Skidmore College

FACULTY STUDENT SUMMER RESEARCH PROGRAM

SUMMER 2018

FINAL PRESENTATIONS
AUGUST 2, 2018

Faculty Student Summer Research Program
Summer 2018

Index

Alumni, Parents, Friends, and Foundation Support… ……...2

Schedule of Presentations ……..……..4

Project Abstracts……..……..….9
(In Alphabetical Order by Faculty Name)

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 2018, there are 40 students funded by the Faculty Student Summer Research program, 25 students funded by external grants received by the faculty and 12 students funded by the S3M grant, working with 31 faculty members on 54 summer-long research projects in a wide range of disciplines.

Funding Sources for Faculty Student Summer Research Programs

ALUMNI, FAMILY, AND FRIENDS

Class of 1967
Samuel Croll ’73
Marlene Oberkotter Fowler ’61
Christy Johnson ’90
Jim Lippman and Linda Friedman Lippman ’82
Richard A. Mellon ’87
Rafael M. Nasser ’88
Margaret Williams Page ’43
The Pates Family
Michael Rose ’90
The Riederer Family
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.

The Valentine Family
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

W.M. Keck Foundation
Rathmann Family Foundation
JKV Foundation
American Chemical Society, Petroleum Research Fund
CCI Center for Aerosol Impacts on Chemistry of the Environment
The National Science Foundation
National Institutes of Health, National Institute on Aging
National Institutes of Health, National Institute of Child Health and Human Development
National Institutes of Health, National Institute of Neurological Disorders and Stroke
S3M Transitional Program
U.S. Department of Homeland Security, FEMA

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.

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

2009-2010
Korena Burgio '11
Evan Caster '11
Megan Gaugler '12
James Turner '11

Faculty Student Summer Research Program

Schedule of Final Research Presentations

Thursday, August 2, 2018

9:00 am – 9:25 am Coffee and Muffins

9:30 am – 10:40 am Poster Presentations

ROOM A

EFFECTS OF CAPSAICIN ON THE VASCULAR RESPONSE TO PASSIVE LEG MOVEMENT
Meaghan Lynch, 2019
Stephen Ives, Assistant Professor, Department of Health and Human Physiological Sciences

ASSESSING THE NEEDS AND ASSETS OF OLDER ADULTS AND THEIR CAREGIVERS
Bailey Hutchins, 2019
Kelly Melekis,Assistant Professor, Department of Social Work

UNDERSTANDING THE KINETICS AND REGULATION OF GLUCAN PHOSPHATASES
Tiffany Henao, 2019
Madushi Raththagala, Assistant Professor, Department of Chemistry

RECONSTRUCTION AND ANALYSIS OF FUNCTIONAL NEURAL NETWORKS OF THE OPTIC TECTUM IN XENOPUS TADPOLES
Philip Steudel, 2019; Ella Long, 2020
Csilla Szabo, Visiting Assistant Professor, Department of Mathematics and Statistics

PETROLOGIC EVOLUTION OF LOW-PRESSURE METAMORPHIC ROCKS FROM COASTAL MAINE
Nathan Smail, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

OLD ORGENIC COLLAPSE AND YOUNG HYDROTHERMAL ALTERATION OF THE ADIRONDACKS REVEALED BY U-Pb ZIRCON PETROCHRONOLOGY
Tess Drauschak, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

ROOM B

CHARACTERIZATION OF ArkA SEGMENT 1 BINDING TO Abp1-SH3 USING MARKOV STATE MODELS
Henry Huang, 2020; Gabriella Gerlach, 2019; Robyn Stix, 2018, Elliott K. Stollar*
K. Aurelia Ball, Assistant Professor, Department of Chemistry
*Eastern New Mexico University

CONFORMATIONAL FLEXIBILITY OF HIV-VIF/APOBEC3F BINDING REGION IN HIJACKED UBIQUITINATION COMPLEX
Kate Johnson, 2020; Elise Tierney, 2018; Sampriti Thapa, 2018; Lieza Chan, 2018; Acadia Connor, 2021; Juan Alcantara, 2021
K. Aurelia Ball, Assistant Professor, Department of Chemistry

COPPER RESISTANCE AS SURVIVAL STRATEGY OF BACTERIAL PATHOGENS
Emily O'Connor, 2019
Sylvia F. McDevitt, Associate Professor, Department of Biology

VALIDATING RAMAN SPECTROSCOPY FOR THE DETECTION OF SURFACE MOLECULES ON SILVER NANOPARTICLES
Julia Danischewski, 2021
Maryuri Roca, Teaching Professor, Department of Chemistry

ESSENTIALISM, ATTITUDES TOWARD TRANSGENDER INDIVIDUALS, AND SUPPORT FOR TRANSGENDER RIGHTS
Rebekah Clapham, 2019
Leigh Wilton, Assistant Professor, Department of Psychology

ROOM C

EXPANDING THE GENETIC CODE WITH PYROGLUTAMATE
Jazmine Sepulveda, 2020
Kelly Sheppard, Associate Professor, Department of Chemistry

PURIFICATION OF THE *BACILLUS SUBTILIS* TRANSAMIDOSOME COMPONENTS
Ashley Sisto, 2020 (Haverford College)
Kelly Sheppard, Associate Professor, Department of Chemistry

CHARACTERIZING THE EFFECT OF SIFAMIDE ON WAKE-SLEEP CYCLE OF DROSOPHILA
Haoyang Huang, 2020
Christopher Vecsey, Assistant Professor, Neuroscience Program

ATMOSPHERIC PROCESSING OF COMBUSTION PARTICLES: IRON MOBILITY AND NITRITE FORMATION FROM FLY ASH
Yao Xiao, 2019; Renee Karchere-Sun, 2020
Juan G. Navea, Assistant Professor, Department of Chemistry

PRELIMINARY EXPLORATION OF A STORAGE MODEL FOR SOCIAL NETWORK DATA
John Litscher, 2020; Esteban Acosta, 2020
Christine F. Reilly, Assistant Professor, Department of Computer Science

10:45 am – 11:50 am Oral Presentations

ROOM A

A COGNITIVE MEDIATION MODEL OF MUSICAL PREFERENCE
Ethan Simon, 2019
Dominique Vuvan, Assistant Professor, Department of Psychology

TESTING DIFFERENT CHRIMSON TRANSGENES TO OPTIMIZE OPTOGENETIC SLEEP EXPERIMENTS
Terrence Gatton, 2020
Christopher Vecsey, Assistant Professor, Neuroscience Program

DISRUPTING THE ENDOCANNABINOID SYSTEM DURING ADOLESCENCE: EFFECTS ON ANXIETY & SOCIABILITY
Colin Johnston, 2019; Henry Stadler, 2019
Hassan Lopez, Associate Professor, Department of Psychology

ROOM B

THE CELLULAR" POST OFFICE": CELL WALL COMPONENTS DELIVER MECHANISM FOR SPECIFIC LOCI AT THE CELL SURFACE
Liangyu Zhou, 2019
David Domozych, Professor, Department of Biology

INVESTIGATING EXTERNAL ELECTRIC FIELD EFFECTS ON ORGANIC SEMICONDUCTORS
Farouq Yusuf, 2021
W. Ruchira Silva, Visiting Assistant Professor, Department of Chemistry

STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF STARCH EXCESS4
Jordan Alvarez, 2020
Madushi Raththagala, Associate Professor, Department of Chemistry

LOS MERCADOS INDIGENAS DE AMERICA LATINA: SABIDURIA Y EMPODERAMIENTO PARA LAS MUJERES
Alex Ahrens, 2019
Viviana Rangil, Professor, Department of World Languages and Literatures

