OFFICE OF SPONSORED RESEARCH

Annual Report of External Funding

Proposals and Awards: A Year in Review

JUNE 2018 | MAY 2019

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New Awards

Characterization and Modulation of SH3 Domain Binding Pathway Biophysics

THE NATIONAL SCIENCE FOUNDATION

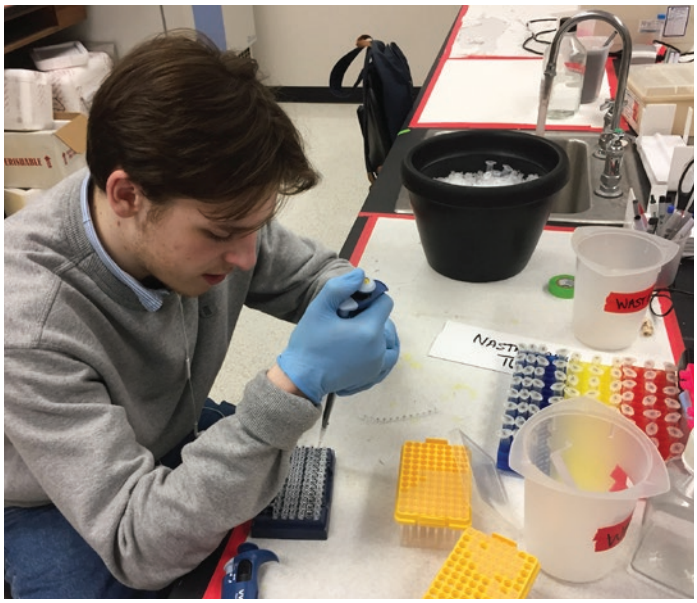
PROJECT PERSONNEL:

Principal Investigator **K. Aurelia Ball** (Chemistry)

Collaborators: **Elliott Stollar** (University of Liverpool) and **Michael Latham** (Texas Tech University)

ABSTRACT:

The goal of this research is to understand how common protein binding interactions can be tuned in small ways to perform specialized functions in different cellular contexts. The communication within cells that allows cellular processes to occur is mediated by interactions between proteins. Understanding the details of these interactions, including their strength and specificity, will allow researchers to predict and modify the many types of cell behavior. Results will provide deeper insights into how protein binding interactions function in different cellular contexts and help explain how a common interaction can specialize to perform many different cellular functions. Undergraduate students working on this project will have the opportunity to learn both computational and experimental biophysics skills, including how both computational and experimental data can contribute to a project to form a more complete model of protein interactions. Students will also work closely with scientists at Texas Tech University (Mike Latham) and the University of Liverpool (Elliott Stollar) and experience first-hand the importance of collaboration to the modern scientific process. To allow a larger number of students to have an experience with undergraduate research, a research-based lab course will expose students to techniques in computational biophysics and molecular dynamics simulations. In this course, students develop and carryout a research project contributing to the larger project goals. This project also includes the development of a one-credit course for science majors on women and underrepresented groups in science. This course will be geared toward all natural science majors, and will encourage students navigating a major where women are traditionally underrepresented to consider and grapple with ideas about identity in science. Topics will include the challenges that women and minorities may face regarding identifying as scientists, stereotype threat, and impostor syndrome. The course will prepare students to be leaders on the topic of underrepresented groups in science and include a service-learning project.



Victor Koltenyuk ('20) purifies RNA from tilapia tissues in support of the Breves lab's ongoing investigations into the physiological mechanisms that support hydromineral balance in vertebrates.

Identifying Osmosensitive Molecular Targets Using a Unique Vertebrate Model

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Jason Breves** (Biology)

Collaborators: Principal Investigators **Andre P. Seale** and **Darren Lerner** (University of Hawai'i at Mānoa)

ABSTRACT:

A stable internal osmotic environment is essential to life because the functional structures of macromolecules are highly sensitive to small changes in their osmotic environment. In vertebrates, specific osmoreceptor cells respond to physiologically relevant changes in osmolality to restore and maintain osmotic homeostasis. In euryhaline teleost fishes, including Mozambique tilapia (*Oreochromis mossambicus*), the hormone prolactin (Prl) plays an indispensable role in freshwater osmoregulation. Accordingly, Prl release from tilapia pituitary is inversely related to extracellular osmolality. Tilapia Prl cells have been employed as a model for studying osmoreception, as they are easily separated for in vitro studies where prl gene expression and/or Prl secretion can be characterized simultaneously with other cellular transduction components. Nonetheless, little is known on how the prl gene is activated by hyposmotic stimuli. Our investigations will characterize the specific prl promoter regions that respond to secondary messengers activated by changes in extracellular osmolality, thereby allowing for the identification of novel transcription factors that mediate hyposmotic induction of the prl gene. By combining the tilapia Prl cell with a prl promoter reporter assay, the overarching goal is to further our understanding of the molecular mechanisms underlying osmoreception, a fundamental, albeit understudied sensory modality. This collaborative study linking the research, teaching, and outreach programs at the University of Hawai'i and Skidmore College will provide knowledge on the mechanisms involved in osmoreception in a manner that is applicable to all vertebrates.

Quick Carbon Rapid Soil Carbon Assessment Research Program

THE NOBLE RESEARCH INSTITUTE

PROJECT PERSONNEL:

Principal Investigator **Kristofer Covey** (Environmental Studies and Sciences)

ABSTRACT:

Dr. Covey received research funding from the Noble Research Institute to prepare a report on the progress of the Quick Carbon rapid soil carbon assessment research program (quickcarbon.org). Funds were used to support travel expenses for seven Skidmore Environmental Studies and Sciences students to attend a multi-day prescribed fire workshop. The workshop was a joint field tour with Yale University School of Forestry and Environmental Studies. In addition to classroom training and active participation in three prescribed fires, students from Skidmore and Yale joined regional experts in presentations and conversations related to rangeland management, fire, climate change, and food systems. In addition to the direct research funding, the Noble Research Institute provided for ground transportation, meals and lodging, and waived workshop fees for all Skidmore participants.

Elle Ping ('21), Greta Binzen ('19), Ruthann Richards ('21), Sam Vogel ('19), JC Mueller ('21), and Brandon Radcliffe ('20) along with students from the Yale University School of Forestry and Environmental Studies and staff from the Noble Research Institute.

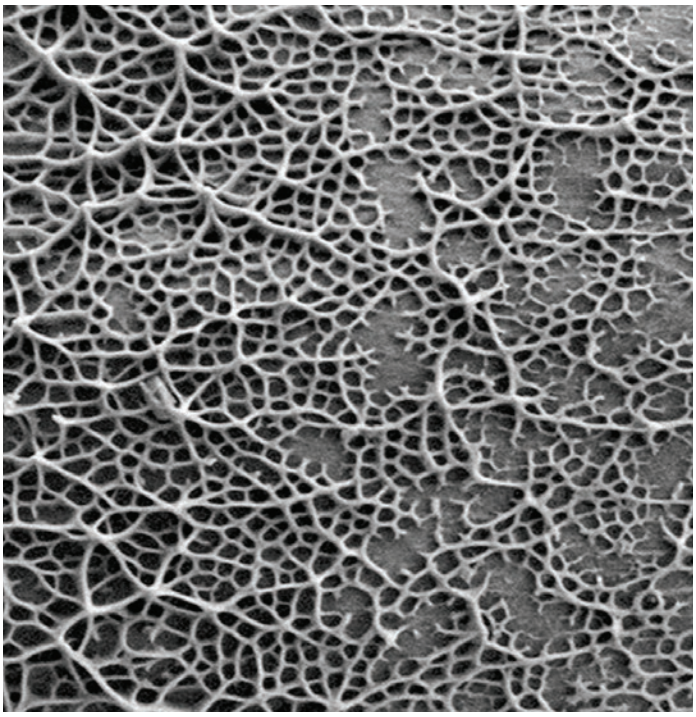


Image of altered pectin deposition in the alga, Penium, using Skidmore's newly acquired Field Emission Scanning Electron Microscope.

Acquisition of a Field Emission Scanning Electron Microscope and Energy Dispersive Spectrometry Attachment for High Resolution Imaging at Skidmore College

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **David Domozych** (Biology), Co-Principal Investigators **Jason Breves** (Biology), **Kimberley Frederick** (Chemistry), **Richard Lindemann** (Geosciences), and **Juan Navea** (Chemistry), and Major Users **Heather Hurst** (Anthropology) and **Kurt Smemo** (Environmental Studies and Sciences)

ABSTRACT:

An award is made to Skidmore College to acquire a Field Emission Scanning Electron Microscope (FESEM) for support of multiple ongoing research projects and the development of new research initiatives in the life and physical sciences. The FESEM will significantly enhance student-faculty collaborative research at the College, provide a powerful new tool for science courses requiring high resolution surface imaging, and will directly contribute to active collaborations between Skidmore scientists and researchers from around the world. This instrument will also be used to enhance early student engagement in science and technology via the Skidmore Scholars in Science and Mathematics (S3M) and the Higher Education Opportunity Program (HEOP), and for community outreach, including the Johns Hopkins Center for Talented Youth and the annual Skidmore Science and Math Open House.

