOW EACH SEGMENT OF A DISORDERED PEPTIDE CONTRIBUTES TO BINDING ITS SH3 DOMAIN PARTNER
Raymond East, 2023
K. Aurelia Ball, Assistant Professor, Chemistry Department

Many proteins that are involved in cellular signaling are flexible. ArkA, an intrinsically disordered protein, binds to an SH3 domain which controls cell signaling and cytoskeleton regulation. It is important to understand how one segment of ArkA might cause the domain to change structure

and allow the other segment to bind differently an effect known as allostery. ArkA is made up of two segments: the proline-rich segment 1 and segment 2, which is important for binding specificity. Molecular Dynamics simulations are used to view how the segments interact with the domain. Results show that segment 1's interactions with the SH3 domain are not significantly affected by the absence of segment 2. Future work includes running simulations of segment 2 only interacting with the domain.

Project:

SH3 DOMAIN BOUND TO ARKA17 IN THE PRESENCE OF KCL
Oluebube Onwuzulu, 2024
K. Aurelia Ball, Assistant Professor, Chemistry Department

The SH3 domains is a common protein domain found across all forms of life. However, little is known about how flexible peptides bind to these domains. In this experiment, the salt ion potassium chloride (KCl) will be included in the interaction between SH3 domain (negatively charged ion) and ArkA17 (positively charged ions) to determine what effect it has in the binding mechanism or any other effects. Previously in our lab, we have analyzed ArkA17 bound to SH3 in the presence of NaCl, and discovered that NaCl prevents the attraction of the charge in ArkA17 and SH3. So, I performed the same simulation with KCl to find out if different salt has different effects.

Project:

ANALYSIS OF THE STABILITY OF THE VIF-A3F INTERFACE OVER TIME
Elizabeth Miller, 2023
K. Aurelia Ball, Assistant Professor, Chemistry Department

HIV hijacks an immune cell's natural function to evade its antiviral defenses with assistance from the protein viral infectivity factor (Vif). Vif is an intrinsically disordered protein that lacks a fixed structure but binds to an E3 ubiquitin ligase complex to gain stability. The HIV-hijacked complex tags the antiviral protein A3F for ubiquitination and subsequent degradation. We want to study the dynamics of the complex and how Vif is able to bind A3F. Molecular dynamics simulations were used to identify the specific residue interactions between Vif-A3F. The preliminary results showed the residues in contact varied slightly within the simulations. Understanding the molecular basis of Vif's affinity towards A3F will allow for the development of therapeutics that can interrupt the Vif-A3F binding, rendering the virus useless.

Project:

STRATEGIC CONSERVATION PLANNING IN THE LAKE GEORGE WATERSHED AND BEYOND
Addison Braver-Walsh, 2021
Charlie Bettigole, Director, GIS Center for Interdisciplinary Research

This study was based on a grant from the Lake George Land Conservancy to identify parcels of land to be prioritized for conservation. To determine which parcels to target for acquisition, we

created a geospatial model consisting of 15 different environmental factors. The "conservation score" yielded by these calculations was then visualized into three maps: one of the Lake George watershed, a 15 mile buffer zone around the watershed, and an interactive online map where users can change the weighting of the factors on the fly. The first two maps were created using ArcGIS Pro, while the interactive one was created in Google Earth Engine's JavaScript API. In a separate study, I also collaborated with the Dome Island team to investigate gypsy moth defoliation in the watershed.

Project:

HIGH-RESOLUTION 3D MAPPING OF DOME ISLAND
Christina Lindstrom, 2022; Sophia Rubien, 2022; Roger Mercado, 2022; Mya Carter, 2024
Charlie Bettigole, Director of the GIS Center for Interdisciplinary Research, GIS Department
Kurt Smemo, Associate Professor, Environmental Studies and Sciences Program
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

Dome Island, a small island in Lake George, NY, has been a reserve for uninterrupted natural processes since the early 1900's. Over the past 3 years, Skidmore College students have conducted research to gain a better understanding of the island's disturbance history and forest dynamics. This summer, we developed new methods to collect photosynthetically available radiation (PAR) and temperature data, as well as soil carbon samples to build on past datasets. To map canopy openness, we compared the efficacy of an inexpensive clip-on fisheye lens to a spherical panorama from the Google Street View app and 3D canopy models collected by a drone. These stacked multitemporal datasets allow us to assess forest and soil dynamics so we can continue monitoring and conserving the island's biodiversity.

Project:

ANTI-EMPIRE IMPERIALISM? THE IDEATIONAL FOUNDATIONS OF US AND USSR GLOBAL HEGEMONIES
Samantha Hotz, 2022
Yelena Biberman-Ocakli, Associate Professor, Political Science Department

Our research addresses how the US and USSR—two countries founded on ideas rejecting a standing army in peacetime—ended up amassing some of the world's most powerful militaries. The role of the police in a democratic society is currently being questioned and even challenged. We aim to expand the conversation about the relationship between democracy and coercive power with a focus on the military. Drawing on a comparative historical analysis of US and Soviet/Russian military establishments, we generated a novel hypothesis. We found that the expansion of the armed forces in both countries was driven not just by strategic logic and culture, but also by anxiety over keeping together a divided nation. We then tested our hypothesis with an "out-of-sample" case study of India.