12:00 pm – 12:55 pm Lunch, Murray Aikins Dining Hall

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

ROOM A

ASSESSING THE NEEDS AND ASSETS OF OLDER ADULTS AND THEIR CAREGIVERS
Bailey Hutchins, 2019
Kelly Melekis,Assistant Professor, Department of Social Work

DIRECT PATHWAY FOR *BACILLUS ANTHRACIS* tRNA ASPARAGINYLATION
Jose Giron, 2020
Kelly Sheppard, Associate Professor, Department of Chemistry

CHARACTERIZATION OF THE DUAL PATHWAYS FOR *B. HALODURANS* ASPARAGINYL-tRNA FORMATION
Jon Matthew Bilé, 2021
Kelly Sheppard, Associate Professor, Department of Chemistry

WHAT PROCESSES DROVE METAMORPHISM AND EXHUMATION OF EARTH'S YOUNGEST EXPOSED METAMORPHIC ROCKS? INSIGHTS FROM U-Th-Pb PETROCRHONOLOGY
Telemak Olsen, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

THE ROLE OF VARYING NEURON POPULATIONS IN sNPF-MEDIATED SLEEP BEHAVIOR IN *DROSOPHILA*
Jamie Stonemetz, 2019
Christopher Vecsey, Assistant Professor, Neuroscience Program

MIND WANDERING AND TEST PERFOMANCE
Emily Popp, 2020
Daniel Peterson, Associate Professor, Department of Psychology

ROOM B

CONFORMATIONAL EFFECTS OF SALT ENVIRONMENT AND GS LINKER ON ABP1-ARKA17 COMPLEX
Colin McClure, 2020; Kristina Foley, 2018; Ben Lantz, 2018; Elliott J. Stollar*
K. Aurelia Ball, Assistant Professor, Department of Chemistry
*Eastern New Mexico University

CONFORMATIONAL FLEXIBILITY OF HIV-1 VIF IN COMPLEX WITH HOST CELL PROTEINS
Lieza Chan, 2018
K. Aurelia Ball, Assistant Professor, Department of Chemistry

LOCAL CONFORMATIONS OF VCBC COMPLEX WITH V25-A MUTATION
Acadia Connor, 2021
K. Aurelia Ball, Associate Professor, Department of Chemistry

UNDERSTANDING COPPER RESISTANCE IN Enterobacter cloacae
Shannon Cassel, 2019; Tzu-Yi Lin, 2019
Sylvia F. McDevitt, Associate Professor, Department of Biology

IMPLICIT THEORY OF PERSONALITY AND JUDGMENTS OF MORAL TRANSGRESSORS ACROSS MORAL FOUNDATIONS
Samantha Abrams, 2019
Leigh Wilton, Assistant Professor, Department of Psychology

ROOM C

INSIGHTS INTO SUBSTRATE SPECIFICITY OF STARCH EXCESS4
Claudia Mak, 2020
Madushi Raththagala, Assistant Professor, Department of Chemistry

PRESERVING SILVER NANOPARTICLE COLOR IN SOLUTIONS AND FILMS USING SILICA COATING
Destiny Donelson, 2021
Maryuri Roca, Teaching Professor, Department of Chemistry

QUANTUM CHEMICAL CALCULATIONS COMBINED WITH VIBRATIONAL SPECTROSCOPY TO INVESTIGATE REACTIONS OF ORGANIC COATINGS WITH NON-THERMAL PLASMA
Silver Cang, 2021; Sabrina Xie, 2021; Jack Spagnoletti, 2020
Juan G. Navea, Assistant Professor, Department of Chemistry

DAYTIME CHEMISTRY OF SEA SPAY AEROSOLS
Angelina Leonardi, 2020; Grace Freeman-Gallant, 2021
Juan G. Navea, Assistant Professor, Department of Chemistry

DESIGNING SCENERY FOR SARATOGA SHAKESPEARE COMPANY
Sarah Markley, 2019
Garett Wilson, Artist-in-Residence, Department of Theater

Project:

CHARACTERIZATION OF ArkA SEGMENT 1 BINDING TO Abp1-SH3 USING MARKOV STATE MODELS

Henry Huang, 2020
K. Aurelia Ball, Assistant Professor, Department of Chemistry

An SH3 domain is an interaction domain involved in a large number of the cellular processes responsible for signal transduction or supramolecular complex formation. To function, SH3 domains interact with intrinsically disordered proteins (IDPs). However, these IDPs bind in multiple steps, making the characterization of their full binding pathway a difficult task to complete with experiments alone. To better understand how such interactions contribute to cellular function, we used Molecular Dynamics to simulate the domain-peptide interaction between the peptide ArkA12 and domain AbpSH3. Hidden Markov state models were further used to define separate bound states and their specific transition rates on statistically relevant timescales. Preliminary work suggests that similar analytical methods using different sample features may produce results with improved prediction performance and computational efficiency.

*Other Contributors: Gabriella Gerlach, 2019; Robyn Stix, 2018; Elliott K. Stollar**
**Eastern New Mexico University*

Project:

CONFORMATIONAL FLEXIBILITY OF HIV-VIF/APOBEC3F BINDING REGION IN HIJACKED UBIQUITINATION COMPLEX

Kate Johnson, 2020
K. Aurelia Ball, Assistant Professor, Department of Chemistry

Antiviral APOBEC3 proteins are capable of hypermutating HIV's DNA, effectively inhibiting its spread throughout human cells. However, with HIV's accessory protein, Vif, APOBEC3 proteins are degraded and prevented from hypermutating HIV's DNA. Through molecular dynamics simulations, we computationally predicted the atomic interaction between HIV-Vif and APOBEC3F. We found that APOBEC3F binds with Vif in two regions. One is less stable than the other, and the proteins will detach there periodically, allowing a half bound conformation to occur.

Other Contributors: Elise Tierney, 2018; Sampriti Thapa, 2018; Lieza Chan, 2018; Acadia Connor, 2021; Juan Alcantara, 2021

Project:

CONFORMATIONAL EFFECTS OF SALT ENVIRONMENT AND GS LINKER ON ABP1-ARKA17 COMPLEX

Colin McClure, 2020
K. Aurelia Ball, Assistant Professor, Department of Chemistry

SH3 domains are common interaction domains in the human body which foster cellular communication through protein-protein interactions. SH3 domains, like Abp1, often bind to intrinsically disordered proteins (IDPs), like ArkA17. It was found experimentally that a high salt environment destabilizes the Abp1-ArkA17 complex. Molecular Dynamics (MD) simulations were used to study the binding kinetics that cannot be observed experimentally. The results of these simulations support the experimental data and suggest that electrostatic interactions play an important role in the stabilization of the complex. Our experimental collaborators use a hybrid structure which directly links the domain and IDP together to decrease the concentration of proteins required. MD was also used to simulate this hybrid structure and compare the results to those of the wild type structure.

*Other Contributors: Kristina Foley, 2018; Ben Lantz, 2018; Elliott J. Stollar**
**Eastern New Mexico University*

Project:

CONFORMATIONAL FLEXIBILITY OF HIV-1 VIF IN COMPLEX WITH HOST CELL PROTEINS

Lieza Chan, 2018
K. Aurelia Ball, Assistant Professor, Department of Chemistry

HIV-1 Vif is an intrinsically disordered protein (IDP) that is responsible for the ubiquitination of the APOBEC family antiviral proteins. Vif gains structure through binding with Elongin-B (EloB), Elongin-C (EloC), CBF-β and Cullin5 (Cul5) creating the Vif-CBFβ-EloB-EloC-Cul5 (VCBC-

Cul5) complex, an E3 ubiquitin ligase complex. Understanding how Vif interacts with the ubiquitin complex is essential for creating therapeutics. This complex has been crystallized and to understand the intermolecular interactions, Molecular Dynamics (MD) simulations were run to characterize the conformational changes of the VCBC complex with and without with and without Cul5 to show additiona global and local conformational sampling when Cul5 is not bound to the VCBC complex. These alternate conformations of the VCBC complex may be important for preventing binding and ubiquitination of APOBEC.

