

Stonehill Undergraduate Research Experience (SURE) Summer 2017 Awards

Forty-five Stonehill College students will work with twenty-one faculty members on a variety of research projects during the summer of 2017. The Stonehill Undergraduate Research Experience (SURE) program provides students with an opportunity to perform significant, publishable research under the guidance of an experienced faculty researcher. The research experience gives students a competitive advantage in graduate and professional school applications and in post-college employment opportunities, as well as to offer assistance to faculty in research activities.

Alexa Guerrero '18 will work with **Bronwyn Bleakley**, Associate Professor of Biology, on *Influence of the Chemical Environment Provided by Social Partners on Cooperative Behavior in Guppies (Poecilia reticulata)*. Using prior SURE findings, the project will further analyze the hormone profiles of wild-derived fish collected from Trinidad. In addition, they will determine if there is a correlation between responsiveness to and influence on the social environment and hormone levels in the families of fish. Guerrero, a biology major, will have several responsibilities such as hormone extraction, behavioral observation and data organization. Submitting the findings to a journal is planned.

Mackenzie Mayes '18 and **Mariah Smith '18** will work with **Bronwyn Bleakley**, Associate Professor of Biology, on *Quantifying Variation in Lateral Line Morphology and Cooperative Behavior of Guppies (Poecilia Reticulata)*. The project will determine how variations in the lateral line correspond to responsiveness to the social environment of the guppies. The lateral line is a diffuse sensory organ that detects the strength and direction of vibrations in the water. Mayes, a biology major, and Smith, a neuroscience major with an English minor, will have various responsibilities, such as record keeping and behavioral observations.

Jason Comeau '19 and **Anna Pinckney '19** will work with **Nicholas Block**, Assistant Professor of Biology, on *A Resurvey of Odonata Diversity and Phenology in the Blue Hills*. The group will conduct a survey of odonata (dragonflies and damselflies) at Ponkapoag Pond and the surrounding area and compare these data to results of surveys conducted by Hal White during the period of 1966 to 1971. They hypothesize that, due to climate change, species will be emerging earlier in the year and new southerly species will be present. Comeau, a biology major, and Pinckney, an environmental science and arts administration double major, will be responsible for designing and implementing a survey strategy and comparing the data collected to White's results. They plan to use the information obtained to further support findings from SURE 2015 and 2016 for a potential journal publication.

Hedvig Blanco '18 will work with **Kirk Buckman**, Assistant Professor of Political Science and International studies, on *Modeling Peru's Political Economy*. This project will explore the development and shape of Peru's economy by comparing the development, structure and macroeconomic management styles to Argentina, Colombia, Peru and Venezuela. Blanco, an economic and political science and international studies double major, will be responsible for reading materials, collecting data and narratives and writing an essay on theories of transitional justice and democratic development in the four countries. The results will be used towards Buckman's textbooks as well the course, Political Science Research Methods.

Helene Brehany '18 will work with **Kirk Buckman**, Assistant Professor of Political Science and International Studies, on *Democratic and Economic Development in Latin America and Southern Europe*. This project will compare the European countries of Slovenia, Greece and Turkey to the Latin American counties of Uruguay, Venezuela and Bolivia in terms of international and domestic factors on democratic and economic development. Brehany, a political science major with a minor in economics, will be responsible for reading materials about the countries, collecting economic and polling data and writing an essay on the theories of consolidation and political developments in the countries.

Kristen Fontaine '18 will work with **Kirk Buckman**, Assistant Professor of Political Science and International Studies, on *Democratic Consolidation and Economic Development in Central Europe*. The project will look at three European countries, Czech Republic, Slovakia and Hungary, and will compare the economic development and democratic consolidation. They will apply theories of international democratic consolidation and explore why these countries have responded differently to certain pressures. They hypothesize that the reason is due to the country's identity. Fontaine, a political science and English double major, will be responsible for reading specific materials, collecting economic and polling data, and writing an essay on the project.

John Irving '18 will work with **Kristin Burkholder**, Assistant Professor of Environmental Science, on *Subsurface Nutrient Pathways in the Gulf of Maine*. Using a numerical model of ocean circulation, they will launch synthetic drifters into a model ocean in order to track the transport of nutrient rich water around the Gulf of Maine. Irving, an environmental science major, will be responsible for identifying key launch zones, creating drifter trajectories and analyzing data. The results will be presented at a national conference and will hopefully contribute to a future publication.