Project:

OPTIMIZING THE OXIDATIVE CLEAVAGE OF INDOLES IN THE PRESENCE OF MANGANESE PORPHYRIN CATALYST
Oscar Fischer, 2022
Anna Brezny, Assistant Professor, Chemistry Department

In this research, oxidative cleavage of indoles is being optimized. Oxidative cleavage is where a carbon-carbon double bond is replaced with two carbonyl groups. This reaction is valuable due to its use in the synthesis of pharmaceuticals and fine chemicals. Current methods used to do this chemistry release ozone into the atmosphere (which is not environmentally friendly). Here, a manganese porphyrin is used to catalyze the cleavage of 2,3-dimethyl-1H-indole with oxygen gas instead of ozone. Through manipulating concentrations, varying solvents, and other factors, the reaction is optimized to give the highest yield of desired product. This research has the potential to provide other organic chemists with new techniques for their own labs, causing a molecule to undergo oxidative cleavage without using ozone.

Project:

AEROBIC EPOXIDATION OF ALKENES

Elizabeth Scholer, 2024
Anna Brezny, Assistant Professor, Chemistry Department

Many current methods of oxidation are reactive and somewhat inefficient as they fail to utilize the oxygen in the atmosphere and instead use highly reactive compounds. This research aimed to develop better ways to add an oxygen atom to organic molecules using O_2. Epoxidation is the process of transforming an alkene, which contains a carbon-carbon double bond, to an epoxide which has one oxygen atom in a three-atom ring. This project focused on the transformation of cis-cyclooctene to cyclooctene oxide using the catalyst manganese tetraphenyl porphyrin and electricity. The effects of different variables were explored in attempts to optimize product yield, including varying time, solvents, anhydrides, and axial ligands. This method was then applied to other alkenes to see if similar results would be achieved.

Project:

OXIDATIVE CLEAVAGE OF AN INDOLE USING AN IRON PORPHYRIN CATALYST

Emma Straton, 2022
Anna Brezny, Assistant Professor, Chemistry Department

Many chemical reactions are hazardous and difficult to perform in laboratory settings. Ozonolysis, which involves the cleavage of carbon-carbon double bonds, uses the toxic and highly reactive gas ozone. Since the oxidative cleavage of alkenes requires two oxygen atoms, O_2 is an ideal oxidant, however, it is kinetically unreactive. Alternatives to ozonolysis with O_2 would lead to the safer and greener oxidative cleavage of alkenes. In this work, alternate oxidative alkene cleavage methods were developed on 2,3-dimethyl-1H-indole using an iron porphyrin (Fe(PFPP)Cl) catalyst and O_2. We found that Fe(PFPP)Cl activates O_2 and leads to the cleavage of the alkene. Two side products of this reaction were identified. Reaction optimization and mechanistic studies are underway.

Project:

MYSOC - SOIL SAMPLING ON VINEYARDS IN NAPA AND SONOMA COUNTIES

Eliana Colzani and Morgan McClure, 2022
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

As soil sequestration is increasingly studied for potential greenhouse gas reduction, we researched the extent of soil sequestration happening on vineyards in northern California. We sought to answer three major questions: how does carbon distribution differ between the tractor and vine row, within the vine row how does it differ between irrigation emitters and non emitter locations, and what is the best sampling method for vineyards? Soil samples were collected at 0-15 cm and 15-30 cm depths across 3 vineyards using a single sample technique followed by a cluster sample design utilized to examine carbon concentrations within the vine, tractor, and emitter soil. Maps of each vineyard will be created to visualize carbon distribution and a selection of one-way ANOVA tests will be run to determine if a statistical difference in soil organic carbon between locations or management practices exists.

Project:

MYSOC - SOIL SAMPLING IN THE HUDSON RIVER VALLEY

Olivia Hunt, 2023; Sage Ganshirt, 2022
Kris Covey, Assistant Professor, Environmental Studies and Sciences Program

MySOC is a project that works to gather data on soil carbon within farms and then plans to utilize that data to create a soil carbon market. We gathered soil samples from farms in the Hudson River Valley over the course of eight weeks to contribute data to an overall map of soil carbon. We acted as testers of the equipment to provide feedback for a more streamlined soil sampling kit that will be handed out to farmers. Using Field Maps we entered data regarding sample location and type of agriculture. A set of augers, a drill, and an extractor were utilized to sample at depths of 0-15 cm and 15-30 cm. Samples were bagged and shipped to Ward Laboratories for testing.

Project:

CARMEN ET ERROR: GAMING THE LATIN CLASSROOM

Nicky Kiernan, 2021
Dan Curley, Associate Professor, Classics Department

Our project is to develop a role-immersion game for Skidmore's introductory fall and spring Latin sequence. As students play the game, they will put their Latin to work and learn about the literary, social, and material culture of ancient Rome. The player-character is Perilla, a Roman girl descended from the disgraced poet, Ovid, who was exiled from Rome a century earlier. Tasked by the imperial librarian, Suetonius, with investigating Ovid's legacy, Perilla explores the public and private spaces of Rome and uncovers a conspiracy in her own era. Role-immersion games have been hailed for transforming Humanities pedagogy, integrating argumentation and close reading with competitive strategy. In adapting these modes to Skidmore's Latin courses, our game reinforces retention of the language and adds perspectives on Roman history and society.