Project:

LOCAL CONFORMATIONS OF VCBC COMPLEX WITH V25-A MUTATION

Acadia Connor, 2021
K. Aurelia Ball, Associate Professor, Department of Chemistry

The HIV-Vif protein hijacks an E3 ubiquitin ligase complex by binding to Elongin B (ELoB), Elongin C (EloC), CBF-β and Cullin 5 (Cul5) forming the Vif-CBFβ-EloB-EloC-Cul5 (VCBC-Cul5) complex which is in charge of tagging molecules to be degraded. Through previous experimental research, single point mutations on the N-terminus of Vif have been observed to affect Cul5 binding to the VCBC complex. To determine the effects of the mutation on local conformational sampling, atomic fluctuations and dihedral angle analysis were performed on MD simulations of VCBC, VCBC-V25a and VCBC-Cul5 complexes. Understanding the local conformational changes of the complex with V25a is important for understanding the mechanics of Vif and how the mutation might interrupt Hiv-Vif function to develop a possible therapeutic treatment.

Project:

THE CELLULAR "POST OFFICE": CELL WALL COMPONENTS DELIVER MECHANISM FOR SPECIFIC LOCI AT THE CELL SURFACE

Liangyu Zhou, 2019
David Domozych, Professor, Department of Chemistry

Expansion of a plant cell requires coordinated interaction of cell wall deposition and modulation mechanisms at specific sites on the cell surface in response to internal turgor pressure. While the endomembrane system synthesizes and packages the cell wall components, the cytoskeletal system is responsible for transporting and delivering the components to the cell surface. In this study, an analysis of the actin cytoskeleton and cytoplasmic streaming was undertaken in the unicellular model charophyte, Penium margaritaceum. Immunocytochemical labeling and confocal laser scanning microscopy were the primary tools for this project. Actin forms a series of aggregated bundles just underneath the plasma membrane that run parallel to the long axis of the cell. Using myosin, an ATP dependent motor protein and engine for the actin-based motility, various cell components including Golgi-derived vesicles travel on these bundles to deliver the necessary building blocks of cell wall like freight train on rails. This is process of moving nutrients, proteins and organelles within cell is thus called cytoplasmic streaming. During these ten weeks, my first project was to show that cytoplasmic streaming exist in other type of plants, such as angiospermae. Yellow lilly pollen tube was cultivated to show its streaming. My second project was rhodamine phallodin labeling of the actin cable inside cells to show case the extensiveness of the cables. Actin affecting poisons and myosin affecting poisons such as Latrunculin B, and NEM were used to

explore the degree of damage they cause toward the cables. My last project was involved with using actin and myosin affecting poisons to stop or significantly slow streaming rate, and then restart streaming by washing the poison out. This is to show the importance of actin-myosin motility system in cell division.

Project:

ENVIRONMENTAL JUSTICE IN SARATOGA SPRINGS
Jillian Seigel, 2018
Jordana Dym, Professor, Department of History

Environmental justice ensures fair treatment and access to natural resources for all people regardless of their backgrounds. What does local environmental justice look like in Saratoga Springs? How has the community factored access to environmental resources into planning, development, regulations and policies, and implementations of environmental laws? Through working with Project HAL (Humanities Action Lab) and our community partner, Sustainable Saratoga, we began the research of stories and materials to be used by Skidmore students in a traveling exhibit in the Spring of 2019. The theme of modes of and access to transportation weaves through the project, and will help address other issues prevalent in the community such as housing, green spaces, work opportunities, gentrification, and others.

Project:

SUPERSTAR EFFECT AND CONSUMER TIPPING BEHAVIOR: EVIDENCE FROM THE NBA
Chenyu Zhou, 2019
Qi Ge, Assistant Professor, Department of Economics

We match NBA game outcomes with a high frequency dataset on taxi rides in New York City to investigate how emotions as a result of sporting events, particularly in the presence of superstars, affect passengers' tipping behavior. Our empirical results indicate that the post-game tipping amounts are not only driven by surprises due to deviations from pre-game expectations but also magnified by the presence of superstars. In particular, we find that compared to games without superstars, the presence of home team superstars can make fans tip more (less) by as much as 2.5 percentage points when their home team incurs a surprise win (loss). Our findings suggest that the superstar effect may extend far beyond sporting events and affect consumer behavior off the field.

Project:

PETROLOGIC EVOLUTION OF LOW-PRESSURE METAMORPHIC ROCKS FROM COASTAL MAINE
Nathan Smail, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

Low-Pressure Metamorphism (LPM) is a prevalent feature of rocks affected by the Taconic and Acadian orogenies, which were mountain-building events roughly ~425 and ~380 millions of years

ago in coastal Maine. How are high thermal gradients reached during LPM? What was the source of heat? The pressure-temperature paths recorded by metamorphic rocks may be diagnostic of heating mechanism(s). Results from one sample show a polymetamorphic history, with an initial, high-pressure metamorphism (~8 kbar, 610°C), followed by LPM (3.6 kbar, 670°C) concurrent with movement along a crustal-scale strike-slip fault. Another sample only records evidence for the initial, high-pressure event. This suggests: 1) these rocks record previously unrecognized metamorphism related to continental collision, and 2) the later LPM was more limited in spatial extent than previously assumed.

Project:

WHAT PROCESSES DROVE METAMORPHISM AND EXHUMATION OF EARTH'S YOUNGEST EXPOSED METAMORPHIC ROCKS? INSIGHTS FROM U-Th-Pb PETROCRHONOLOGY

Telemak Olsen, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

Nanga Parbat (NP), one of the highest mountains in the western Himalaya, is comprised of the youngest high-temperature, partially melted metamorphic rocks on Earth, which crystallized approximately 1 million years ago (Ma). This is in contrast to the rest of the Himalaya, in which older (15-25 Ma) rocks are exhumed, with previous studies suggesting that rapid erosion by the Indus River at NP drove deep crustal metamorphism/partial melting. We used U-Th-Pb dating, chemical analyses, and textures of accessory minerals to constrain the timing and duration of metamorphism and partial melting in NP. Our results suggest anomalously young (~2 Ma) partial melting occurred, rapidly followed by exhumation and cooling at ~1 Ma. This history could be consistent with either rapid erosion driving partial melting, or vice-versa.

Project:

OLD ORGENIC COLLAPSE AND YOUNG HYDROTHERMAL ALTERATION OF THE ADIRONDACKS REVEALED BY U-Pb ZIRCON PETROCHRONOLOGY

Tess Drauschak, 2020
Victor Guevara, Assistant Professor, Department of Geosciences

The rocks that comprise the Adirondacks represent the deep crust of a mountain belt known as the Grenville orogenic province, ~1.1 billion years ago. A significant portion of the Adirondacks is comprised of a rock known as the Marcy Anorthosite massif (Mm), whose margins are ductilely deformed. This deformation suggests that the Marcy massif was exhumed during collapse of the Grenville orogen, ~1050 million years ago (Ma). We dated rocks potentially related to this exhumation using U-Pb isotopes. Our data shows that the Mm was exhumed at ~1050 Ma. Data from another sample indicates that the Adirondacks experienced hydrothermal alteration at ~211 Ma, during breakup of the Pangea supercontinent. Our study is the first to document that the Adirondacks were affected by continental rifting at ~200 Ma.