Preparing a High-Resolution Chronology of Xultun, Guatemala

THE RUST FAMILY FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Heather Hurst** (Anthropology)

ABSTRACT:

The San Bartolo-Xultun project will produce "high resolution chronology" using radiocarbon and ceramic chronology that will enable us to examine critical periods of social change in the Maya area spanning the Middle Preclassic to Terminal Classic periods (1000 BCE to CE 950). The sites of San Bartolo and Xultun are key regional lowland polities, the former with murals providing information on the initial development of Maya rulership, and the latter as a significant urbanized settlement with a dynastic history stretching to the end of the 9th century. Our understanding of the development of urbanized settlement led by dynasties with divine rule, as well as the maintenance of these political systems, is based on the analysis of material culture that is enhanced by precise temporal control. At the conclusions of over 15 years of fieldwork, sampling results will provide a chronological framework grounded in chemistry and ceramics that will refine our discussion of the archaeological data already documented at site, improve publications poised to be disseminated, and direct future excavations.

Advice and Counseling Pertaining to Voter Communications

THE NORTH CAROLINA LEAGUE OF CONSERVATION VOTERS FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Christopher Mann** (Political Science)

ABSTRACT:

Dr. Mann will provide advice and counseling pertaining to voter communications, namely, advice and counseling on program content, timing, and data processing for programs related to nonpartisan voter education about voter registration, voting by mail, early in person voting, election day voting, and/or reducing down-ballot roll-off to be conducted between July 2018 and November 2018, and on design and analysis of field experiments to evaluate these programs.

Advice and Counseling Pertaining to Voter Communications

THE LEAGUE OF CONSERVATION VOTERS EDUCATION FUND

PROJECT PERSONNEL:

Principal Investigator **Christopher Mann** (Political Science)

ABSTRACT:

Dr. Mann will provide advice and counseling pertaining to voter communications, namely, advice and counseling on program content, timing, and data processing for programs related to nonpartisan voter registration and voter mobilization to be conducted between August 2018 and November 2018, and on design and analysis of field experiments to evaluate these programs.

Text Out the Vote: Voter Registration and Mobilization Through SMS Text Messages

VOTE.ORG

PROJECT PERSONNEL:

Principal Investigator **Christopher Mann** (Political Science)

ABSTRACT:

Dr. Mann will evaluate randomized control tests conducted by Vote.org between September 2018 and December 2018 as part of programs using SMS messaging for voter mobilization. These tests seek to increase mail ballot chase in postal voting states, states with permanent mail voter status, states with requested mail ballots, and California (permanent and requested ballots); encourage voting on Election Day, in areas hit by Hurricanes Florence and Michael, and among Vote.org opt-in list; and encouraging voter turnout in Mississippi and Georgia run-off elections.

Media Myths and Public Perception of Polling Place Wait Times

THE MIT ELECTION DATA AND SCIENCE LAB

PROJECT PERSONNEL:

Principal Investigator **Christopher Mann** (Political Science)

Collaborator: Principal Investigator **Kathleen Searles** (Louisiana State University)

ABSTRACT:

News media coverage on Election Day often focuses on long wait times at polling places – despite long waits being rare. Despite scholars and election administrators frequent criticism of this media coverage, this two-part research project is the first rigorous examination of the impact of this coverage on public opinion and voting behavior. The first stage of the project will conduct a systematic examination of media coverage of lines to vote in 2018 and 2016. The second stage of the project will conduct a randomized experiment to a national sample to assess the impact of this news media coverage on voting participation, public perception of long wait times, confidence in election administration, and trust in government institutions.

Students Claudia Bennett-Caso ('19) and Sarah Gowan ('19) working on the new photochemical flow enclosure for the QCM.

CCI Center for Aerosol Impacts on Chemistry of the Environment

THE NATIONAL SCIENCE FOUNDATION (SUBAWARD FROM THE UNIVERSITY OF CALIFORNIA SAN DIEGO)

PROJECT PERSONNEL:

Subaward Principal Investigator **Juan Navea** (Chemistry)

Collaborator: Principal Investigator **Kimberly Prather** (University of California San Diego)

ABSTRACT:

The aim of the proposed work is to investigate the effect of solar radiation on sea spray aerosol (SSA), including (1) the consequences of aged SSA on the atmospheric chemical balance and (2) SSA daytime particle changes. This project proposes to investigate alternative pathways for the formation of HONO and the concomitant renoxification of the atmosphere, specifically via photosensitized/photolysis reactions. We propose to study the kinetics of photosensitized reactions using humic-like substances (HULIS), photosensitizers found in SSA during the previous phase of CAICE. Two major hypotheses will be examined: (i) HULIS will become nitrated upon reactive uptake of trace gases, such as NO2 and nitric acid; and (ii) nitrated HULIS, along with NO2 and nitrates on the HULIS framework, will photolyze to form a previously unrecognized formation pathway of HONO in the marine boundary layer. In conjunction with the formation of gas-phase products such as HONO, we will also investigate the fate of HULIS in SSA. Specifically, we hypothesize that the HULIS photosensitization of carboxylic acids within SSA, such as glycolic acid, can facilitate VOC reactive uptake, thus increasing the organic fraction and mass of SSA. We propose to use quartz crystal microbalance (QCM) photochemical flow cell to investigate the mass changes in SSA during daytime reactions of excited glycolic acid with isoprene, using HULIS model system and marine-extracted HULIS in a photosensitizer.

Shifting Control From Negative Plant-Microbe Feedback to Nutrient Limitation: Predictions from Dominant Tree Traits and Ecosystem Nutrient Economies

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Kurt Smemo** (Environmental Studies and Sciences)

Collaborators: Principal Investigators **Christopher Blackwood** (Kent State University) and **Richard Phillips** (Indiana University)

ABSTRACT:

Forest ecosystems are globally important due to their biological diversity and influence on carbon and nutrient cycles. In forests worldwide, fungi and tree roots form a mutually-beneficial relationship that provides food to fungi in return for helping trees gain access to soil nutrients. This relationship is increasingly recognized as a key trait for predicting long-term forest dynamics. Tree species can be divided into two categories based on whether the fungi grow inside the root cells ("arbuscular mycorrhiza") or on root surfaces ("ectomycorrhiza"). This research addresses whether biochemical differences between mycorrhizal tree types have cascading effects on the soil microbial community and other members of the plant community. Specifically, the project will test the novel hypothesis that the type of mycorrhizae formed by the dominant trees in a forest determines whether the trees and other plants are more likely to be limited by nutrients or by disease (pathogens). Ectomycorrhizal trees produce leaf and root tissue that is more difficult to decompose than the tissue from arbuscular mycorrhizal trees, reducing nutrient availability but also the ability of plant pathogens to persist since many pathogens grow on dead plant tissue when between live hosts. Thus, the mycorrhizal type of the dominant tree species is predicted to create a soil environment that either reduces nutrient availability (under ectomycorrhizal trees) or enhances the speed and severity of plant-pathogen interactions (under arbuscular mycorrhizal trees). This project merges ecological theories about drivers of plant populations and communities, providing a powerful general framework that may transform our understanding of how shifts in tree species composition affect future ecosystem dynamics. The project outcomes will also include training the next generation of scientists and a public forest restoration project that will establish plots of differing mycorrhizal tree types, engage volunteers, help educate the public, and contribute to our understanding of forest restoration.

Skidmore undergraduates collecting forest floor samples as part of a long-term study on how forest fungi control species composition and ecosystem processes in temperate forests.

BETTER HEART research team participants gather at Broward County Fire & Rescue for the Medical Advisory Team meeting.

Building Evaluations That Translate Evidence and Research for Health Evaluations And Related Training (BETTER HEART)

THE FEDERAL EMERGENCY MANAGEMENT AGENCY

PROJECT PERSONNEL:

Principal Investigator **Denise Smith** (Health and Human Physiological Sciences) and Co-Investigator **Julie Douglas** (Mathematics and Statistics)

Collaborators: Subaward Principal Investigators **Casey Grant** (Fire Protection Research Foundation), **Stefanos Kales** (Cambridge Health Alliance), **Steven Moffatt** (National Institute for Public Safety Health), and **Chief Ronald Siarnicki** (National Fallen Firefighters Foundation)

ABSTRACT:

BETTER HEART addresses an important Fire Service vulnerability – the need for occupationally relevant medical evaluations for the detection of cardiomegaly and left ventricular hypertrophy and early atherosclerosis. Approximately half of all on-duty fire fighter deaths each year are cardiac related. These deaths impact all areas of the Fire Service including wildland, volunteer, and career fire fighters. Additionally, for every cardiac fatality, there are approximately 26 non-fatal cardiac events. Fire departments have a legal responsibility to manage risk, including occupational health risk. While many hazards at a fire scene are not identifiable, there is ample evidence of the increased risk of cardiac events, and fire departments have an explicit mandate to manage that risk. Fire fighter specific and appropriate medical screening is essential to managing that risk. Research has identified cardiomegaly and left ventricular hypertrophy as greatly increasing the risk of sudden cardiac events in fire fighters, yet these structural heart changes are seldom addressed in medical evaluations. In this project, a medically-focused, multidisciplinary team will synthesize current medical understanding and Fire Service research/data to develop evidence-based cardiac screening recommendations and training materials. These guidelines will be pilot tested in fire departments and the outcomes evaluated and incorporated into final recommendations that will be shared with the NFPA 1582 committee, the Fire Service, and the medical community to ensure that more fire fighters receive medical evaluations and more fire fighters receive better medical evaluations.