Project:

DETERMINATION OF PHOSPHATE AND NITRATE LEVELS IN WATER AND SOIL

Emily Luo, 2023; Sarah Varua, 2024
Kim Frederick, Professor, Chemistry Department

Farmers utilize fertilizer to meet the high nutrient demand of modern agriculture, but tend to overcompensate due to the lack of accessible tools for field testing. Excess phosphate and nitrate can runoff and lead to eutrophication (algae growth) that competes for oxygen with aquatic ecosystems, resulting in dead zones or massive fish kills. By managing the initial levels of phosphate and nitrate in the soil through affordable microfluidic technology, farmers can minimize excessive use of fertilizer and prevent nitrogenous and phosphoric waste. The aim of this research was to develop accurate and consistent microfluidic assays that can be produced inexpensively, used easily and produce results using cell phone technology. We will present our work on developing color-based analysis methods that can accurately and precisely determine nutrient levels in both soil and water.

Project:

DEVELOPMENT OF A RAPID AND INEXPENSIVE TOTAL WATER HARDNESS TEST

Mary Kate Palleschi, 2022
Kimberley A. Frederick, Professor, Chemistry Department

Water hardness is the amount of dissolved magnesium and calcium in water. There are many different settings in which the concentrations of calcium and magnesium in water are important to know. For example, this information can be useful when determining if the concentrations in water are safe for drinking or causing increased rates of pipe erosion. However, the most common measurement tests for determining water hardness require access to a lab or are not effective in determining exact concentrations of calcium and magnesium separately. We developed a simple and easy to use microfluidic device that can accurately determine the concentration of water hardness by chelation via colorimetric detection that does not require laboratory skills or costly lab equipment.

Project:

DEVELOPMENT OF A MICROFLUIDIC DEVICE FOR THE ANALYSIS OF SUGARS

Kaelan Young, 2022
Kimberley A. Frederick, Professor, Chemistry Department

Sugars such as glucose, galactose, and lactose are commonly found in many food substances. Analysis of the different types of sugars in food products is typically used as a method of quality control (i.e., lactose in dairy products or “dryness” of wine). Since laboratory methods can be expensive and difficult to perform, our goal is to develop a simple, semi-quantitative paper-based analytical method. Paper labware was constructed by patterning hydrophobic wax which contained the deposited chemicals including enzymes that metabolize and detect the various sugars. The color intensity of the result was detected using a cell phone camera. The linear ranges of glucose (10-50 mg/mL) and galactose (10-100 mg/mL) were found to be at levels often found in foods.

Project:

STABILITY STUDIES OF AN ANTIOXIDANT MANGANESE(II) COMPLEX IN AQUEOUS SOLUTION

Rat Phalkun, 2023
Steven Frey, Associate Professor, Chemistry Department

Reactive oxygen species (ROS) are known to cause cardiovascular, inflammatory and many other diseases. Compounds that exhibit antioxidant activity are therefore of interest as potential pharmaceuticals. We have recently synthesized a manganese(II) complex containing the tripodal ligand N,N-bis(2-pyridylmethyl)hydroxyethylamine (DPEA), and observed its antioxidant behavior. The goal of our work this summer was to examine the stability of this complex in aqueous solution. To do so, we have used potentiometric, UV-vis, and ^{1}H NMR titrations. The potentiometric method provides information about the acid dissociation constant (Ka) of the DPEA and stability constant of the Mn(II) DPEA complex. The UV-vis and NMR titrations support the 1:1 formation of both Fe(II) and Mn(II) complexes with DPEA and high degree of their stability in aqueous solution.

Project:

EXAMINING THE CATALYTIC ACTIVITY AND REDUCTION POTENTIAL OF A LOW MOLECULAR WEIGHT, BIOMIMETIC MANGANESE(II) COMPOUND

Katheryn Rinaolo, 2022
Steven Frey, Associate Professor, Chemistry Department

Catalase and superoxide dismutases (SODs) are enzymes that function to protect cells from toxic reactive oxygen species (ROS). Catalase effectively catalyzes the decomposition of hydrogen peroxide (H_2O_2) while SOD disproportionates superoxide ion (O_2^-). We have studied the catalase and SOD activity of a low molecular weight, biomimetic manganese(II) compound consisting of a tripodal ligand, N,N-bis(2-pyridylmethyl)hydroxyethylamine (DPEA), that coordinates to Mn^{+2} through three nitrogen atoms and one oxygen atom. A volumetric method to measure oxygen production upon reaction with H_2O_2 was used to determine the catalase activity, while the SOD activity of the complex was determined by the Fridovich Assay. Cyclic voltammetry (CV) was performed to study reduction potential of the complex, a parameter that controls the catalase and SOD activity of Mn(II) compounds.

Project:

FRAMING EXTERNALITIES

Jeremy Budner, 2023
Sandra H. Goff, Associate Professor, Economics Department

This study uses an online survey experiment to assess the fairness evaluations subjects assign to a series of vignettes involving negative externalities – costs imposed on bystanders to a market transaction. Each of the five vignettes describes a different hypothetical scenario in which the details of a negative externality are varied through random assignment. Specifically, our study investigates whether the way we talk about externalities affects how fair people think the externalities are. In the context of three different framing interventions, participants are asked to

evaluate the fairness of (i) the externality-producing entity's behavior, (ii) the government's intervention aimed at addressing the externality, and (iii) the situation, in general, following the implementation of the government intervention.

Project:

ADDRESSING SUCKER AVERSION
Rachel Dentler, 2023
Sandra H. Goff, Associate Professor, Economics Department

This project addresses sucker aversion, an aversion to being, or being seen as, a naïve cooperator. We identify a participant's sucker aversion type by observing their behavior on a series of choices in an online survey experiment with random assignment. "Aversives" tend to forgo a higher payoff for themselves to avoid a lottery that might benefit an undeserving other (a country club). "Excuse-drivens" do not forgo the higher payoff for themselves, but instead use the small probability (p = 0.10, 0.01, or 0.002) that the country club might receive the payoff as an excuse to forgo donating to charity. After determining each participant's type, we investigate whether types respond differently to our set of information treatments when making a subsequent donation decision.