Project:

THE SOCIAL ECONOMY IN CHINA: THE CASE OF HAPPY LIVING

Siqi Chen, 2019
Xiaoshuo Hou, Associate Professor, Department of Sociology and Asian Studies Program

The social economy, revived in the West as a response to neoliberalization, is often seen as a way to moralize the economy under the principles of locality, reciprocity, and solidarity. Through the case study of Happy Living, a non-profit organization in China that provides aging and youth services, we explore how such organizations navigate their external environment. We find that the state is both an enabler and an inhibitor in the development of organizations like Happy Living that heavily depend on state resources. While previous literature often regards social economy organizations as forces for democratic empowerment, we find that service-oriented social organizations in China do not necessarily view challenging the status quo as their mission. They do, however, provide more localized services to marginalized populations.

Project:

EFFECTS OF CAPSAICIN ON THE VASCULAR RESPONSE TO PASSIVE LEG MOVEMENT

Meaghan Lynch, 2019
Stephen Ives, Assistant Professor, Department of Health and Human Physiological Sciences

Previous work in isolated and animal models suggests, capsaicin, the spicy ingredient in peppers, improves vascular function. Therefore, we sought to determine the effects of capsaicin on vascular function using passive leg movement (PLM), a technique shown to be sensitive to alterations in vascular health. In a single blind crossover design, 13 healthy young males underwent continuous PLM at 60 cycles/minute for two minutes after taking placebo or capsaicin. At baseline and during PLM Near infrared spectroscopy (NIRS) of the thigh was recorded for oxygen saturation (StO2), total hemoglobin concentration (THC), oxyhemoglobin concentration (HbO), and deoxyhemoglobin concentration (Hb), as estimates of vascular function. Preliminary analyses suggest acute capsaicin ingestion attenuated vascular function and thus further work is needed to determine if capsaicin supplementation is advisable.

Project:

DISRUPTING THE ENDOCANNABINOID SYSTEM DURING ADOLESCENCE: EFFECTS ON ANXIETY & SOCIABILITY

Colin Johnston, 2019; Henry Stadler, 2019
Hassan Lopez, Associate Professor, Department of Psychology

Animal models suggest that the endocannabinoid system (eCS) helps regulate various aspects of social behavior, including play, during childhood and adolescence. In the current experiment, we pharmacologically disrupted the eCS during early adolescence, and then assessed the short and long-term behavioral effects. 36 male Long Evans rats received daily injections between post-natal day (PND) 25-39 of either: 1) vehicle, 2) CP55,940 (a cannabinoid agonist), or 3) AM251 (a cannabinoid antagonist). In both middle adolescence (PND 40-44) and early adulthood (PND 66-70), subjects were assessed for general anxiety (using an elevated plus maze) and sociability (using

a 3-chambered sociability apparatus). We hypothesized that drug-treated subjects would express reduced sociability compared to controls. This would indicate that early disruption of the eCS has long-term, persistent neurobehavioral effects.

Project:

A MASKED FORM PRIMING MEGA-STUDY: THE ROLE OF LETTER IDENTITIES AND POSITIONS DURING READING

Jessica Cheng, 2019; Eden Shiferaw, 2018
Rebecca Johnson, Associate Professor, Department of Psychology

Masked form priming is an experimental paradigm in which prime stimuli (words or nonwords) are presented briefly, then masked by a series of #'s, and followed by a target stimulus. Letter position in preview words are manipulated through letter removal, transposition and addition. Participants then identify if the stimulus is a word or nonword, measured by reaction time. The results of masked form priming studies contribute to our understanding of how letter identities and positions are encoded and processed. Findings show that reaction time increased with increased spacing between transposed letters (ie. "ANCHOR"; "ANHCOR", "AOCHNR") and with additions and subtractions of letters. No significant differences were found between beginning and middle letter removal, or between single letter and double letter additions.

Project:

INDOLE FLUORESCENCE BY QUANTUM MECHANICS IN GAS AND AQUEOUS PHASE

Gregory Foley, 2021; Wenqin He, 2021
William Kennerly, Senior Teaching Professor, Department of Chemistry

Indole is the aromatic sidechain of the amino acid tryptophan, a useful biological probe due to the sensitivity of its fluorescence properties. We want to use quantum-mechanical calculations with *Gaussian* to assess its fluorescence, particularly using time-dependent density functional theory due to its time efficiency. After testing various functionals with excited-state gas-phase indole, LC-BLYP, LC-PBEPBE, and ωB97X yielded relatively successful results, while many others were deemed unacceptable due to a "confusion" bug in Gaussian not allowing crucial identification of the L_a/L_b excited states. We further evaluated various aqueous environment models, both implicit and explicit on these calculations. The implicit solvent model SCRF completely failed. The explicit water molecule approach was partially successful.

Project:

PYTHON SCRIPTING SUPPORT FOR INDOLE FLUORESCENCE ANALYSIS

Ryan Dohrn, 2020
Dr. William Kennerly, Senior Teaching Professor, Department of Chemistry

Our research group uses *Gaussian* to determine accurate quantum mechanical properties of indole in different molecular environments. We needed a script to parse the *Gaussian* output files into a usable format to permit easy analysis. An initial version was written in Python, as a standalone parser that also reformatted, saved, and graphed the relevant data. However, we needed another more universal method of extraction that could tolerate using different software. The open-source Python module named *cclib* is designed to use output files from a wide variety of simulation programs similar to *Gaussian*. We implemented *cclib* and rewrote the script giving it the ability to parse all data contained in the given output file, regardless of the format and allow fresh takes on the data.

Project:

HÜCKEL MOLECULAR ORBITAL THEORY IS CONNECTED TO GRAPH THEORY VIA DATA MINING

Ethan Celebuski, 2019
Dr. William Kennerly, Senior Teaching Professor, Department of Chemistry

Hückel molecular orbital theory allows chemists to easily calculate the π electron energy and orbitals of a molecule using a linear combination of its carbon 2p atomic orbitals. *Mathematica* can quickly compute the π electron energy using the eigenvalues of the adjacency matrix of the graph corresponding to the molecule. While many molecule's energies can be expressed with exact mathematical formulas, others result in polynomial equations that can't be solved exactly. We have used a combination of graph theory and data mining techniques to look for connections between the molecular graph properties and whether the energies are exactly solvable, or not.

Project:

COPPER RESISTANCE AS SURVIVAL STRATEGY OF BACTERIAL PATHOGENS

Emily O'Connor, 2019
Sylvia F. McDevitt, Associate Professor, Department of Biology

Research indicates that macrophages are utilizing heavy metals, such as copper and zinc ions, to kill pathogens they engulfed as part of our non-specific immune response. While copper is an essential trace element, at high concentrations copper can be toxic to all cells, including bacteria. Some strains of *Enterobacter cloacae* carry a 20-gen copper resistance gene cluster that can aid them to counteract the toxic effect of elevated metal concentrations. Here we tested if the presence of the 20-gene copper resistance cluster in *E. cloacae* ATCC13047 increases the bacteria's ability to survive short time exposure to high concentrations of copper as well as their survival in the presence of macrophages.

Project:

UNDERSTANDING COPPER RESISTANCE IN *ENTEROBACTER CLOACAE*

Shannon Cassel, 2019; Tzu-Yi Lin, 2019
Sylvia F. McDevitt, Associate Professor, Department of Biology

While copper is an essential trace element, at high concentrations copper can be toxic to all cells, including bacteria. *Enterobacter cloacae* ATCC13047 possesses two 20-gene copper resistance gene clusters, one of which is encoded on a plasmid (pECL_A). However, one of the genes involved in regulation is disrupted on pECL_A. After transfer of pECL_A into *Escherichia coli* we tested the transconjugants' ability to grow in the presence of elevated copper concentrations while at the same time worked on cloning an intact copy of the disrupted pcoRS to be utilized in the transconjugants. Initial results indicate that the transconjugants are as sensitive to the presence of copper as *E. coli* without the plasmid, whereas *E. cloacae* ATCC13047 is able to grow at higher copper concentrations in the medium.