Origins of Recursive Mathematical Knowledge in Childhood

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Jessica Sullivan** (Psychology)

Collaborator: Principal Investigator **David Barner** (University of California San Diego)

ABSTRACT:

This project will investigate how children between the ages of 3 and 7 years learn about the rules that govern counting. The main goal of this project is to examine how the verbal structure of counting in different languages affects children's ability to learn core math concepts like recursion and infinity. Therefore, the work will have a broad impact on understanding how the structure of symbolic systems taught to children affect their ability to learn core STEM concepts. The project will foster interdisciplinary research, and will create a collaborative bridge between the University of California-San Diego, a PhD granting university, and Skidmore College, where research is conducted as part of undergraduate training. This will promote new forms of training on both campuses, spanning Psychology, Cognitive Science, Linguistics, and Education.

Dr. Jessica Sullivan with children from elementary school in India where she conducted research on children's developing understanding of infinity.

Active Grants

Dance to Success

THE GKV FOUNDATION

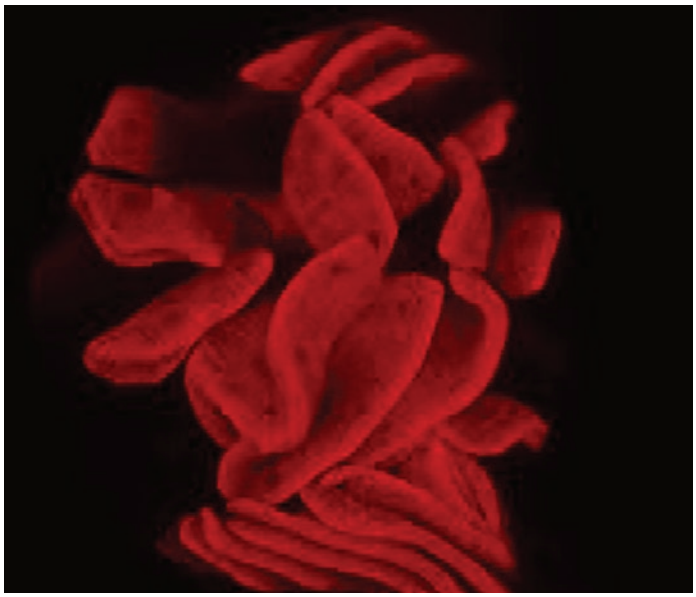
PROJECT PERSONNEL:

Principal Investigator **Sarah DiPasquale** (Dance)

ABSTRACT:

Previous research sponsored by the National Endowment for the Arts has reported on the relationship between arts engagement and at-risk youth. It was found that students with low socioeconomic status but with a high exposure to the arts demonstrate higher college enrollment and show improved academic achievement than their non-arts-exposed peers. The Dance to Success program is designed to improve student learning outcomes by means of making high-quality dance accessible to public-school teachers in districts with high rates of student socioeconomic disadvantage. Dance to Success provides teachers with web-based access to 3-5 minute dance videos, consisting of original, brain-based movement geared to promote body-mind connectivity and improve student focus. Teachers are asked to utilize the dance videos with their students before every assessment given and, additionally, as 'brain breaks' as they see fit throughout the school day. Skidmore College students create the videos on campus as part of the program's pre-college overlay. The aim of Dance to Success is to demonstrate the importance of dance and movement integration in public-school education through quantitative analysis of state and local assessment scores, reading levels, behavior referrals, and attendance as compared to a control group of nonparticipating classrooms. Furthermore, a qualitative assessment of teacher, student, and parent perceptions will allow for additional insight into the program. To our knowledge, our study is the first of its kind to both quantitatively and qualitatively investigate the use of dance in relation to student achievement and, more specifically, the relationship between dance exposure and at-risk youth.

Dance to Success workshop with 4th graders at Park Terrace Elementary School, Gloversville, NY.



Altered chloroplast of Penium after chemically-induced loss of microtubules. Image = Chlorophyll autofluorescence.

Invasion of Land: Using Model Charophyte Penium margaritaceum to Elucidate Subcellular Responses to Stress that Were Key in the Evolution of Land Plants

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **David Domozych** (Biology)

Collaborator: Principal Investigator **Jocelyn Rose** (Cornell University)

ABSTRACT:

The colonization of land by green algae 450 to 500 million years ago and their evolution into land plants represent important events in the natural history of the planet. These terrestrial (land) plants have caused major changes to the Earth's biochemistry and biosphere. Land plants evolved from green algae called charophytes, a small but diverse group of freshwater and terrestrial organisms. Central to the success of the charophyte colonization of land was the extracellular matrix (ECM) that surrounds their cells. This ECM is made up of a wall that covers the outside of the cell and the gel-like substances that are secreted from these organisms. This project will provide a comprehensive understanding of the formation and function of the ECM of the charophyte being tested, Penium. This organism will be grown under various environmental conditions, including water stress and extreme dryness. The ECM and its related biosynthetic processes will be studied using cutting edge technologies that were previously funded by the National Science Foundation. This research will provide insight into the mechanisms that were important to initiate survival on land by ancient charophytes, as well as mechanisms that are still used by many land plants today. This information will be used to devise models of how plants adapt to life on land and how they tolerate non-biological stresses such as drought. This project will also provide opportunities for post-doctoral training and summer undergraduate research, initiate external summer programs for local high school students, and serve as a basis for future course development.

Quantitative Parenchyma Descriptor as an Imaging Biomarker for Breast Cancer Risk

THE NATIONAL INSTITUTES OF HEALTH (SUBAWARD FROM THE UNIVERSITY OF MICHIGAN)

PROJECT PERSONNEL:

Subaward Principal Investigator **Julie Douglas** (Mathematics and Statistics)

Collaborator: Principal Investigator **Jun Wei** (University of Michigan)

ABSTRACT:

Breast cancer remains one of the leading causes of death among women at the age of 40 and older. Mammography has been used as a low-cost screening tool for breast cancer. The recent controversy on breast cancer screening recommendations has increased public awareness and interests for informed counseling of screening and health care options based on individualized estimates of risk. The goal of this proposed project is to develop a computerized image-based biomarker to assess the breast cancer risk of individual patients in the screening population. The innovation of our approach lies in the fact that the quantitative breast parenchyma descriptor (q-BPD) will be designed to take into account not only the percentage of dense tissue (PD) but also the stromal and epithelial structural pattern of an individual's breast that is complementary to, rather than a surrogate of, the breast density. Dr. Douglas will provide consultation on interpretation of project data and assist with manuscript preparation.

Intergovernmental Personnel Act Assignment Agreement

CENTERS FOR DISEASE CONTROL / NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

PROJECT PERSONNEL:

Principal Investigator **Denise Smith** (Health and Human Physiological Sciences)

ABSTRACT:

The Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) is a public health and safety program. Since 1998, FFFIPP has investigated the line of duty deaths (LODDs) of more than 300 fire fighters due to a cardiac/medical cause. This Assignment Agreement will benefit the FFFIPP and NIOSH by bringing in a research associate from Denise Smith's First Responders Health and Safety Research Laboratory at Skidmore College to facilitate the organization of cardiovascular disease and other program data so that these data can be used to benefit FFFIPP and, ultimately, fire fighters. These data will help meet key program and fire service objectives such as to characterize fire fighter cardiac-medical LODDs investigated by FFFIPP/NIOSH, recommend ways to prevent similar deaths and injuries/illness, and to disseminate prevention strategies to the fire service, families, primary care providers, and others who play a role in the health and well-being of fire fighters.

Linking Satellite Observations of the Biological Pump to Autonomous, Float-Based Measurements of Twilight Zone Carbon Flux

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROJECT PERSONNEL:

Principal Investigator **Margaret Estapa** (Geosciences)

ABSTRACT:

The contribution of the ocean biological pump to the global carbon cycle is currently poorly constrained, in part because we lack observations of 1) processes controlling carbon export from the euphotic zone and 2) attenuation of carbon fluxes below the euphotic zone, in the upper ~1000m. Autonomous, profiling floats carrying beam transmissometers act as "optical sediment traps", drifting at depth while measuring the accumulation of sinking particles on the upward facing window of the transmissometer. Optical sediment traps have the potential to greatly increase the number and spatiotemporal density of particle flux measurements in this critically under-sampled "twilight zone." Field calibrations versus co-deployed, neutrally-buoyant sediment traps (NBSTs) are currently underway. To fully exploit the unique, high-resolution carbon flux data that can be acquired using transmissometers on profiling floats, the flux observations must be interpreted in the context of upper ocean biological production and ecosystem function. Satellite ocean color-based estimates of net primary productivity (NPP), ecosystem structure metrics, and export provide our only global view of the processes controlling particle flux out of the euphotic zone. Similarly, autonomous platforms able to measure flux at depth are at present the only way to remotely observe particle flux attenuation, and make inferences about its driving processes, in the twilight zone beyond the view of satellites. Float-based measurements of particle flux just beneath the euphotic zone, and down to depths of 1 km, will be analyzed in the context of corresponding satellite-based, surface ocean estimates of NPP, export, and ecosystem metrics. Long-term deployments of bio-optically instrumented profiling floats with transmissometers have been underway since mid-2011, and data from several sources have been made available for the proposed analysis.