Project:

ARCHAEOLOGY AT THE DENTON HOME SITE: GPR AND METAL DETECTION ANALYSIS
Kaylee Jellum, 2022; Riley Mallory, 2022
Siobhan Hart, Associate Professor, Anthropology Department

The Denton Homesite in Skidmore's North Woods was home to Revolutionary War veteran Preston Denton in 1775. In the 1880's, the area was transformed by Henry Hilton into "Woodlawn Park." Metal detection and ground penetrating radar (GPR) are non-invasive survey methods used in archaeology; they give us clues into what lies beneath the ground surface without disturbing the land. We used GPR to locate hidden cultural features, and then excavated them. Metal detection allowed us to see the density of underground metal objects. Both methods gave us information about areas with culturally relevant material. The data we collected will help future excavations at the site and contribute to a better understanding of the people who lived and worked here before us.

Project:

RETURN MIGRATION AND ECONOMIC PROSPERITY IN A TRANSNANTIONAL MEXICAN COMMUNITY
Yalinel Beltre, 2021
Ruth Hernández-Ríos, Teaching Professor, Sociology Department

This project draws on five qualitative interviews with Mexican migrants who have returned home to Tlaxcala, Mexico, from the United States. This project is part of a more extensive study about a transnational Mexican community spanning Connecticut, U.S.A., and Tlaxcala, Mexico. The five interviews were transcribed and coded to find broader themes and patterns. A central theme found in the interviews is the dangerous conditions migrants endure when crossing the U.S.-

Mexico border, as well as human rights abuses by Immigration Enforcement and Customs (ICE). Thus, this project contributes to the ongoing debate about human rights abuses at the border, crucial in the current economic climate and humanitarian crisis at the U.S.-Mexico border.

Project:

MAPPING MAYA AGRICULTURAL AND HYDRAULIC FEATURES IN GUATEMALA
Sarah Baker, 2021
Heather Hurst, Associate Professor, Anthropology Department
Charlie Bettigole, Director, GIS Center

Numerous Maya archeological sites are located in the Petén region of Guatemala. This research focused on the San Bartolo-Xultun area and its historic land use with specific focus on agricultural and hydraulic features. Using LiDAR data, we identified 1,300 individual agricultural terraces, as well as several check-dams and wetland channels. Next, we visualized watersheds and delineated water features to enhance our understanding of water flow and its potential effects on settlement patterns. *Bajos*, which are seasonally flooded lowlands, were delineated using historic maps and higher resolution data to create a cohesive understanding of the *bajo* boundaries. In this project, multiple lines of evidence combining on-the-ground archaeology, previous remote sensing and mapping, and new lidar data are used to analyze and characterize ancient Maya human-landscape interaction.

Project:

MAPPING MAYA AGRICULTURAL AND WATER FEATURES IN GUATEMALA
Amity Wilson, 2022
Heather Hurst, Associate Professor, Anthropology Department
Charlie Bettigole, Director, GIS Center

Numerous Maya archeological sites are located in the Petén region of Guatemala. This study focused on land use in the San Bartolo-Xultun area, specifically terraces, which refer to linear features used for agricultural purposes. Using LiDAR data, we identified terraces along with other agricultural and water features by highlighting irregularities that suggested the presence of human construction. We mapped over 1,300 individual terraces within the study area, as well as check-dams, wetland channels, and defensive walls. We then experimented with various methods for enhancing the visualization of these features before moving on to analysis. Analysis of aspect, curvature, and slope suggests preferred conditions for such terraces, allowing further comparison within this area and opening the door for future terrace characterization and analysis.

Project:

SEX DIFFERENCES IN ESTIMATES OF CARDIAC AUTONOMIC FUNCTION USING TIME DOMAIN BASED METHOD OF HEART RATE VARIABILITY: EFFECTS OF ORAL CAPSAICIN
Kendall Zaleski, 2022; Abena Gyampo, 2023
Stephen Ives, Associate Professor, Health and Human Physiological Sciences Department

Heart rate variability (HRV) estimates autonomic nervous system influence on the heart and is sex-specific. This study sought to determine the sex-specificity in the effect of capsaicin, a TRPV1-channel agonist, on HRV-estimated cardiac autonomic function. **METHODS**: Resting HRV metrics were obtained in 38 young males (n=25) and females (n=13) in a blinded crossover design, after ingestion of placebo or capsaicin capsules. **RESULTS**: Under placebo, males had significantly lower minimum HR and significantly higher NN50 than females. There was a main effect of sex on HR, minimum HR, and NN50, and a significant interaction between sex and treatment for RMSSD. **CONCLUSION**: Capsaicin ingestion increased RMSSD in men, but decreased RMSSD in women, suggesting sex-differences in parasympathetic nervous system response, possibly due to differences in TRPV1-channel sensitivity.

Project:

DO RACIAL DIFFERENCES EXIST IN PERIPHERAL AND CENTRAL BLOOD PRESSURE AND VASCULAR STIFFNESS IN OTHERWISE HEALTHY YOUNG MEN?