Project:

RESIDENTAL HOMES FOR THE DYING: UNIQUE TRAINING IN END-OF-LIFE CARE

Bailey Hutchins, 2019
Kelly Melekis, Assistant Professor, Department Social Work

Communityrun residential homes for the dying offer a unique venue for obtaining interprofessional skillstraining to improve students' confidence and ability to provide endoflife care. This mixed-method pilot study examined the impact of placing undergraduates in direct caregiver roles in residential homes for the dying in upstate New York. Data revealed significant increases in empathy ($p < .05$) and perceived selfefficacy to provide palliative care ($p < .001$) after completion of the program. Qualitative data analysis of journal entries unveil that comfort care homes may be an ideal place to train students—across health care disciplines—about caregiving, self-reflection, communication, and teamwork. Students state that these developed skills can be utilized in health care fields and beyond.

Project:

FACTORS ASSOCIATED WITH LONELINESS AMONG RURAL OLDER ADULTS

Bailey Hutchins, 2019
Kelly Melekis, Assistant Professor, Department of Social Work

Loneliness has been linked to negative health outcomes including disability, cognitive decline, and depression (Cacioppo et al., 2006; James et al., 2011) and recent research has led to a growing call for loneliness to be viewed as a "major public health issue" (Gerst-Emerson & Jayawardhana, 2015). Using data from a statewide needs assessment of older adults in Vermont, this study utilized survey data from 433 older adults to examine the relationships between health, quality of life, and the role of the environment with the experience of loneliness and isolation (R-UCLA Loneliness Scale). Results revealed significant relationships between loneliness and self-reported health status ($p<.001$), living arrangements ($p<.001$), functional capability ($p<.001$), falls ($p<.05$), and concerns about staying at home ($p<.001$). Respondents' qualitative comments are congruent with these findings.

Project:

DAYTIME CHEMISTRY OF SEA SPAY AEROSOLS

Angelina Leonardi, 2020; Grace Freeman-Gallant, 2021
Juan G. Navea, Assistant Professor, Department of Chemistry

Nitric acid (HNO3) and particulate nitrates have long been considered a sink for atmospheric NOx. However, recent studies suggest that sea spray aerosols (SSA) provide a reactive media for HNO3, resulting in the renoxification of the atmosphere. Yet, little is known about the role of solar radiation in these atmospheric systems. Sunlight can excite photoactive components of SSA, initiating photochemical processes on nitrated particles or carboxylic acids present within SSA. To model these processes, we simulate nitrate photodegredation by humic acids (HA), a proxy for humic substances in SSA. Humic substances photosensitize nitrate particles, opening an additional pathway for daytime HONO and NOx formation. In addition, photosensitized carboxylic acids were observed to react with volatile organic compounds (VOC), decreasing the mass of SSA particles.

Project:

QUANTUM CHEMICAL CALCULATIONS COMBINED WITH VIBRATIONAL SPECTROSCOPY TO INVESTIGATE REACTIONS OF ORGANIC COATINGS WITH NON-THERMAL PLASMA

Silver Cang, 2021; Sabrina Xie, 2021; Jack Spagnoletti, 2020
Juan G. Navea, Assistant Professor, Department of Chemistry

Important fractions of petroleum refining require extensive processing before commercialization, but selective oxidation of these organic molecules is challenging because of their high volatility and requirement for high temperatures. Here, we present an alternative method for the oxidation of volatile hydrocarbons at room temperature using non-thermal plasma. Organic coatings on alumina surfaces have been proven to prevent gas-phase partition of chemisorbed hydrocarbons. Oxidation is performed by non-thermal plasma processing, using O(3P) as oxidizing agent.

Vibrational spectroscopy is used to investigate the reaction kinetics and quantum calculations aid in the analysis of chemisorbed hydrocarbons and surface-bound oxidized products. Quantum calculations suggest multiple oxidations of 1-hexene, leading to the formation of an alcohol via hydrogen subtraction, followed by carbonyl groups. Continued plasma treatment leads to product loss.

Project:

ATMOSPHERIC PROCESSING OF COMBUSTION PARTICLES: IRON MOBILITY AND NITRITE FORMATION FROM FLY ASH

Yao Xiao, 2019; Renee Karchere-Sun, 2020
Juan G. Navea, Assistant Professor, Department of Chemistry

Fly ash, a byproduct of coal-firing power plants, is an aerosol particle rich in iron oxides. Under atmospheric acidic conditions, it can leach iron, an essential nutrient for living organisms in the ocean. In this study, we compare the iron mobility from fly ash in hydrochloric acid and in nitric acid. In the presence of nitrates, we found that iron containing particles induce a surface-mediated redox reactions that reduces nitrates into nitrites. In this project, the yield and rate of aqueous iron leached and nitrite formed from US, Indian and European ashes has been investigated atmospherically relevant conditions during both daytime and nighttime.

Project:

MIND WANDERING AND TEST PERFOMANCE

Emily Popp, 2020
Daniel Peterson, Associate Professor, Department of Psychology

While performing an everyday task, humans often find their mind beginning to wander to another topic. Instead of thinking about the current task, we imagine future tasks we need to complete, analyze our state of being, and daydream. These types of task unrelated thoughts can be detrimental to performance on the current activity. Mind-wandering often occurs while individuals are reading or studying materials. While previous research has focused on how mind-wandering affects memory, only few experiments have investigated how to reduce levels of mind-wandering. The present research seeks to explore whether different methods of testing (cued recall, recognition, free recall) lead to differential rates of mind-wandering. We predict that mind-wandering will be highest for recognition tests, followed by cued-recall tests, and finally free recall tests.

Project:

LOS MERCADOS INDIGENAS DE AMERICA LATINA: SABIDURIA Y EMPODERAMIENTO PARA LAS MUJERES

Alex Ahrens, 2019
Viviana Rangil, Professor, Department of World Languages and Literatures

Indigenous women in many Latin American countries have been labeled “the poorest of the poor, among the planet’s least represented and most exploited.” The precarious position these women occupy within the political and economic realms in society obscures their importance as custodians of culture, language, and knowledge – a role that merits more attention and recognition.

MERCADOS INDIGENAS is an archive of oral histories that presents the agency of women as producers and sellers of food and art. We believe that food and art are cultural practices that reaffirm identity, and at the same time, provide the means for women to be players in the global economy. We hope that the texts, images, and interviews we have selected for this presentation will provide a new perspective on the invaluable role indigenous women play in Latin America.

Project:

STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF STARCH EXCESS4

Jordan Alvarez, 2020
Madushi Raththagala, Associate Professor, Department of Chemistry

Throughout the day starch is synthesized in chloroplast and is then used for cellular maintenance the subsequent night. The reversible phosphorylation of glucose moieties of starch (1 phosphate in 1500 glucose molecules) is essential to starch synthesis and degradation. Plant glucan phosphatase Starch Excess4 (SEX4) binds to starch granular surfaces at the interfaces of CBM (carbohydrate binding module) and DSP (dual specificity phosphatase), then proceeds to remove phosphate groups attached to the C6 and C3 glucose moieties. It is unclear how SEX4 identifies phosphate groups throughout the heterogeneous starch environment. Our goal is to demonstrate the ways SEX4 molecules recognize and dephosphorylate linear and branched chains of glucose. We have used structure guided mutagenesis followed by protein purification and biochemical assays to understand this process.

Project:

INSIGHTS INTO SUBSTRATE SPECIFICITY OF STARCH EXCESS4

Claudia Mak, 2020
Madushi Raththagala, Assistant Professor, Department of Chemistry

Glucan phosphatases are vital to the reversible phosphorylation process that occurs during starch degradation in plants. However, little is known about how glucan phosphatases navigate and interact with the complex starch granule. Insights into this process can be applied to industrial settings for harnessing starch and future biofuel research. This study aims to create a novel Concavalin A-based assay to further the understanding of glucan phosphatase-starch interactions. This rapid and accessible method will measure the binding affinities of glucan phosphatase Starch Excess4 (SEX4) to the different components of the starch granule (linear, branched, phosphor-oligosaccharides, etc.). Once optimized, this assay can be extended to other glucan phosphatases and carbohydrate-binding enzymes such as dikinases and amylases.