Elaina McDowell '18 will work with **Kristin Burkholder**, Assistant Professor of Environmental Sciences and Studies, on *Changing Source Waters and Subsurface Property Fields in an Ocean Circulation Model of the Gulf of Maine*. Their work will involve comparing changes in the real Gulf of Maine's subsurface environment to changes to that same environment in a numerical model of ocean circulation. This analysis will help them to understand how well the model is recreating changes in the real Gulf of Maine, then utilize the model to better understand the subsurface environment. McDowell, an environmental science major, will be responsible for using Matlab to analyze model output and to compare results to the work she did on the "real" Gulf of Maine as a SURE 2016 participant. The results will be presented at a national conference and will contribute to a future publication.

Cathryn Cutia '19 will work with **Nicole Cyr**, Assistant Professor of Biology and Neuroscience, on *The Role of Hypothalamic Sirtuin 1 in Obesity*. The goal of this project is to investigate how changes in the enzyme Sirtuin 1 in the brain regulate body weight. They hypothesize that an increase in hypothalamic Sirt 1 during obesity blocks the action of the mTOR pathway and causes weight gain. Cutia, a neuroscience major, will learn how to design an experiment and how to extract proteins and analyze her findings. The results will be submitted for a possible presentation at the NEURON conference next year.

Cassandra Daisy '18 will work with **Nicole Cyr**, Assistant Professor of Biology and Neuroscience, on *The Role of Hypothalamic ER Stress and mTOR in Obesity*. This project is designed to determine the interaction between two major physiological processes that control body weight. Last summer, Daisy began her research and found that ER stress decreases the mTOR signaling protein. Now, she will investigate what these changes mean for regulating leptin and body weight in the obese state. Daisy, a biology major, will be responsible for conducting experiments, analyzing data, reading literature and starting to write a thesis of her results. They anticipate to present the data at the NEURON conference.

Mark Khalil '18 will work with **Nicole Cyr**, Assistant Professor of Biology and Neuroscience, on *The Role of Neural Injury in Obesity*. Recent findings show that rats kept on a high-fat diet show signs of neuronal injury in the hypothalamus. More specifically, the damage was to proopiomelanocortin, which produces an appetite suppressing neurohormone. Khalil, a biology major, will be responsible for learning how to conduct an experiment and analyze data using the NIH software program. The results are planned to be shared at the NEURON conference.

Alec Mercier-Patterson '19 will work with **Deno Del Sesto**, Assistant Professor of Chemistry, on *Determination of Methane Reactivity on the Ni(111) Surface*. This project continues previous SURE research by measuring the reaction curves for different fractions of excited molecules. A second goal of the project is to develop and refine a new theoretical model to describe methane reactivity and learn how to apply it to more generalized metal-catalyzed gas phase reactions. Mercier-Patterson, a physics major, will be responsible for operating instruments such as a molecular beam apparatus and ultra-high vacuum reaction chamber. The results will contribute to the understanding of how molecular motions within the reagent methane activate reactivity.

Caitlin Little '19 and **Matthew Shaw '19** will work with **Suzanne Edinger**, Assistant Professor of Management, on *Unpacking Team Task Performance: The Role of Positive and Negative Network Ties*. The research team will work towards coding previously recorded videotaped data of project team meetings. The student researchers hope to highlight differences in interaction patterns and relationships among the teams. To accomplish this, the research team will investigate positive and negative social network ties in the teams and see how these ties relate to organizational outcomes. The business majors will also be responsible for reading academic articles and analyzing the data once it has been coded. The team hopes to produce a paper to present at a national conference such as the Academy of Management from their summer work.

Gloria Mahame '18 and **Erica Botelho '19** will work with **Marilena Hall**, Associate Professor of Chemistry, on *Construction of a More Virulent LacZ α -containing M13 Phage Vector*. This project continues previous research into how genetic alterations affect the health of organisms using bacteriophage (phage). This summer's focus will be on investigating how Joachim Messing's insert affects the phage. Mahame, a biochemistry major, will lead the Hall group and be responsible for finding new locations to make less disruptive insertions in M13 phage. Botelho, also a biochemistry major, will be responsible for applying M13-based bacteriophage to the identification of peptides that bind to a target of interest. The group is looking to publish their findings and build future research for students.