Aboard the R/V Falkor, Estapa and collaborators C. Durkin (Moss Landing Marine Laboratories), M. Omand (University of Rhode Island), and I. Cetinic (National Aeronautics and Space Administration) prepare a neutrally-buoyant sediment trap for deployment in the subtropical North Pacific Ocean.

Particle-Specific DNA Sequencing to Directly Observe Ecological Mechanisms of the Biological Pump

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Margaret Estapa** (Geosciences)

Collaborators: Principal Investigators **Colleen Durkin** (Moss Landing Marine Laboratories) and **Melissa Omand** (University of Rhode Island)

ABSTRACT:

Carbon is fixed into organic matter by phytoplankton growing in the surface ocean, and is naturally sequestered in the ocean interior when particles and organisms sink: a process called the "biological pump." Because of its recognized influence on the global carbon cycle, ocean scientists have studied the biological pump for decades. However, we still do not have a sufficient understanding of the underlying processes to accurately quantify and predict carbon cycling. Much of this uncertainty stems from an inability to directly link specific plankton in the surface ocean with the types of particles sinking out of the surface ocean. To address this missing link in biological pump research, this work will directly observe how plankton are transported out of the surface ocean using novel, particle-specific observational approaches embedded within an interdisciplinary field program that will finely resolve upper ocean plankton groups and the resulting amount of sinking carbon across space and in time. The genetic identity of organisms within different types of sinking particles will be determined by sequencing the genetic contents of individually collected particles. This new application of a molecular method will definitively link surface plankton with sinking particles at five locations across the Pacific Ocean. This work has the potential to transform our understanding of the biological pump by identifying previously unknown links between surface ecosystems and sinking carbon particles. Because this work is embedded within an interdisciplinary field program, including biogeochemical modelers and remote sensing scientists, these data will feed directly into new models of the biological pump, improving our ability to quantify and predict carbon uptake by the ocean. This project will train 1 graduate student and at least 2 undergraduate researchers. Findings will be communicated to the non-scientific public through blogs, videos, and the public communication channels of participating institutions.

Are All Traps Created Equal? A Multi-Method Assessment of the Collection and Detection of Sinking Particles in the Ocean

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Margaret Estapa** (Geosciences)

Collaborator: Principal Investigator **Ken Buesseler** (Woods Hole Oceanographic Institution)

ABSTRACT:

There is considerable need to understand the biological and ecological processes that through net primary production fix dissolved carbon dioxide (CO2) into organic matter in the upper ocean, and the processes that subsequently transport this organic carbon in to the ocean's interior. Most of the particulate organic carbon flux to the deep ocean is thought to be mediated by sinking particles. Ultimately it is the deep organic carbon transport and its sequestration that define the impact of ocean biota on atmospheric CO2 levels and hence climate. Currently, various methods are available to measure the amount of particles in the ocean that sink over a specified period of time commonly referred to as particle flux. Unfortunately, all of these methods are used independently of each other with very little intercomparison, leaving some uncertainty as to which approach provides the most accurate estimates. This study seeks to be the first concerted effort to standardize particle flux measurements. Seeking to keep the cost modest, the researchers are taking advantage of a collaboration with scientists in the United Kingdom to participate in an already scheduled research cruise. The proposed research will have much greater impact that merely standardization of particle flux measurements because it will provide the science and modeling community the ability to quantify the transfer of carbon throughout the surface ocean. Also, this project provides a variety of mentoring and training opportunities for students. A PhD student at Woods Hole Oceanographic Institute will get their first sea-going experience and will learn all of the processing steps for the study of an isotope of thorium (234Th). Skidmore College will have an undergraduate participant in the research and the results from the cruise will also be an excellent additional component for undergraduate oceanography classes.

The shipboard laboratory aboard the RRS Discovery, showing the set of sediment trap tubes that will be deployed as part of a trap intercomparison project with collaborators at the National Oceanography Centre, Southampton, UK. Photo credit: Claire Evans.

Meg Estapa and colleagues work to recover a neutrally buoyant sediment trap from the R/V Revelle, during the EXPORTS North Pacific field campaign. Shown here is the most challenging part of the recovery: the moment when the ship has maneuvered to within only a few meters of the trap, but it has not yet been hooked by the crane to be lifted aboard. Photo credit: Andrea Miccoli.

Linking Sinking Particle Chemistry and Biology with Changes in the Magnitude and Efficiency of Carbon Export into the Deep Ocean

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROJECT PERSONNEL:

Principal Investigator **Margaret Estapa** (Geosciences)

Collaborators: Subaward Principal Investigators **Ken Buesseler** (Woods Hole Oceanographic Institution), **Colleen Durkin** (Moss Landing Marine Laboratories) and **Melissa Omand** (University of Rhode Island)

ABSTRACT:

The magnitude of particulate carbon export from the upper ocean and efficiency of its transfer into the interior remains one of the least predictable processes influencing the global carbon cycle. The overarching goal of the EXPORTS program is to develop mechanistic models predicting the strength and efficiency of this exported carbon. A central requirement – one might argue the central requirement – of the ambitious set of field measurements necessary to develop satellite-driven models is accurate measurement of sinking particle fluxes and their biological and chemical compositions. These measurements must be embedded in a broader suite of physical, biological, and optical observations, so a second requirement is that the team quantifying particle flux cooperates and works closely with the broader EXPORTS science team. Here, we propose a hypothesis-driven study of particle fluxes that both advances our understanding of the ocean biological carbon pump and meets the broader program goals above. The broad hypothesis of the EXPORTS program is that the strength and efficiency of the biological carbon pump can be predicted from satellite ocean color observations. Implicit in this hypothesis are a number of assumptions which must be tested. The specific hypotheses we will address are 1) that the biological origin of the particles sinking out of the euphotic zone exerts significant control on both the magnitude of the sinking carbon flux and its rate of attenuation with depth; and 2) that temporal variability in the magnitude and attenuation of sinking particle flux is caused by biological processes. Our proposed study will employ a mature, field-tested technology – quasi-Lagrangian, Neutrally Buoyant Sediment Traps (NBSTs) – to sample sinking particles at 5 depths in the upper 500 m of the ocean for each ecosystem state characterized during the EXPORTS field program.

Testing the Tropical Storm and Tropical Cyclone Masking Hypotheses: Advancing Speleothem Reconstruction of Paleotempestology and Paleohydrology

THE NATIONAL SCIENCE FOUNDATION

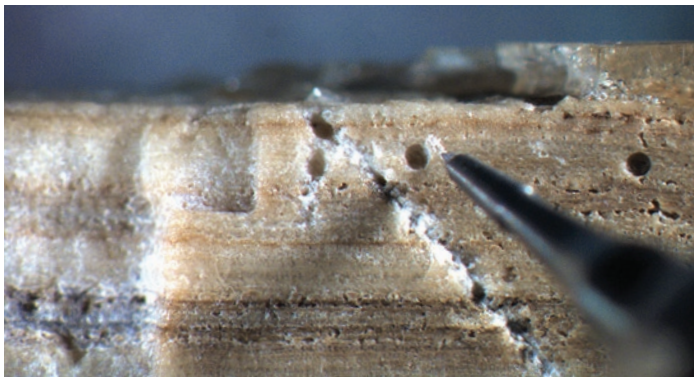
PROJECT PERSONNEL:

Principal Investigators **Amy Frappier** and **Brian Frappier** (Geosciences)

Collaborator: Principal Investigator **Martin Medina-Elizalde** (Auburn University)

ABSTRACT:

Stalagmite records of oxygen isotope ratios ($\delta^{18}O$ values) from the Yucatán Peninsula can be used to reconstruct quantitative rainfall and hurricane records affecting the Caribbean and Gulf of Mexico regions, spanning hundreds to thousands of years. The success of these reconstructions depends on our understanding of the relationship between local rainfall amount and precipitation $\delta^{18}O$ values (i.e. the amount effect), and on how this relationship is preserved in stalagmite deposits. Hurricane rainfall can shift the amount effect and it has been hypothesized that hurricane (aka: tropical cyclone (TC)) rain may therefore bias quantitative stalagmite $\delta^{18}O$-based rainfall records (i.e. the "TC masking hypothesis"). Recent studies based on stalagmite $\delta^{18}O$-based rainfall records, on the other hand, suggest that TC variability was linked to the collapse of the ancient Maya civilization (i.e. the "tropical storm hypothesis"). Available stalagmite $\delta^{18}O$-based rainfall records to test this hypothesis have not yet been replicated, and existing paleo-precipitation estimates may reflect TC masking. Replication, furthermore, may be hindered by chronological uncertainty, the lack of equilibrium stalagmite $\delta^{18}O$, and regional climate variability. We propose: (i) to apply a promising approach for replication of available stalagmite $\delta^{18}O$-based rainfall records during selected intervals spanning the last 2000 years, (ii) to examine quantitatively the TC masking influence on the amount effect and on stalagmite rainfall records, and (iii) to test the "tropical storm hypothesis" by applying an ultrahigh resolution sampling approach to detect the particular isotopic signature from hurricanes in three known stalagmites (CH-1, Chaac and Itzamna).