Project:

UNDERSTANDING THE KINETICS AND REGULATION OF GLUCAN PHOSPHATASES

Tiffany Henao, 2019
Madushi Raththagala, Assistant Professor, Department of Chemistry

Glucan phosphatases are a family of enzymes responsible for the dephosphorylation of starch. The three glucan phosphatases found in plants are Starch EXcess4 (SEX4), Like Sex Four2 (LSF2), and Like Sex Four1 (LSF1). Previous studies have discovered, through the crystalized structures

of SEX4 and LSF2, the primary mechanism of how glucan phosphatases bind carbohydrate chains and integrate them into the catalytic site. SEX4 preferentially dephosphrylates at the C6 position of glucose in starch where as LSF2 dephosphorylates at the C3 position. However, the kinetics and regulatory mechanisms of these glucan phosphatases have not been studied extensively. Therefore, the project aims to define the enzymology of SEX4 and LSF2. The results of generic phosphatase assay using pNPP as the substrate for SEX4 showed the enzyme to follow Michaelis-Menten Kinetics.

Project:

MONITORING PERFORMANCES OF STUDENT ATHLETES: ETHNOGRAPHY AND WEARABLE TECHNOLOGY

David Rivera, 2020
Bernardo Ramirez Rios, Assistant Professor, Department of Anthropology

This project examined athletic performance using a mixed-methods approach (Ethnography and Player Tracking Technology) by modeling the daily-lived experience of a student-athlete during over a three-week period. First, using ethnography as a methodology, a series of field-notes and interviews were conducted. This qualitative measurement was aggregated at the end of the project to produce cultural themes. Then, these themes were used to build bio-cultural bridges (correlations). Meaning, ethnography provided the daily-lived experience (cultural outcomes) of the model student-athlete that were used as a foundation for the data set. Second, a survey was created using Qualtrics to track daily habits (sleep, energy, nutrition) before gameplay. Finally, using player tracking technology (SPT) as a data source, we periodically obtain data from pick-up basketball games across the three-week period to quantify performance by tracking distance covered and intensity levels. These results were cross-tabulated with the ethnographic data to determine overall performance and their relationship to the daily-lived experience of a model student-athlete.

Project:

PRESERVING SILVER NANOPARTICLE COLOR IN SOLUTIONS AND FILMS USING SILICA COATING

Destiny Donelson, 2021
Maryuri Roca, Teaching Professor, Department of Chemistry

Silver nanoparticles can be synthesized to become certain colors in solution. Methods have been introduced to properly coat these nanoparticles with silica and transform them into films maintaining their solution color. Coating gold takes 2-3 hours, but the reagents are not silver nanoparticle friendly. Silver takes many steps and 2-3 days to coat, which can be costly at large amounts. A hybrid method between the silver and gold coating methods was tested, taking 2-3 h to completely coat silver nanoparticles. The color was monitored in solutions and films using uv-vis, and with TEM, the formation of the nanoparticle and silica shell were monitored. Color was preserved from solution to film. Reproducing the silver nanoparticle colors could make the design of sensors environmentally friendly and cost-efficient.

Project:

VALIDATING RAMAN SPECTROSCOPY FOR THE DETECTION OF SURFACE MOLECULES ON SILVER NANOPARTICLES

Julia Danischewski, 2021
Maryuri Roca, Teaching Professor, Department of Chemistry

Recent studies have focused on the ability of silver nanoparticles to enhance the Raman spectra of molecular compounds, but not the signal of the molecules which inherently surround the particle. The signal of these compounds (PVP, ascorbic acid, and PVA), though weak, may be used to track changes in the molecules present at the particle surface. The validation of the Raman spectroscope using relevant standards was followed by SERS investigations of various stages of nanoparticle film production. Changes in the ratio of spectral peaks were observed, suggesting a connection between the ratio and particle size, concentration, and PVA content in films. By better understanding the surface properties of nanoparticles, a clearer picture of how particles interact with each other and other compounds may be generated.

Project:

TIMEOUT

Mary Brimmer, 2019
Rik Scarce, Professor, Department of Sociology

Timeout is a filmic space dedicated to uniting the voices of high school students so often overlooked by those claiming to know their experiences. It follows a group of students' experiences with the conflict resolution and community building technique known as "restorative justice," and finds those students eager to embrace a platform that both encourages them to share their concerns and to suggest how school climate can be improved in a time of great fear. The footage reveals the daily strains in young adults' lives and the emotional turmoil bubbling beneath the surface. In their own words, students call for greater attention to those who are most deeply affected by school change and its consequences.

Project:

EXPANDING THE GENETIC CODE WITH PYROGLUTAMATE

Jazmine Sepulveda, 2020
Kelly Sheppard, Associate Professor, Department of Chemistry

Formation of pyroglutamate in proteins is associated with diseases such as Alzheimer's. To better understand pyroglutamate's role in protein structure and function, an *E. coli* model system was developed to directly incorporate pyroglutamate into proteins. Key to this process is the use of a modified archaeal RNA-dependent glutamine biosynthetic pathway in which pyroglutamate is synthesized on an amber suppressor tRNA. Enhanced yellow fluorescent protein was used as a reporter system to determine levels of read-through, and therefore incorporation, of pyroglutamate in response to an amber codon. As yield was poor, we are developing a new pyroglutamate system using mesophilic enzymes. Success of this system will be confirmed by mass spectrometry.

Project:

OVERPRODUCTION OF *B. ANTHRACIS* PROTEINS FOR ASPARAGINE BIOSYNTHESIS

Sento Kai Kargbo, 2020
Kelly Sheppard, Associate Professor, Department of Chemistry

Proteins are essential for all of life and are polymers composed of amino acids. The amino acid asparagine can be synthesized in organisms in one of three ways. 1) Asparagine synthetase A (AsnA) using free ammonia to modify the amino acid aspartate into asparagine; 2) asparagine synthetase B (AsnB) transamidating aspartate to asparagine by transferring ammonia from glutamine; or 3) the amidotransferase, GatCAB, synthesizing asparagine on RNA. The pathogen *Bacillus anthracis* uniquely codes for all three pathways. Why *B. anthracis* encodes all three is not clear. We hypothesize that the different pathways provide the bacteria the means to exploit different chemical environment. To test this, the relevant proteins must be overproduced and purified before being characterized under different conditions.

Project:

DIRECT PATHWAY FOR *BACILLUS ANTHRACIS* tRNA ASPARAGINYLATION

Jose Giron, 2020
Kelly Sheppard, Associate Professor, Department of Chemistry

Protein synthesis is essential for life and requires the correct pairing of amino acids to their cognate transfer tRNA (aminoacylation). To date, only two routes exist to attach asparagine (Asn), to it cognate $tRNA^{Asn}$: the direct and indirect pathways. The direct path uses asparaginyl-tRNA synthetase to attach Asn to $tRNA^{Asn}$ when Asn is present. Asn is synthesized by asparagine synthetase A. The causative agent for anthrax, *Bacillus anthracis*, appears to encode both routes for Asn-$tRNA^{Asn}$ formation. We would like to understand why *B. anthracis* codes for both routes, and if one pathway is preferred over the other under varying conditions. This summer we have focused on the direct pathway. We report the successful purification enzymes and $tRNA^{Asn}$ involved in the direct pathway as well as initial kinetic studies.