Abena O. Gyampo, 2023; Kendall S. Zaleski, 2022
Stephen J. Ives, Associate Professor, Health and Human Physiological Sciences Department

Cardiovascular disease is the leading cause of death in the U.S., and high blood pressure (BP) is a major risk factor, both of which are elevated amongst African Americans (AA). The purpose of this study was to explore racial differences in central and peripheral BP and vascular stiffness between young healthy AA and Caucasian American (CA) men. **Methods:** 17 college-aged males were assessed for peripheral systolic and diastolic BP, from which central blood pressures, and measures of vascular stiffness (augmentation index and pulse wave velocity) were derived. **Results:** There were no significant group disparities in vascular function marked by all six variables observed. **Conclusion:** There were no significant racial differences in central or peripheral BP and vascular stiffness between young healthy AA and CA men.

Project:

PERIL OR PROMISE: A CASE STUDY OF WIND ENERGY EQUITY IN UPSTATE NEW YORK

Finn Weber, 2023; Kara White, 2024
Karen Kellogg, Associate Professor, Environmental Studies and Sciences Program

Over 1000 wind turbines, with a total capacity of approximately 2000MW, have been installed in New York. Given the state's goal of a zero-emission electricity sector by 2040, more wind development is anticipated. We conducted a case study analysis to assess what wind energy equity means to communities that host wind projects, both to inform future development and provide a baseline for assessing recently enacted legislation. Through our quantitative analysis, we found that projects are sited in counties with significantly lower incomes, percentages of bachelor's degrees, and population densities and include a range of economic benefits. Through qualitative analysis involving stakeholders from six wind projects, we found complex views on equity involving themes around economic development, community values, Upstate/Downstate tensions, and energy production more broadly.

Project:

IT SHORE BLOWS: A SYSTEMATIC LITERATURE REVIEW AND SURVEY OF ONSHORE AND OFFSHORE BARRIERS TO WIND ENERGY IMPLEMENTATION IN THE UNITED STATES

Chloe Faehndrich, 2023; Paige Karl, 2023
Karen Kellogg, Associate Professor, Environmental Studies and Sciences Program

Wind energy is one of the most rapidly growing electricity markets in the US, with significant capacities still untapped both onshore and offshore. To assess the growing literature on wind implementation barriers, we conducted a systematic literature review, coupled with a nationwide survey of stakeholders, to provide a comprehensive review of the most significant barriers. We modeled our search criteria and barrier categories on past studies to allow for chronological assessment, but added new barriers to reflect the changing landscape. We found exponential growth in the number of publications on barriers with the most predominant barriers in the literature being lack of awareness/information and social acceptance, grid system constraints, environmental impacts, and uncertain government policies. Transmission was the most prevalent barrier in our survey results.

Project:

QUANTUM CHEMISTRY OF TRYPTOPHAN FLUORESCENCE

Sebastian Caparas, 2023; Chloe Waldt, 2024
William W. Kennerly, Senior Teaching Professor, Chemistry Department

Tryptophan, a naturally occurring amino acid, absorbs and emits UV light in a process called fluorescence. The way tryptophan fluoresces is heavily influenced by its environment which can reveal information about its environment. We study indole, the substructure of tryptophan key to its fluorescence. We approximate the behavior of tryptophan in real life with computational chemistry applications that operate within density functional theory (DFT). There are numerous functionals that lay out DFT parameters, mapping calculations to prior experiments and the laws of physics. Through them, we create new models of fluorescence. We furthered our understanding twofold: 1) Validating various functionals based on how well the theoretical calculations reflected experimental precedent 2) Developing Python software to read computational output more efficiently.

Project:

shRNA KNOCKDOWN OF MIC60 IN SCA1 CELL LINES

Emily Gilbert, 2022; Nayah Bullen, 2022
Sara Lagalwar, Associate Professor, Neuroscience Program

Spinocerebellar ataxia type 1 (SCA1) is a progressive and ultimately fatal neurodegenerative disease that attacks the Purkinje cells of the cerebellum and initially affects balance and motor control. SCA1 is caused by an autosomal dominant mutation in the ATXN1 gene that leads to neuronal toxicity. Cultured cell exposure to the mutant ATXN1 results in mitochondrial deficits and reduced expression of Mic60/mitofilin. Mic60 is a mitochondrial protein that is part of the MICOS complex and involved in maintenance of mitochondrial architecture, organization, and

function. Its disruption has been implicated in other neurodegenerative diseases, including Parkinson's Disease. This project used short-hairpin RNAs (shRNA) against various parts of Mic60 to examine the effects of its knockdown. shRNAs were transformed and grown in component *E. coli* cells before being extracted, purified, and transfected into human cerebellar Daoy 30Q mammalian cells. Cells were stained and imaged and results will be reported.

Project:

IMAGING MITOCHONDRIA IN SCA1 CELLS
Georgia Berry, 2023; Richard Glynn, 2024
Sara Lagalwar, Associate Professor, Neuroscience Program

Neurodegenerative ataxias including spinocerebellar ataxia type 1 (SCA1) exhibit degeneration of the cerebellum. Our lab has found that mitochondrial dysfunction plays a significant role in SCA1 degeneration. In this study, using immunocytochemistry and fluorescence confocal microscopy, we targeted differing mitochondrial genes in order to examine the structure and pathology of mitochondria in SCA1 cells. We optimized staining and microscopy methods for future studies to compare mitochondrial gene expression and uncover the molecular pathways underlying SCA1 cells.