Visible light photomicrograph of the top few centimeters of stalagmite CH-1 in polished cross-section, showing fine annual-scale layers in the crystal structure deposited in the late 20th century. At left: the edge of the micromilling trough where we collected ~monthly samples at ~4 micron resolution; at right: the micromilling dental drill bit stationed between samples. Circular holes show locations of hand-drilled samples from an earlier exploratory study.

Male common yellowthroat (Geothlypis trichas), showing the melanin-based black facial mask and carotenoid-based, UV-yellow bib.

Functional Genomics of Plumage Ornaments in a Warbler

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Corey Freeman-Gallant** (Biology)

Collaborator: Principal Investigator **Peter Dunn** (University of Wisconsin-Milwaukee)

ABSTRACT:

A long-standing goal of evolutionary biology is to understand the genetic basis of phenotypic traits, particularly those that affect fitness and lead to phenotypic divergence between populations, such as the extravagant ornaments used by females to choose mates. This study uses genomic analyses to test several recent hypotheses for the genetic basis of ornament expression in a warbler, the common yellowthroat (Geothlypis trichas). This warbler is one of a few species of birds in which females are known to choose mates based on ornamental traits that are associated with indices of fitness. Interestingly, sexual selection targets different ornaments in different populations of the common yellowthroat. In Wisconsin, females prefer males with larger black masks, whereas in New York females prefer males with larger, more colorful yellow bibs. In their respective populations, these different ornaments appear to be honest signals of similar aspects of male quality, including antibody production, body condition, survival, and resistance to oxidative stress. Based on these results, the present study uses a genomics approach to determine if elaborate ornaments are related to the expression of genes in growth, immunity and oxidative stress pathways, as predicted by recent hypotheses, and if these traits exhibit molecular parallelism where the same genetic pathways are most closely associated with the sexually selected ornament in each location. The pigments underlying plumage variation in common yellowthroats (carotenoids, melanin) are widespread across vertebrates, and the results are expected to provide a general model for researchers studying the evolution of colorful ornaments.

Linking Behavior and Transport of Larvae Using Waves and Turbulence as Cues

THE NATIONAL SCIENCE FOUNDATION

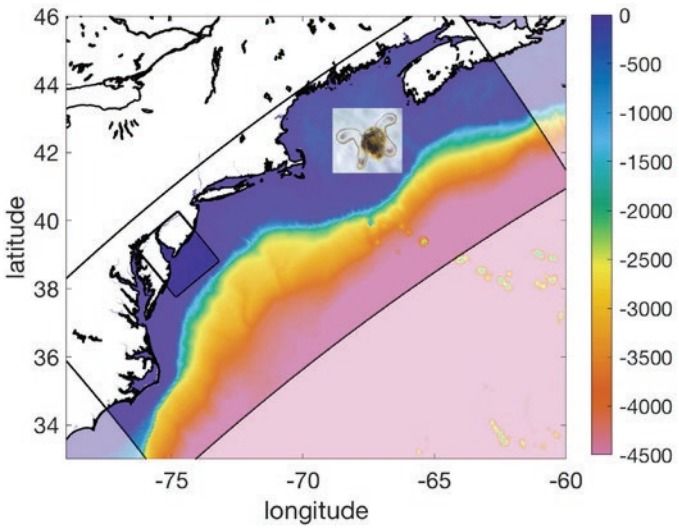
PROJECT PERSONNEL:

Principal Investigator **Gregory Gerbi** (Physics)

Collaborators: Principal Investigators **Heidi Fuchs** and **Robert Chant** (Rutgers University New Brunswick)

ABSTRACT:

Many bottom-dwelling marine species have larvae whose behavior in the water column impacts dispersal and adult distributions. Snail larvae swim up with more effort or sink in response to cues from waves and turbulence, and it remains unclear whether larvae can use these physical cues for retention within or navigation among habitats. Larvae that swim up under waves may be retained over the continental shelf by wave-induced shoreward drift in surface waters. However, ocean warming causes larvae to be released earlier in spring when waves are larger and coastal upwelling is weaker, potentially carrying larvae into shallower waters that exceed the adults' temperature tolerance. The investigators will use a physical model of the Middle Atlantic Bight and adjacent estuaries to test hypotheses about how waves and turbulence affect transport patterns, retention near adult habitats, and climate-induced shifts in adult distributions. The project will produce simulations of ocean circulation and larval tracking codes that include waves both as behavior cues and as a transport mechanism; these products will be made publicly available. A graduate student will do a related dissertation. Undergraduate students will be involved through an NSF-funded REU program, the Aresty Program, which engages Rutgers' diverse undergraduates in research to boost retention in STEM majors, the Rutgers Research in Science and Engineering program, which targets underrepresented minorities, and the Skidmore Summer Research program. Model outputs will be used to develop learning materials for undergraduates, packaged as a case study for distribution through the National Center for Case Study Teaching in Science. Research results will also be presented to adult (55 and over) learners through the Skidmore Encore lecture series.



Map showing the model domains in which larval transport trajectories will be determined. Inset shows a larva of the continental shelf snail, which is one of the species of interest in this study. Colors show water depth in meters. Dark lines outline the coarse model domain (from North Carolina to Nova Scotia) and the fine model domain (centered on Delaware Bay).

IDEAS in Cultural Heritage: Preserving Maya Murals through Imaging, Documentation, Education, Access and Sustainability

THE AMERICAN COUNCIL OF LEARNED SOCIETIES – FREDERICK BURKHARDT RESIDENTIAL FELLOWSHIP

PROJECT PERSONNEL:

Principal Investigator **Heather Hurst** (Anthropology)

ABSTRACT:

"IDEAS in Cultural Heritage: Preserving Maya Murals through Imaging, Documentation, Education, Access and Sustainability" takes a multipronged approach to examine the history and address the future of the San Bartolo murals revealed during the archaeological excavation at San Bartolo, Guatemala. This project moves beyond iconography to integrate archaeological evidence and material analysis in order to consider the murals as potent objects that produced knowledge, but also required them to be destroyed. "IDEAS in Cultural Heritage" pairs a book project that reveals the missing chapters of an epic Maya narrative of creation expertly rendered on the fragile plaster walls at San Bartolo, with a public heritage effort addressing factors that threaten their continued preservation and scholarship. In its dual focus, the project inspires broad discovery of the murals' cultural legacy.

From Darkness to Light: Maya Mural Fragments from San Bartolo, Guatemala, Hosted at the Museo Nacional de Arqueología y Etnología de Guatemala (MUNAE)

THE JOHN D. AND CATHERINE T. MACARTHUR FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Heather Hurst** (Anthropology)

ABSTRACT:

From Darkness to Light included art/artifact installation and public lectures that took place at the Museo Nacional de Arqueología y Etnología, Guatemala, (MUNAE). The keynote titled, "Los colores del mundo Mesoamericano: imágenes, textos, materiales y significados," [Colors of the Mesoamerican World: Images, Texts, Materials and Meaning], was a public event that included a presentation by Diana Magaloni (curator, LACMA) on the materiality of colonial period Mexican manuscript painting followed by a panel discussion on image making and cultural heritage, with Magaloni, David Stuart (epigrapher, University of Texas at Austin), Heather Hurst (artist and materials science, Skidmore College), and Daniel Aquino (director, MUNAE). This event was hosted at the Casa Herrera, Antigua, Guatemala (an extension of the University of Texas at Austin). The inauguration of the exhibition, three-day international conference at MUNAE, and keynote brought together eleven interdisciplinary scholars to discuss Maya murals, as well as the future of education and access to cultural heritage materials. The purpose of this event was 1) to provide unique access to high-level academic scholars in Guatemala where cultural and educational institutions are extremely under-resourced, and 2) to increase visibility of indigenous cultural heritage and help restore this heritage in displaced Maya communities.