Project:

CHARACTERIZATION OF THE DUAL PATHWAYS FOR *B. HALODURANS* ASPARAGINYL-tRNA FORMATION

Jon Matthew Bilé, 2021
Kelly Sheppard, Associate Professor, Department of Chemistry

Protein synthesis requires the attachment of an amino acid to its cognate transfer RNA (tRNA). Two distinct pathways for attaching asparagine (Asn) to $tRNA^{Asn}$ are known: the direct pathway, in which Asn is directly attached to $tRNA^{Asn}$ by AsnRS; and the indirect pathway, in which Asn is attached to tRNA by non-discriminating AspRS and GatCAB. *Bacillus halodurans* uses both routes for the formation of the Asn-$tRNA^{Asn}$ complex. To better understand why *B. halodurans* possesses both pathways, we are purifying its AsnRS and AspRS in order to test and compare their activities under different chemical conditions such as reactive oxygen species and pH. This research will provide insight into how *B. halodurans* has adapted to survive in different environmental conditions.

Project:

INVESTIGATING EXTERNAL ELECTRIC FIELD EFFECTS ON ORGANIC SEMICONDUCTORS

Farouq Yusuf, 2018
W. Ruchira Silva, Visiting Assistant Professor, Department of Chemistry

Charge transfer species, which creates an electric field, plays a central role in organic semiconductors. However, there is a lack of understanding how does these electric fields effect on neighboring molecules. We investigate the effect of external electric field on of Tetracyanoquinodimethane (TCNQ)-a paramount molecule in organic semiconductors using density function theory. We saw a significant anisotropic effect on IR spectrum of TCNQ when the applied electric field along with the symmetry axis of TCNQ. Further studies show a nonlinear field dependence on IR modes. Interestingly, major contribution for the vibrational spectral change is mainly due to the vibrational Stark effect. These finding can be used as an internal sensor to quantitatively determine the localized electric fields of organic semiconductors.

Project:

RECONSTRUCTION AND ANALYSIS OF FUNCTIONAL NEURAL NETWORKS OF THE OPTIC TECTUM IN XENOPUS TADPOLES

Philip Steudel, 2019; Ella Long, 2020
Csilla Szabo, Visiting Assistant Professor, Department of Mathematics and Statistics

In *Xenopus* tadpoles, visual motion is first detected in the optic tectum (OT) region of the brain. The firing patterns of each neuron in a portion of the OT have been recorded using calcium imaging. In this project, the functional network of the OT is reconstructed by correlating the firing data for each neuron in order to find the probability of a connection between each pair of neurons. The resulting correlation matrices for each trial are thresholded to yield networks with the least random assignment of directed connections. Network metrics are calculated for these structures and compared across varying developmental stages and visual stimulus conditions.

Project:

MAKING "A MESS OF THINGS," A DOCUMENTARY ARTIST'S BOOK
Atlan Arceo-Witzl, 2018
Adam Tinkle, Visiting Assistant Professor, Media and Film Studies/MDOCS

Working from the audio of Adam Tinkle's documentary sound performance "A Mess of Things," we developed a book project that contains a full transcript of the piece's text and a series of dense visual collages of archival material relevant to the piece's content. The project entailed graphic design, digital collage, and a range of analog and physical approaches to handmade book construction..The resulting books will be available to read and handle.

Project:

A PRELIMINARY STUDY OF THE EFFECTS OF MATERNAL AND PATERNAL METHAMPHETAMINE USE ON OFFSPRING CIRCADIAN RHYTHM IN *DROSOPHILA MELANOGASTER*
Emily Cross, 2019; Arianna McDaniels, 2021
Christopher Vecsey, Assistant Professor, Neuroscience Program

Methamphetamine use can cause increased arousal, and, when used during gestation, can affect offspring. Studies have been done to determine the effects of maternal use on offspring, but no study has been done to determine the effects of paternal use on offspring. *Drosophila melanogaster* is a good model for comparing these effects on offspring because their sleep-wake patterns are known to be affected by methamphetamine and they have a high fecundity rate. In this preliminary study, the optimal dose of methamphetamine (0.1% ME) was determined through circadian rhythm analysis using Drosophila Activity Monitors (DAMs). 0.1% ME dosage altered circadian rhythm in both males and females and was also discovered to have a lower mortality rate when used in long-term exposure compared to acute exposure.

Project:

CHARACTERIZING THE EFFECT OF SIFAMIDE ON WAKE-SLEEP CYCLE OF *DROSOPHILA*
Haoyang Huang, 2020
Christopher Vecsey, Assistant Professor, Neuroscience Program

SIFamide (SIFa) is a neuropeptide produced in four specific neurons in the *Drosophila* brain. Previous studies suggest that SIFamide plays a critical role sleep. However, the pathway and the mechanism of SIFamide remained unclear. To further characterize the effect and the pathway of SIFamide in sleep, we first created transgenic fly lines whose SIFaminergic neurons would be activated by red light stimulus. Then, by utilizing DAM (*Drosophila* Activity Monitor) system and infrared light camera, we recorded and quantified sleeping patterns of experimental *Drosophila* in response to red light stimuli. Our results supported previous studies which suggested that SIFa is a sleep promoter, and our data also revealed that female experimental flies had stronger response to the stimulus than males did, suggesting possible sexual dimorphism.

Project:

THE ROLE OF VARYING NEURON POPULATIONS IN sNPF-MEDIATED SLEEP BEHAVIOR IN *DROSOPHILA*

Jamie Stonemetz, 2019
Christopher Vecsey, Assistant Professor, Neuroscience Program

In *Drosophila*, a variety of neuropeptides play a role in controlling sleep and circadian rhythms, one of which is Short Neuropeptide F (sNPF). Activation of all sNPF neurons has been shown to lead to an increase in sleep. However, sNPF is expressed throughout the nervous system and is co-expressed with other neurotransmitters, and it is not yet known how different neuronal populations contribute to sleep promotion. We addressed this issue using optogenetic tools to control sNPF neuron activation and monitoring sleep behavior in response. When neuronal activation was refined to non-clock neurons, flies exhibited a less sustained response to stimulation than when sNPF neurons were broadly activated, suggesting that clock neurons play a role in maintaining the sleep-promoting effect of sNPF activation.

Project:

A COGNITIVE MEDIATION MODEL OF MUSICAL PREFERENCE

Ethan Simon, 2019
Dominique Vuvan, Assistant Professor, Department of Psychology

Previous research indicates that musical training is associated with improved auditory working memory, and an increased preference for musical complexity (Bugos et al., 2007; Burke & Gridley, 1990; Lu & Greenwald, 2016; Przysinda et al. 2017; Ramachandra et al., 2012). Work in the visual domain suggests that appreciation is increased when the visual complexity of an artwork is compatible with the viewer's visual working memory capacity (Sherman et al., 2015). We therefore hypothesize a novel mediation model in which auditory working memory mediates a relationship between musical training and preference for musical complexity. By developing a cognitive model of aesthetic preference, the current study refines our understanding of the relationship between complex skills training and its cognitive outcomes.

Project:

DESIGNING SCENERY FOR SARATOGA SHAKESPEARE COMPANY

Sarah Markley, 2019
Garett Wilson, Artist-in-Residence, Department of Theater

Saratoga Shakespeare Company is a professional theater company that provides free theater for the Saratoga Community in Congress Park. Over the summer, Professor Wilson and I designed the sets for this season of Shakespeare, which included *As You Like It* and *Henry IV Parts 1 and 2*. First, we designed the architectural structure of the stage. We collaborated with the directors to understand their visions for each show. From this information we conceptualized our own interpretations of each show and began planning how to create high caliber sets in a short amount of time. Through the process of sketching, drafting, building and painting, we created the spooky and dangerous forest of Arden, elegant French Court, King Henry IV's palace, and the Boar's Head Tavern.