Project:

MILLENNIAL STRONG: BLAVITY ADDRESSING THE NEEDS OF BLACK COMMUNITIES
Hana Sadoff, 2022
Elzbieta Lepkowska-White, Professor, Management and Business Department

Morgan DeBaun has to make a decision. Should she expand the target market for Blavity or continue to focus on Black Millennials? After all, her company already ventured from providing news to information on travel, lifestyle and entertainment in this target market. Blavity is an American Internet company with a mission to "economically and creatively support Black Millennials across the African diaspora, so they can pursue the work they love, and change the world in the process." A recent graduate, Morgan DeBaun, launched Blavity in 2014 after she could not find reliable information about Black Lives Matter and other protests in response to police brutality in Black communities. This teaching case about Blavity's strategy and its founder is a great lesson for anyone interested in marketing and leadership and especially for young women entrepreneurs coming from underrepresented groups.

Project:

EXPRESSIONS OF EMPATHY IN END-OF-LIFE EDUCATION
Claire Slattery, 2022
Kelly Melekis, Associate Professor, Social Work Department

Due to regular exposure to death and dying, palliative and end-of-life care providers face unique emotional challenges and a high demand for empathic expression. Prior research indicates that experiential experiences are the most effective forms of empathy education, however the ways in which empathy develops is still poorly understood. This study explored empathy development among 24 undergraduate students participating in an 8-week experiential end-of-life care program.

Within-case and cross-case analysis was used to assess empathy development as expressed via student responses to case studies (n=48), and reflective journals (n=120). First cycle coding methods included descriptive and magnitude coding, while elaborative and longitudinal coding were utilized in the second cycle. Preliminary findings provide insight into participants' empathic expressions and the potential impact of different pedagogical practices.

Project:

OPTICAL PROPERTIES OF MODEL SYSTEMS FOR ENVIRONMENTALLY RELEVANT PHOTOSENSITIZERS

Onita Alija, 2021; Natalia Karimova; R. Benny Gerber
Juan Navea, Professor, Chemistry Department

Sea-spray aerosols (SSA) released from the ocean through wave breaking and bubble bursting contain marine chromophoric dissolved organic matter (m-CDOM). These complex light-absorbing substances act as photosensitizers of atmospheric trace gases, opening previously unrecognized chemical reactions within SSA. Previous studies seeking to replicate the optical and photochemical properties of m-CDOM have used small molecules, such as pyruvic acid, to simulate m-CDOM. This work introduces two additional photosensitizers, 4-benzoylbenzoic acid (4BBA) and 4-imidazolecarboxaldehyde, towards a more holistic molecular model of m-CDOM. The effect of environmentally relevant pH in the optical properties of the photosensitizers are investigated experimentally and theoretically. The absorbance of m-CDOM and the molecular proxies is shown to be affected by molecular speciation, changing the region of absorbance as the acidity within SSA changes.

Project:

BRINGING TO LIGHT THE OXIDATION OF SEA SPRAY AEROSOLS: A STUDY OF MODEL SYSTEMS FOR MARINE PHOTOSENSITIZERS

Grace Freeman-Gallant, 2021; Emily Davis, 2023; Onita Alija, 2021; Syafira Nurlita, 2023; Anthony Peraza, 2022
Juan G. Navea, Professor, Chemistry Department

Despite containing oily hydrophobic organic compounds, sea-spray aerosols (SSA) are important cloud seeds. Yet, the interaction of SSA with atmospheric water, leading to cloud formation, is poorly understood. Here, we explore a photosensitized oxidation mechanism that make SSA hydrophilic, explaining their effectiveness in cloud formation. As SSA are formed, they carry marine chromophoric dissolved organic matter (m-CDOM), a photosensitizer, from the sea surface microlayer. These light-absorbing components open alternative pathways for oxidation of fatty acids within SSA. To simulate these reactions, we use two proxies of m-CDOM: 4-benzoylbenzoic acid (4-BBA) and 4-imidazolecarboxaldehyde (imidazole). We utilize state-of-the-art techniques to analyze light-induced oxidation in SSA proxy samples. Photoexcitation of 4-BBA and imidazole within the solar spectra initiate atmospherically relevant reactions resulting in hydrophilic products.

Project:

ATMOSPERIC PROCESSING OF COMBUSTION PARTICLES: IRON MOBILITY AND EFFECTS IN THE MARINE ENVIRONMENT

Cecily Szady and Abby Schlinger, 2022
Juan Navea, Professor, Chemistry Department

Atmospheric combustion particles, such as ashes produced in kilns and power plants, are an important source of environmental iron, a limiting nutrient for plankton in the ocean. These iron-containing particles can partition into the air and dissolve during atmospheric processing, leading to aqueous-phase iron deposition in the marine environment. Here, we investigate the atmospheric acidic processing of two iron-containing combustion particles: ashes from a Lithuanian power plant and from a kiln. Bioavailable Fe^{2+} was found to leach from the particles. If the dissolved iron remains in the marine boundary layer, it can spark plankton blooms. Using samples from the SeaSCAPE experiment, we show the link between iron and plankton blooms and the mechanism that stabilizes iron in the ocean surface.

Project:

COMPUTATIONAL MODELLING OF THE DAYTIME FORMATION OF NITROUS ACID IN THE MARINE ATMOSPHERE

Syafira Nurlita, 2023
Juan Navea, Professor, Chemistry Department

Nitrous Acid (HONO) photodissociates quickly to form nitric oxide (NO) and hydroxyl radicals (OH), with the latter being the main oxidizing agent in the atmosphere. Despite its rapid degradation in the presence of solar radiation, HONO reaches its maximum concentration in the marine atmosphere at noon. This paradox suggests that daytime HONO formation pathways must exist. Recently, our laboratory uncovered a previously unrecognized pathway for the daytime formation of HONO that explains its concentration in the marine atmosphere. Now, we use a box model (KinSim) to assess the atmospheric relevance of this and other photoreactions. Using kinetic parameters we investigate HONO formation from : (i) photochemistry of nitrate; (ii) hydrolysis of nitrosyl chloride (ClNO); and (iii) the role superoxide radicals (O_2^-) from marine photosensitizers.