The Dependence of AGN Properties on Inclination Angle

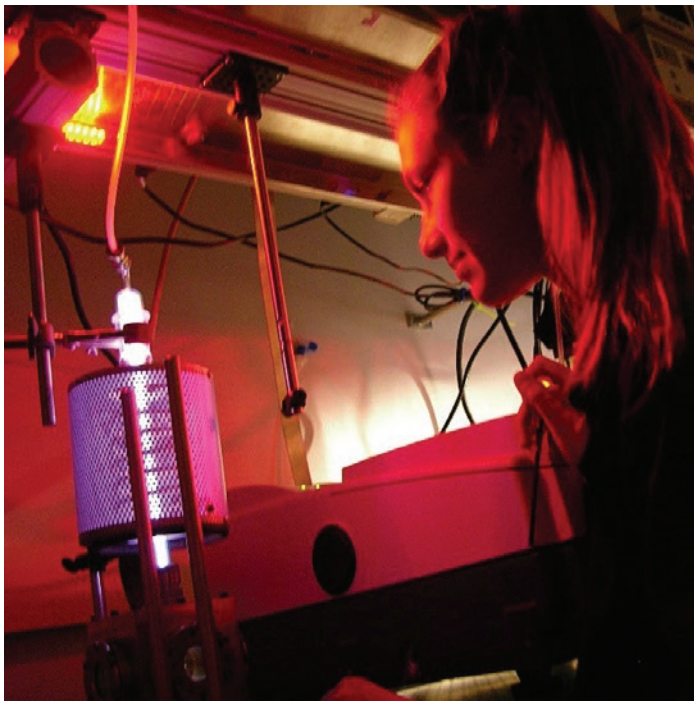
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION / SMITHSONIAN ASTROPHYSICAL OBSERVATORY

PROJECT PERSONNEL:

Principal Investigator **Kendrah Murphy** (Physics)

ABSTRACT:

Active Galactic Nuclei (AGN) are supermassive black hole (SMBH) systems at the centers of galaxies that are actively accreting. According to the theoretical "unified model" of AGN, differences in the observed spectra of AGN depend largely on viewing angle. Understanding how the observed properties of AGN change with inclination angle is of utmost importance for constraining and refining unification schemes. Determining whether the AGN is aligned with the stellar disk of the host galaxy is also important for distinguishing between SMBH feeding mechanisms. Yet, in most cases the AGN inclination is unknown or poorly constrained. We propose to measure this parameter in 8 Seyfert galaxies with archival Chandra-HETG, Suzaku, and NuSTAR data by self-consistently modeling the spectral signatures of the torus, thus independently testing results of a Hubble-STIS study, and investigating the dependence of X-ray spectral properties on polar angle have been underway since mid-2011, and data from several sources have been made available for the proposed analysis.



Student Claudia Bennett-Caso ('19) performing an experiment with non-thermal plasmas.

A Kinetic Study of the Oxidation of Chemisorbed Hydrocarbons by Non-Thermal Plasma

THE AMERICAN CHEMICAL SOCIETY PETROLEUM RESEARCH FUND

PROJECT PERSONNEL:

Principal Investigator **Juan Navea** (Chemistry)

ABSTRACT:

Petroleum processing generates an excess of volatile and semivolatile hydrocarbons (VHC and SVHC) that are usually oxidized to produce valuable feedstock for the chemical industry. While hydrocarbons oxidation is traditionally carried out via catalysis, a greener alternative exists in non-thermal plasma. The oxidation of hydrocarbons with hydroxyl (OH) free radicals produced in a non-thermal plasma show promising selectivity and efficiency. Yet, studies completed to date have been limited to non-volatile hydrocarbons because VHC and SVHC volatize into the plasma, leading to low selectivity products. As an alternative, VHC and SVHC can be chemisorbed onto a metal oxide support, such as the components of fly ash, a byproduct of coal-fired power plants. This approach offers two advantages: first, the kinetics of the reaction can be studied in situ by monitoring surface species; second, it offers an innovative use to fly ash. This project proposes to investigate the mechanism and kinetics of the heterogeneous oxidation of chemisorbed hydrocarbons by OH radicals in a non-thermal plasma as a step towards a greener alternative of hydrocarbon treatment. A state-of-the-art plasma-surface reactor will be used to carry out reactions of water plasma rich in OH radicals with hydrocarbons of different volatility adsorbed on aluminum oxide and iron oxide, proxies of fly ash. The rate of the heterogeneous reaction and the kinetics of the surface-bound and gas-phase products will be determined. In addition, molecular quantum mechanics will be used to better understand the role of the surface and the spectroscopic signatures of the adsorbed species.

CCI Center for Aerosol Impacts on Climate and the Environment

THE NATIONAL SCIENCE FOUNDATION (SUBAWARD FROM THE UNIVERSITY OF CALIFORNIA SAN DIEGO)

PROJECT PERSONNEL:

Subaward Principal Investigator **Juan Navea** (Chemistry)

Collaborator: Principal Investigator **Kimberly Prather** (University of California San Diego)

ABSTRACT:

Organic chromophores in the marine boundary layer (MBL) have recently been proposed as photoactive species inducing a nearly steady-state concentration of HONO in the MBL. In particular, marine chromophoric dissolved organic matter (m-CDOM) in sea spray aerosols (SSA) can act as photosensitizers of particulate nitrate and nitrogen dioxide (NO2). This photosensitization would represent a previously unrecognized pathway for the formation of HONO and the renoxification of the atmosphere. In order to better understand the photosensitization of particulate nitrate and NO2 by m-CDOM, Dr. Navea will investigate humic acid films, a model system of HULIS, as a photosensitizer of nitrate and NO2. In this study Dr. Navea will utilize a tandem vibrational spectroscopy system that he has developed to simultaneously study: (1) The photochemistry of m-CDOM-NaNO3 and m-CDOM-NO2 films, model systems for SSA in the marine boundary layer; (2) The gas-phase products resulting from the photosensitization of nitrates, with emphasis on the detection of HONO and nitrogen oxides; and (3) The kinetics of the humic photosensitized reaction of nitrates and NO2. The experiments proposed here involve a novel state-of-the-art set-up that allows realtime and in situ monitoring of heterogeneous photochemistry on SSA model systems and its gas phase products as it reacts with solar simulated light.

Students Angelina Leonardi ('20), Renee Karchere-Sun ('20), and Yao Xiao ('19) presenting their work on HONO formation at the international Conference in Global Atmospheric Chemistry (iGAC), in Takamatsu, Japan, 2018.

Molecular Education and Research Consortium in Undergraduate computational chemistRY (MERCURY)

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Co-Principal Investigator **Juan Navea** and Member **K. Aurelia Ball** (Chemistry)

Collaborators: Principal Investigators **George Shields** (Furman University) and Co-Principal Investigators **Marc Zimmer** (Connecticut College), **Carol Parish** (University of Richmond) and **Maria Gomez** (Mount Holyoke College)

ABSTRACT:

With this award, 29 faculty in 25 primarily undergraduate institutions have acquired a computer cluster to be shared through a consortium referred to as MERCURY (Molecular Education and Research Consortium in Undergraduate computational ChemistRY). The cluster is used in computational chemistry research projects. These projects employ theoretical chemistry programs and algorithms or processes using principles from quantum mechanics or molecular mechanics (often called molecular dynamics simulations). The computations are used to predict and understand a wide range of properties of molecules such as their acidity, chemical reaction mechanisms such as those that lead to the production of tropospheric ozone and hydroxyl radicals, biochemistry questions such as the binding of small molecules to proteins and even the study of environmental problems such as the chemistry of steroids that are common contaminants in surface and wastewater. The acquisition has a broad impact on the training of undergraduate research students who are incorporated into the workforce or those who attend graduate and professional schools.

How Does Retrieval Shape Memory? Exploring the Retrieval Practice Effect

THE JAMES S. MCDONNELL FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Daniel Peterson** (Psychology)

ABSTRACT:

When eyewitnesses see a crime, they often do so under physiological stress. Research suggests that stress disrupts memory accuracy, but less is known about whether stress impacts the relationship between confidence and accuracy. Whereas researchers generally agree that pristine encoding and retrieval conditions lead to a strong relationship between the two (Wixted & Wells, 2017), how violations of pristine conditions affect the relationship is unclear. In two experiments, participants encoded faces either under physiological stress (via a cold pressor task), or under control conditions. Participants were later given a recognition memory test for the faces, and provided confidence judgments in their old/new decisions. As expected, stress impaired face recognition accuracy. However, we observed similar confidence–accuracy relationships regardless of stress condition. Though participants in the stress condition were less accurate in their identifications overall, they had the metacognitive awareness to scale back their confidence judgments.