Project:

ESSENTIALISM, ATTITUDES TOWARD TRANSGENDER INDIVIDUALS, AND SUPPORT FOR TRANSGENDER RIGHTS

Rebekah Clapham, 2019
Leigh Wilton, Assistant Professor, Department of Psychology

How do essentialist beliefs about transgender identities influence attitudes towards transgender people? Participants (N = 555) completed a novel scale consisting of three transgender essentialism domains: belief that transgender identity is biological and unchangeable (*immutability*), consistent across time and place (*universality*), and a separate social category (*discreteness*). Belief in transgender universality and immutability was associated with less transgender bias (e.g., disapproval of transgender people), less transgender stereotype endorsement (e.g., mentally ill), and more support for transgender rights (e.g., restroom access). Belief in transgender discreteness, however, had the opposite effects. Additionally, belief in lesbian-gay immutability was negatively correlated with attitudes towards transgender individuals. Attempts to reduce transgender bias should focus on transgender populations specifically, and emphasize the biological and universal nature of transgender identity.

Project:

IMPLICIT THEORY OF PERSONALITY AND JUDGMENTS OF MORAL TRANSGRESSORS ACROSS MORAL FOUNDATIONS

Samantha Abrams, 2019
Leigh Wilton, Assistant Professor, Department of Psychology

Previous research demonstrates that *implicit moral theories*, or beliefs about the changeability of a person's moral character, affect the way people judge transgressors who violate the rights or welfare of others. The current research expanded upon this literature by examining the effects of implicit moral theory on judgments of transgressors across two different moral dimensions: *Harm/Care*, which includes matters of individual wellbeing, and *Purity/Sanctity*, which includes matters of moral decency or chastity. The present study suggests that people tend to view individuals who engage in harmful behavior as more immoral, cruel, and disgusting; more likely to stay the same in the future; more blameworthy and deserving of punishment; and less deserving of forgiveness than individuals who engage in morally disgusting behavior, regardless of implicit theory.

OTHER SUMMER RESEARCH PROJECTS

Project:

CONFORMATIONAL CHANGES IN THE VIF-A3F INTERFACE USING MOLECUAR DYNAMIC SYMULATIONS

Juan Alcantara, 2021
K. Aurelia Ball, Assistant Professor, Department of Chemistry

Viral Infectivity Factor (Vif) is an intrinsically disordered protein belonging to HIV-1, which gains its stability in human cells by hijacking an E3 ubiquitin ligase complex composed of Elongin-C, Elongin-B, Cullin-5 and CBF-ß (VCBC-Cul5 complex). APOBEC3F (A3F) is an antiviral protein that has the ability stop the propagation of HIV. However, the VCBC-Cul5 complex binds to A3F tagging it with ubiquitins leading to the degradation of A3F allowing HIV to thrive. Molecular dynamic simulations were used to understand the binding interface between A3F and Vif to investigate specific residues that are essential to maintain the interaction. A3F residue Glu662 and Vif residue Arg15 from previous research is speculated to have strong electrostatic interactions; however, further simulations show inconsistences in distances between the residue pair.

Project:

PARENTS' CONCERNS WITH SMART DEVICE USE IN THE HOME

Ruben Ruiz, 2018
Aarathi Prasad, Assistant Professor Department of Computer Science,
Timothy Stablein, Sociology, Union College

Given the rising influence of technology in society, it is imperative to study the equally rising concern of how the technology affects family life. We expect parents to have concerns regarding their kids' usage of smart devices, such as whether the amount of time spent using the devices and the exposure to smart device application content is affecting their children's familial relationships and emotional and social development. During this summer internship, I analyzed data obtained from focus groups and personal interviews conducted by Professors Prasad and Stablein with over 20 parents that explored how the parents felt about their children's device use. In the poster, I will present some of the interesting findings I discovered from the data analysis.

Project:

MENTAL HEALTH APPS FOR COLLEGE CAMPUSES

Asia Quinones, 2021
Aarathi Prasad, Assistant Professor, Department of Computer Science

A study in 2012 showed that 62% of students withdrew from college due to mental health reasons. Researchers have developed several smartphone and wearable apps to help college students manage their anxiety and depression. In the poster, I will present a summary of the relevant technology solutions that I found during the literature review I did as part of my summer internship, as well as describe the experimental studies Professor Prasad and I plan to conduct in fall 2018 along with the counseling center at Skidmore.

Project:

PRELIMINARY EXPLORATION OF A STORAGE MODEL FOR SOCIAL NETWORK DATA

John Litscher, 2020; Esteban Acosta, 2020
Christine F. Reilly, Assistant Professor, Department of Computer Science

This project explores the use of a generic model for the type of data that is commonly used by online social network services. The motivation for this project is to create public knowledge about how to store and query this type of data. We wrote computer programs to demonstrate that the data model can be implemented in two different storage systems. An existing benchmark program was adapted in order to test the two implementations. This is preliminary work for a larger project that focuses on the use of existing distributed storage systems for social network data.

Project:

PURIFICATION OF THE *BACILLUS SUBTILIS* TRANSAMIDOSOME COMPONENTS

Ashley Sisto, 2020 (Haverford College)
Kelly Sheppard, Associate Professor, Department of Chemistry

There are two distinct routes for attaching asparagine (Asn) to its cognate transfer RNA ($tRNA^{Asn}$), an essential step in protein synthesis, in the bacterium *Bacillus subtilis*. The one-step asparaginyl-tRNA synthetase directly attaches asparagine to its corresponding tRNA. In the indirect pathway, a non-discriminating aspartyl-tRNA synthetase (ND-AspRS) initially attaches aspartate to $tRNA^{Asn}$. This aspartate is modified to asparagine by the aminotransferase GatCAB. This two-step pathway synthesizes asparagine using the transamidosome: a complex between the ND-AspRS, $tRNA^{Asn}$, and GatCAB. I am working to purify the components of the transamidosome to characterize the *B. subtilis* indirect pathway to better understand its role in the life cycle of *B. subtilis*, an organism being considered as a probiotic treatment for intestinal disorders.

Project:

IDENTIFYING INTERACTING PARTNERS FOR SYNAPTIC CONNECTIVITY-REGULATING GENE *DIP-α*

Terrence Gatton
Christopher Vecsey, Assistant Professor, Neuroscience Program

Motor neurons are thought to achieve selective muscle connectivity through specific extracellular proteins lining the membranes of both the neuron and muscle. The proteins are hypothesized to interact on a molecular level for target recognition. In *Drosophila Melanogaster* larvae, DIP-α has been found to be essential in neurons for connection to muscle 4. However, it is unknown what mechanism allows DIP-α to mediate these connections. Immunostaining methods allowed visualization of the nervous system of larvae bred with missing regions on their 3rd chromosome to identify genes involved in synaptic connectivity. Of the 9 regions tested, deficiency #7634 was found to rescue connectivity in male larvae lacking DIP-α, suggesting that a gatekeeping mechanism for synaptic connectivity may be mediated by a gene within that region.

Project:

TESTING DIFFERENT CHRIMSON TRANSGENES TO OPTIMIZE OPTOGENETIC SLEEP EXPERIMENTS

Terrence Gatton, 2020
Christopher Vecsey, Assistant Professor, Neuroscience Program

Optogenetics is an experimental method in which experimenters can genetically Optogenetics is an experimental method in which experimenters can genetically manipulate specific types of neurons so that only those neurons produce a light-sensing neuronal activator. Our lab has used the red light sensor *Cs-Chrimson* to activate neurons that produce transmitters implicated in sleep regulation. Unfortunately, expression of the *Cs-Chrimson* gene in fruit flies can have non-specific effects on sleep patterns in the absence of light stimulation, such as causing gradual increases in sleep in males when expressed in sleep-regulating neurons. Different variants of this transgene were tested to see if these unwanted experimental effects could be avoided. The first variant tested, *Chrimson R*, still showed light-independent changes in flies' sleep patterns, specifically an overall increase in sleep in males across multiple days.