Project:

DESIGN OF LASER BASED EXPERIMENTS FOR PHYSICAL CHEMISTRY COURSES

Jing Wang Ou Yang, 2023
Juan G. Navea, Professor, Chemistry Department

In this experiment, we explore the use of the Michelson Interferometer as a tool for students to understand and apply the ideas of quantum mechanics in molecular spectroscopy and material science. An experiment to be used in Physical Chemistry II, the work presented here show how students will assemble an interferometer during a laboratory session, using the interferogram to determine the wavelength of a laser beam. Students will learn how to align optics and work safely with lasers. In subsequent experiments, students in Physical Chemistry will use their Michelson

Interferometer as a spectrophotometer and use the interferogram to determine refractive index and thermal expansion coefficient of different materials.

Project:

ECOMAPPING AS A PRACTICE FRAMEWORK FOR WORKING WITH LGBTQ YOUTH

Minghuang Wang, 2023
June Paul, Assistant Professor, Social Work Department

LGBTQ youth may have difficulty accessing the support they need to become healthy-functioning adults. Moreover, there are no evidence-informed practice approaches designed to increase levels of support among this uniquely vulnerable population of youth when individual supportive relationships, resources, and services are lacking. Through focus groups (youth-centric and provider-centric interviews), participant observations, and survey evaluation, this forthcoming qualitative study aims to develop and evaluate a modified version of a clinical assessment tool called an ecomap for the purpose assessing, and as needed, enhancing support for LGBTQ youth. In this presentation will discuss the content/purpose of the tool, our methods of evaluation, and implications for social work practice.

Project:

SCREENAWARE: AN IOS APP TO MANAGE SMARTPHONE USE

Zoe Beals, 2022
Aarathi Prasad, Assistant Professor, Computer Science Department

Current smartphone management tools such as Apple's ScreenTime use a time-based restrictive approach and can create feelings of shame regarding the amount of smartphone use. Findings from semi structured interviews (n=38) showed that people may benefit from smartphone management tools that focus on helping users achieve their personalized goals in relation to their smartphone use. We designed and developed an iOS app called ScreenAware, which implements a goal-based design, allowing the user to customize the app to their liking, and what will be most helpful to them. In Fall 2021, we plan to use the ScreenAware app to compare the effectiveness of our goal-based approach to ScreenTime's time-based approach in helping people manage their smartphone use without adding additional mental health burden.

Project:

UNDERSTANDING FACTORS THAT AFFECT TRUST IN DIGITAL TECHNOLOGIES FOR CONTACT TRACING AND IMMUNITY PASSPORTS

Zoë Bilodeau, 2023; Aaliyah Lawrence, 2024
Aarathi Prasad, Assistant Professor, Computer Science Department

We designed and distributed a survey on Amazon Mechanical Turk (n=211) to learn which factors affect trust in mobile health technologies. Specifically, we wanted to determine whether factors such as a person's socioeconomic background, attitude towards the COVID-19 pandemic and attitude towards privacy and data collection affected their adoption of smartphone applications for contact tracing and immunity passports. Contact tracing apps were designed to alert users who have recently been exposed to someone who tested positive for COVID-19. Immunity passports

allow for secure storage and verification of the user's vaccination status. Our goal is to use the results from our survey to figure out how to improve the design of digital technologies to increase their adoption to help curb the spread of COVID-19.

Project:

STRUCTURAL CHARACTERIZATION OF CORN GLUCAN PHOSPHATASE

Marissa Frenett. 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

Glucan phosphatases are members of the dual-specificity phosphatase (DSP) family of enzymes. Plant glucan phosphatase binds and dephosphorylates glucans, contributing to processive starch degradation in the chloroplast at night. Despite the wealth of biochemical, mutational, and structural information on SEX4, little is known about the mechanism of SEX4 dephosphorylation. This research aims to characterize corn SEX4 using biochemical, biophysical, and structural techniques. Here, we report the kinetic properties of corn SEX4 using generic and substrate-specific glucan phosphatase assays, substrate-binding properties using Differential Scanning Fluorometry, and initial x-ray crystallography data on wildtype SEX4. These findings provide insights into an important regulatory role for SEX4 in reversible starch phosphorylation.

Project:

BIOCHEMICAL CHARACTERIZATION OF POTATO STARCH EXCESS-4

Juan Carlos Cruz, 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

Starch is the primary form in which plants store energy. Glucan phosphatase Starch Excess-4 (SEX4) is necessary for starch degradation in plants and algae systems. SEX4 assists in the process of solubilizing the starch granule and providing hydrolyzing enzymes access to the granule surface. While of clear importance, there are several outstanding questions regarding the initiation, enzymology, and regulation of glucan phosphatases in starch degradation. We utilized potato SEX4 to determine the dephosphorylation kinetics and substrate binding properties of the SEX4 enzyme. Our results show that SEX4 follows non-Michaelis-Menten kinetics against soluble amylopectin, an important feature of enzyme kinetic cooperativity. Future studies will be focused on investigating the mechanism of SEX4 cooperativity.