Age-Related Obesity and Healthspan: Identifying Interventions and Mechanisms

THE NATIONAL INSTITUTES OF HEALTH

PROJECT PERSONNEL:

Principal Investigator **Thomas H. Reynolds** and Co-Investigator **Stephen Ives** (Health and Human Physiological Sciences)

ABSTRACT:

Obesity is a major public health problem that affects approximately 35% of US adults and results in over $147 billion in annual health care expenditures. Obesity is associated with several age-related diseases (type 2 diabetes, cardiovascular disease, cancer, cognitive impairment/Alzheimer's) and the most recent data from the CDC indicates that middle-aged men and women and older women are more susceptible to obesity compared to their younger counterparts. Increased prevalence of obesity in older adults is particularly alarming since this population's census is expected to double by 2050. Because of the increasing prevalence of obesity and its association with age-related diseases, identifying novel interventions that can reduce adiposity is essential to decrease the burden of obesity on our health care system and improve the healthspan of older Americans. Recently, our lab has shown that manganese tetrakis benzoic acid porphyrin (MnTBAP), a super oxide dismutase (SOD) mimetic, reduces diet-induced obesity, insulin resistance, and inflammation. Because aging and obesity are tightly coupled to increases in oxidative stress and inflammation, MnTBAP may reduce age- related obesity and associated diseases. Our first aim is to determine if MnTBAP treatment can prevent or attenuate age-related obesity and improve healthspan (insulin sensitivity, vascular function, blood pressure, inflammation, blood lipids). Our second aim is to demonstrate that MnTBAP treatment antagonizes the TF-PAR2 signaling pathway, a process that increases AMPK activity by decreasing AMPK's interaction with β-arrestin 2. Our third aim is to demonstrate that intact PAR2 signaling is required for the development of age-related obesity, insulin resistance, and inflammation. Results from this proposal will provide evidence supporting the use of SOD mimetics and PAR2 inhibitors as potential treatments for age-related obesity, insulin resistance, and inflammation.

Behavioral and Ecological Suicide Tracking: Attention, Interpretation and Memory

THE NATIONAL INSTITUTES OF HEALTH (SUBAWARD FROM BUTLER HOSPITAL)

PROJECT PERSONNEL:

Subaward Principal Investigator **Casey Schofield** (Psychology)

Collaborator: Principal Investigator **Michael Armey** (Butler Hospital)

ABSTRACT:

Suicide is a serious and chronic public health concern in the United States, with nearly 1,000,000 suicide attempts resulting in more than 500,000 hospital admissions and approximately 35,000 deaths each year. In contrast to advances in treatments for psychiatric disorders, rates of suicide attempts and resultant deaths in this country have not fallen appreciably. Although previous research has identified a variety of risk factors for suicidal behavior, the level of prediction afforded by these previously identified variables is limited. This inadequate understanding of risk factors for suicidal behavior restricts our ability to predict which people will engage in suicidal behavior as well as making it difficult to develop interventions that directly target the mechanisms that underlie suicidal behavior. Thus, there is a compelling need for research that will identify and validate new risk factors for suicidal behavior that will increase our ability to predict and prevent suicidal behavior and lead to more targeted and effective treatments. The present study proposes comprehensive, investigation of cognitive and experiential measures of suicide risk in a high-risk sample of patients admitted to a psychiatric hospital with significant suicide risk.

Evolution of Bacterial Asparaginyl-tRNA Synthesis

THE NATIONAL SCIENCE FOUNDATION

PROJECT PERSONNEL:

Principal Investigator **Kelly Sheppard** (Chemistry)

ABSTRACT:

The goal of this research is to understand why certain bacteria employ two distinct routes for preparing the amino acid asparagine for protein synthesis. The results will provide insights into the evolutionary origin of these alternate pathways and how they may confer adaptive physiological advantages to bacteria growing in different natural environments, i.e., in soil versus inside a mammalian host. Undergraduate students, including members of underrepresented minorities, will be trained in laboratory research through the project. The impact of the training will be measured by the presentation of the research at scientific meetings, student co-authorship of peer reviewed articles, and future student placement in the workforce and in graduate programs. In addition, the project will allow studies arising from the research to be integrated into an experimental biochemistry laboratory course, training additional undergraduate students in hypothesis driven biochemical research. To expand scientific literacy and retain more students from underrepresented minorities in STEM disciplines, the project will provide outreach to middle school students.

Stills from video recorded using a first-person headcam. These stills represent the infant's perspective at ages 6 months (top row) through 15 months (bottom row.)

Archiving a Large Audiovisual Dataset of Early Childhood Experiences

THE NATIONAL INSTITUTES OF HEALTH

PROJECT PERSONNEL:

Principal Investigator **Jessica Sullivan** (Psychology)

Collaborators: **Michael Frank** (Stanford University) and **Amy Perfors** (The University of Adelaide)

ABSTRACT:

Understanding how children learn, and especially understanding how children learn language, is a critical public health issue. Positive academic outcomes (which are predicted by early language skill) are associated with positive health outcomes like lower rates of substance abuse, higher rates of offspring survival, higher occupational success, and longer lifespans. While we know that early social, cognitive, and language ability predict educational outcomes, many basic questions about early child development remain unanswered, making it challenging to design effective early educational policy and interventions. One important question is how a child's input (e.g., the things that they see and hear in daily life) predicts what they end up learning. This question is relevant to researchers interested in all aspects of development. Answering such a question, however, requires actually measuring a child's input -- something that until recently was technologically impossible. PI Sullivan and Drs. Frank and Perfors created a large longitudinal dataset of videos from the child's perspective to measure input. They are now working with Research Assistant Michelle Mei to make this dataset available and accessible to other researchers. Using a head-mounted camera, PI Sullivan recorded everything that participants saw and heard from their perspective -- for approximately 2.5 hours a week over the course of two years (from infancy through toddlerhood). Recordings were naturalistic, and included a wide array of contexts and activities that have never previously been recorded. This resulted in a dataset of over 325 hours of audiovisual recordings, along with a dense collection of cognitive, social, and linguistic measures that were also collected longitudinally. This dataset is the first of its kind, and is unique in its size, scope, and perspective.

SMARTER (Science Medicine And Research & Technology for Emergency Responders)

THE FEDERAL EMERGENCY MANAGEMENT AGENCY

PROJECT PERSONNEL:

Principal Investigator **Denise Smith** and Co-Principal Investigator **Patricia Fehling** (Health and Human Physiological Sciences)

Collaborators: Subaward Principal Investigators **Mark Buller** (U.S. Army Research Institute of Environmental Medicine), **Casey Grant** (Fire Protection Research Foundation), **Gavin Horn** (University of Illinois), **Aydogan Ozcan** (University of California Los Angeles), and **Chief Ronald Jon Siarnicki** (National Fallen Firefighters Foundation)

ABSTRACT:

SMARTER (Science Medicine And Research & Technology for Emergency Responders) will employ scientific advances, medical knowledge, research findings, and technological solutions to reduce firefighter injuries and fatalities. Among the acknowledged dangers that firefighters face on the fireground, the pathophysiological response to firefighting, including elevated body temperature and cardiac events, poses the greatest risk to firefighters. In fact, nearly half of all line-of-duty deaths each year are due to sudden cardiac events. This project will advance technology that focus on early detection of physiological abnormalities and real-time monitoring of toxic particulates that threaten firefighters. Early detection of abnormalities and real-time monitoring of toxic particulates that threaten firefighters offer tremendous opportunities to address these physiological vulnerabilities. Dr. Smith and her team will develop sensor technology, advance algorithms to estimate core body temperature, and adapt and transition technology for real-time monitoring of firefighters and to support comprehensive medical programs.

c-Air Particulate Matter monitor in use during live fire drills at the Saratoga County Training Tower.

Heart Disease Awareness and Prevention Program (HDAPP)

THE INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

PROJECT PERSONNEL:

Principal Investigator **Denise Smith** (Health and Human Physiological Sciences)

ABSTRACT:

Under the Heart Disease Awareness and Prevention Program (HDAPP), Dr. Smith synthesized information about the medical understanding of cardiovascular disease and research conducted in the fire service to develop online educational modules. The training modules also included materials and resources on topics related to heart disease prevention assist training officers with more broadly disseminating this information. To increase the reach of the training and to help motivate change throughout the fire service, the training material targeted three separate audiences: the fire fighter, the primary care physician, and the fire department physician.

Productive Pathways out of Poverty for Individuals with Disabilities

THE INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

PROJECT PERSONNEL:

Principal Investigator **Smriti Tiwari** (Economics)

ABSTRACT:

The objective of this proposed research is to provide information on whether the International Fund for Agricultural Development's interventions have the potential to be a path out of poverty for people with disabilities (PwDs). In order to do so, the study will investigate whether PwDs are involved in the productive workforce in rural areas and if so, what kind of rural productive activities they are engaged in. In order to provide evidence on the pathways between disability and employment in agri-food systems, panel data from 3-5 household surveys from Sub-Saharan Africa will be analyzed at the individual and household level. Following the framework of the Washington Group on Disability Statistics, the LSMS questionnaire captures disability through six questions that aim to capture self-reported difficulties in hearing, seeing, walking or climbing, remembering or concentrating, self-care, understanding or being understood in case the respondent is older than 5 years.

