Skidmore College

FACULTY STUDENT SUMMER RESEARCH PROGRAM

SUMMER 2021

FINAL PRESENTATIONS
AUGUST 5, 2021

Faculty Student Summer Research Program
Summer 2021

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

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

Samantha Hotz, 2022
Yelena Biberman-

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

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*

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

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:

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

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 P[S)-6 (H)-1 (e)-6 (g).gH2 (7)-Fn 2hekOou, 20244 0 TP /M

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 interaht2 (ng of)3 (e)-10 2 (rG(e)-un(e i)w12 (r)a-5 ( )-c-10 2 -1 (eat)-16(ed)-4 (m)(ng (i)-un9 (

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

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 l(t)-6 (BT0 3.c6o (y)20 (H)-8 (i hha)4 (n 9(ad)-14 (ar))-4 (n4 (d)-4 N4u(t)-6 (i63.9 (n)-

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

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,

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:

Within-case and cross-

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

Project:

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

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

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

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.