Project:

DETERMINING STARCH-GLUCAN PHOSPHATASE INTERACTION USING IN-VITRO SEDIMENTATION ASSAY

Eliana Wolpaw. 2023
Madushi Raththagala, Assistant Professor, Chemistry Department

Glucan phosphatases are members of a functionally diverse dual-specificity phosphatase (DSP) family of enzymes. Glucan phosphatase Starch Excess4 (SEX4) binds and dephosphorylates glucans, contributing to processive starch degradation in the chloroplast at night. Little is known about how glucan phosphatases interact with the substrate for SEX4 dephosphorylation activity. To close this gap, we developed an assay to determine the binding affinities of glucan phosphatases and starch substrates. Concanavalin-A based in vitro sedimentation assay is a fast and reliable

method to determine low binding affinities unique to carbohydrate-protein interactions and allows calculation of apparent dissociation constant of a variety of carbohydrate-glucan phosphatase interactions.

Project:

COMPARING TECHNIQUES FOR IMPLEMENTING A BUSINESS PROCESS ON A GRAPH DATABASE

Michael Shriner, 2022; Selina Almasarwah, 2023
Christine Reilly, Assistant Professor, Computer Science Department

A graph data structure represents information about items and the relationships between those items. Graph structured data is found in many applications including social networks, supply chain management, sensor networks, and the computational representation of various scientific processes. We utilized the GraphMore data model for representing and querying graph data. Our projects this summer focused on using the Neo4j native graph database as the storage system. We implemented the GraphMore model in Neo4j then evaluated this implementation by comparing it with a different model that stores the data directly in Neo4j. These results are also compared with our prior results where data was stored in the MariaDB relational database management system.

Project:

DESIGNING A GOLD-LABELED ANTIBODY FOR FASTER WESTERN BLOT

Haru Kato, 2024
Mayuri Roca, Senior Teaching Professor, Chemistry Department

Western blot is a protein detection assay based on sequential interactions between proteins and antibodies. While powerful, Western blot is very time consuming. In this work, a modified Western blot is proposed using an antibody labeled with gold nanoparticles. Lysozyme and anti-lysozyme antibody were used as models. Gold nanoparticles provided sufficient signal for visual detection of the Western blot. To eliminate false positives, exposed surfaces of metal were covered with different passivating molecules; of these molecules, denatured protein showed the most promise. The designed gold-labeled antibody is advantageous as it requires one less antibody resulting in a faster and cheaper Western blot.

Project:

EFFECTS OF OPTOGENETIC STIMULATION OF SHORT NEUROPEPTIDE F AND PIGMENT DISPERSING FACTOR NEURONS ON SLEEP IN *DROSOPHILA MELANOGASTER*

Casey Koochagian, 2023; Matthew Grega, 2023
Debra Possidente, Lab Technician, Neuroscience Program
Christopher G. Vecsey, Associate Professor, Neuroscience Program

Sleep is a nearly universal behavior that is modulated in part by a subset of neurotransmitters called neuropeptides. In *Drosophila melanogaster*, short Neuropeptide F (sNPF) is a sleep-promoting transmitter, while Pigment Dispersing Factor (PDF) is involved in circadian rhythms and wake promotion. This study aimed to investigate the relationship between the sNPF and PDF pathways by activating sNPF neurons, PDF neurons, or both in combination, and testing the effects on sleep

patterns. Two imaging methods were used to confirm the functionality of these driver lines. Behaviorally, we found that brief activation of both sNPF and PDF neurons during the night increased sleep, closely resembling the pattern from activating sNPF neurons alone. In contrast, PDF neuron activation alone resulted in gradual degradation of circadian rhythms.

Project:

LIGHT HAS COLOR-DEPENDENT EFFECTS ON SLEEP IN *DROSOPHILA MELANOGASTER*

Sam Bond, 2023; Aaliyah Peralta, 2024
Christopher G. Vecsey, Associate Professor, Neuroscience Program

An emergent cause of human sleep disruption is evening exposure to blue light from smartphone and computer screens. In contrast, red light may promote sleep; however, exactly how these colors alter sleep is not fully understood. Therefore, we studied the sleep effects of blue and red light in the model organism *Drosophila melanogaster*. We varied the time of colored-light exposure to investigate whether effects were time-dependent. Experiments were performed on wild-type, red-eyed flies and white-eyed mutants. Our results show that both light colors have time-dependent effects on *Drosophila* sleep. Interestingly, sleep-inhibiting effects of blue light were observed in wild-type flies but not in white-eyed mutants. Future studies will examine how light color is detected by the fly brain and transmitted to sleep centers.

Project:

SPECIFYING THE ROLE OF NPF IN SLEEP INDUCTION OF LARVAL AND ADULT *Drosophila melanogaster*

Elizabeth Roy, 2022
Debra Possidente, Lab Technician, Neuroscience Program
Christopher Vecsey, Associate Professor, Neuroscience Program

Sleep is a highly conserved behavior across species with an important role in promoting organismal health. As the process of sleep induction is not well understood, neuropeptides present an intriguing mechanism with their role in manipulating brain function in long-lasting behaviors. Neuropeptide Y (NPY) has been shown to have a direct role in modifying sleep behavior in mammals, so investigating the *Drosophila melanogaster* homolog, Neuropeptide F (NPF), provides a model to study this potential control in sleep modulation. This project utilized optogenetics to manipulate NPF-producing neuron activity in larvae and adults and quantify resulting behavioral changes. Larvae and adults show an increase in motor activity and grooming respectively in response to red-light stimulation. Further analysis is required to make more definitive connections to sleep induction.