Investigation of Neuropeptide Signaling Mechanisms that Control Sleep

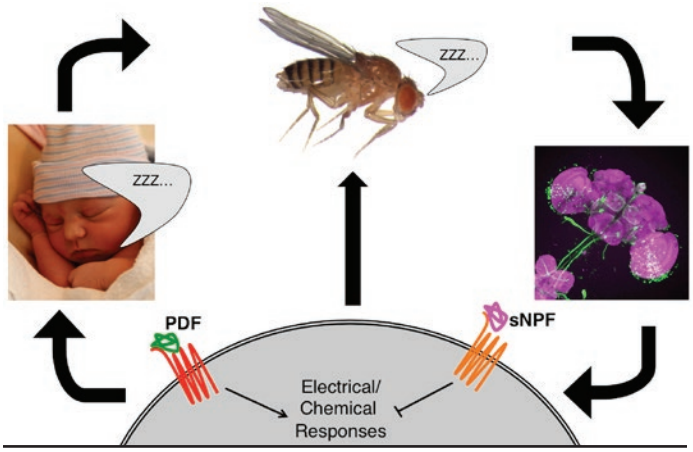
THE NATIONAL INSTITUTES OF HEALTH

PROJECT PERSONNEL:

Principal Investigator **Christopher G. Vecsey** (Neuroscience)

ABSTRACT:

Sleep disturbances are increasingly common and are associated with a variety of comorbidities and other public health consequences. It is therefore critical to improve our understanding of the neural mechanisms that control the timing and quality of sleep. Key signaling molecules that regulate sleep in animals ranging from flies to humans come from the family of neuropeptide transmitters. These molecules have sparse expression levels and selective effects on behavior, including sleep, making them prime candidates for the development of focused drug treatments with minimal side effects. However, the mechanisms by which these molecules act individually and in concert to regulate target cells in the brain and thus behavior are poorly understood. This proposal will take advantage of the powerful genetics and relatively simple sleep network organization of the fruit fly, *Drosophila melanogaster*, to address how neuropeptides function at the molecular, cellular, and behavioral levels to regulate sleep. This R15 AREA proposal will directly involve undergraduate students in all aspects of the research, including designing experiments, carrying out studies involving techniques of genetic manipulation, molecular and cellular neurobiology, and behavioral analysis. Their experiences will provide formative training for future careers in biomedical fields.



This project addresses the cellular mechanisms of sleep regulation, using the fruit fly, "Drosophila melanogaster," as a simple and accessible system in which to gain insights into the roles of specific neurons. In this study, a combination of behavioral and live imaging studies will determine the sleep-regulating role of activity in neurons that produce specific neuropeptide transmitters, and how those transmitters affect their target cells.

A participant looks at a picture of balloons to take a break during one of our infant studies.

ManyBabies 1: Infant-directed Speech Preference

THE ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

PROJECT PERSONNEL:

Principal Investigator **Erika Wojcik** (Psychology)

ABSTRACT:

One classic finding in developmental psychology is that babies prefer infant-directed speech (speech that is higher-pitched, slower, and has exaggerated pitch modulation). However, the original and follow-up experiments behind this finding test only 12 to 32 infants. The Many Babies project aimed to pool resources from many labs around the world to test the preference for infant directed speech across the first year of life with a large sample size of over 2000 babies. This project is the first attempt at this type of data collection in infant research. The Early Learning Lab at Skidmore College received a grant to support participation in this project.

An Individual Differences Approach to Speech-Music Overlap in the Brain

THE GRAMMY MUSEUM FOUNDATION, INC.

PROJECT PERSONNEL:

Principal Investigator **Dominique Vuvan** (Psychology)

Collaborator: Co-Principal Investigator **Megha Sharda** (International Laboratory for Brain, Music, and Sound Research)

ABSTRACT:

An individual differences approach will assess the degree to which music and speech share neural resources. Participants will be identified as lyric- or melody-focused, and scanned using functional magnetic resonance imaging (fMRI) while listening to sung melodies. Differences in neural activation between groups will show where and how the speech and music networks are shared, and guide the development of music therapy for language disorders.

Submitted Proposals

A Modified Concept Inventory Method to Evaluate a Systems Approach to Environmental Education

THE NATIONAL SCIENCE FOUNDATION (SUBAWARD FROM THE UNIVERSITY OF NORTHERN COLORADO)

Subaward Principal Investigator **Nurcan Atalan-Helicke** (Environmental Studies and Sciences)

Collaborator: Principal Investigator **Chelsie Romulo** (University of Northern Colorado)

What Do Students Really Learn from Smartphone-Based Learning Apps? Investigating the Impacts of Student-Generated Questions and Media Multitasking

THE SPENCER FOUNDATION

Principal Investigator **Sara Davis** and Co-Investigator **Daniel Peterson** (Psychology)

The Effect of Capsaicin on Autonomic Nervous System Regulation of Hemodynamics and Peripheral Vascular Function (the TRPV study)

THE AMERICAN HEART ASSOCIATION

Principal Investigator **Stephen Ives** (Health and Human Physiological Sciences)

Acquisition of a Seahorse XFe96 Bioanalyzer for High-Throughput Measurements of Glycolysis and Mitochondrial Respiration at Skidmore College

THE NATIONAL SCIENCE FOUNDATION

Principal Investigator **Sarita Lagalwar** (Neuroscience) and Co-Principal Investigators **Jennifer Bonner** (Biology and Neuroscience), **Jason Breves** (Biology), **Stephen Ives** (Health and Human Physiological Sciences) and **Sylvia McDevitt** (Biology)

The Dark Web and Crime in America: Trends, Correlations and Policy Recommendations

THE SMITH RICHARDSON FOUNDATION

Principal Investigator **Andrew Lindner** (Sociology)

Collaborator: Principal Investigator **Eric Jardine** (Virginia Tech)

The Dark Web and Crime in America: Trends, Correlations and Policy Recommendations

THE KOCH FOUNDATION

Principal Investigator **Andrew Lindner** (Sociology)

Collaborator: Principal Investigator **Eric Jardine** (Virginia Tech)

Atmospheric Chemistry of Complex Interfaces: Chemistry on Light-sensitive Tropospheric Aerosols

THE CAMILLE & HENRY DREYFUS FOUNDATION

Principal Investigator **Juan Navea** (Chemistry)

Mechanisms for Cu-binding Factors to Promote Myogenic Gene Expression

THE NATIONAL INSTITUTES OF HEALTH (SUBAWARD FROM THE UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL)

Subaward Principal Investigator **Juan Navea** (Chemistry)

Collaborator: Principal Investigator **Teresita Padilla-Benavides** (University of Massachusetts Medical School)

Investigating the Replicability and Generalizability of Using Retrieval Practice to Promote the Transfer of Knowledge for Analogical Problem-Solving Tasks

THE NATIONAL SCIENCE FOUNDATION

Principal Investigator **Daniel Peterson** (Psychology)

Collaborator: Principal Investigator **Kathryn Wissman** (North Dakota State University)

Course Hero-Woodrow Wilson Fellowship for Excellence in Teaching

THE WOODROW WILSON NATIONAL FELLOWSHIP FOUNDATION

Principal Investigator **Daniel Peterson** (Psychology)

Privacy Controls for Mental Health Applications

THE NATIONAL SCIENCE FOUNDATION

Principal Investigator **Aarathi Prasad** (Computer Science)

Exploration of Storing and Querying Social Graph Data on a Variety of Distributed Systems

THE NATIONAL SCIENCE FOUNDATION

Principal Investigator **Christine Reilly** (Computer Science)

Multimodal Assessment of Mood in Persons with Aphasia

THE NATIONAL INSTITUTES OF HEALTH (SUBAWARD FROM THE SHIRLEY RYAN ABILITYLAB)

Subaward Principal Investigator **Casey Schofield** (Psychology)

Collaborator: Principal Investigator **Sameer Ashaie** (The Shirley Ryan AbilityLab)

Experimental Test of Public Stigma Towards Anxiety and Depression: Exploring Effects of Ethnicity

THE AMERICAN PSYCHOLOGICAL FOUNDATION

Principal Investigators **Casey Schofield** and **Leigh Wilton** (Psychology)

The Development of Symbolic Reasoning in Art and Language

THE NATIONAL SCIENCE FOUNDATION

Principal Investigator: **Jessica Sullivan** (Psychology)

Investigating the Correlates of – and an Intervention to Improve – Adults' Willingness to Talk to Children about Race

THE AMERICAN PSYCHOLOGICAL FOUNDATION

Principal Investigators **Jessica Sullivan** and **Leigh Wilton** (Psychology)

Testosterone Disruption in the US Fire Service: Prevalence and Cardiovascular Consequences

THE FEDERAL EMERGENCY MANAGEMENT AGENCY

Principal Investigator **Denise Smith** (Health and Human Physiological Sciences) and Co-Investigators **Julie Douglas** (Mathematics and Statistics) and **Maria Korre** (Health and Human Physiological Sciences)

Collaborator: Subaward Principal Investigator **Sushant Mohan Ranadive** (University of Maryland)

PROPOSALS AND AWARDS

A Year in Review

14 NEW AWARDS

Involving 13 Skidmore College Faculty and 13 External Collaborators
From 9 Academic Departments and Programs

Totaling $3,003,715

30 ACTIVE GRANTS *

Involving 27 Skidmore College Faculty and 23 External Collaborators
From 13 Academic Departments and Programs

Totaling $7,352,664

27 PROPOSALS SUBMITTED *

Involving 26 Skidmore College Faculty and 9 External Collaborators
From 14 Academic Departments and Programs

Totaling $4,225,983

**Not including those listed under New Awards*

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