Lindsey Gray '19 and **Megan Salemi '19** will work with **Marilena Hall**, Associate Professor of Chemistry, on *Genetic Analysis and Phage Propagation of the M13mp Vector Series*. This project also focuses on how genetic alterations affect the health of organisms using bacteriophage (phage). Specifically, the two biochemistry majors will investigate the effect of the alteration of DNA in M13 phage and how mutations compensate for these effects. The goal is to further previous student's research and publish their work.

Bridget Belcher '19 will work with **Kate Harris**, visiting Assistant Professor of Chemistry, on *The Synthesis of Fmoc-L-homoglutamine(Trt/Cbz)-OH and Poly-homoglutamine Peptides*. This project proposes to study the property of hydrophobicity in peptides, as well as secondary structure formation. The research will focus on the synthesis of the unnatural amino acid of Fmoc-L-homoglutamine. Once this amino acid is synthesized, it will be used in peptide synthesis to create poly-hQ repeats. Belcher, a chemistry and biology major, will be responsible for the implementation of primary literature resources, unnatural amino acid and peptide synthesis. They hope their findings will result in further research and lead towards a publication.

Amanda Dolan '19 will work with **Kate Harris**, visiting Assistant Professor of Chemistry, on *Thioflavin T Beta-sheet Structure Assay Development*. The purpose of the research is to study the chemistry of the aggregates that form due to a trinucleotide repeat in the coding DNA of individuals affected by Huntington's disease. They will do this by synthesizing polyQ and polyN peptides. Dolan, a biochemistry major with a minor in religious studies, will be responsible for the implementation of primary literature resources to synthesize peptides and investigate their interaction with the small dye-molecule thioflavin T. The outcome of this research will establish a foundational technique to investigate peptide chemistry and gain understanding of primary sequence to secondary structure formation.

Alana Murphy '19 will work with **Kate Harris**, visiting Assistant Professor of Chemistry, on *Studies of Stereochemical Consequences in Peptide Aggregation*. The pair will first synthesize and characterize polyQ peptides using the L-enantiomeric structure for glutamine. They will then investigate the consequence of using the D-enantiomeric structure of the same amino acid, as well as, polypeptide synthesis involving a combination of L- and D-enantiomeric amino acids of glutamine in systematic constructs. Murphy, a chemistry major will be responsible for the implementation of primary literature resources, peptide synthesis and structure characterization. They hope their findings will result in further research and lead towards a publication.

Alexander Baryjames '19 will work with **Magdalena James-Pederson**, Associate Professor Biology and Biochemistry, on *Is there an Ectosymbiotic or Endosymbiotic Relationship between Methylobacteria and Armillaria gallica?* During SURE 2015 and 2016, fungal samples were taken from around campus and nearby towns, many of which were infected with Methylobacteria. The project aims to infect fungal cultures of *Armillaria gallica* with strain of Methylobacteria expressing green fluorescent protein then determine how these two cell types associate with each other spatially. Baryjames, a biology major, will be responsible for establishing the required strain of bacteria and assisting in the microscopic analysis. A research paper will be completed and presented at the 2018 Eastern New England Biology Conference.

Zoie Magri '18 will work with **Magdalena James-Pederson**, Associate Professor of Biology and Biochemistry, on *Characterization of Methylobacteria Species in Fungal Samples*. During SURE 2015 and 2016, scholars collected fungal samples from the college's nature trail and found that most were colonized by multiple species of Methylobacteria. Bacteria of this genus are characterized by their ability to utilize one-carbon compounds as the sole carbon source. In this study, they will characterize the Methylobacteria communities colonizing different types of mushrooms and explore the genetic differences between them. Magri, a biology major, will be responsible for collecting and identifying fungal and bacterial samples. If a novel Methylobacteria species is found, its genome will be sequenced and submitted for publication.

Meredith Pomfret '19 will work with **Louis Liotta**, Professor of Chemistry on *Synthesis of Tetrahydroxylated Indolizidines from L-Glucose*. Liotta and previous research students have successfully developed the means to efficiently convert sugars into iminosugars. This project involves synthesizing more highly hydroxylated polyhydroxylated indolizidines. Pomfret, a biochemistry major, will be responsible for synthesizing, purifying, and characterizing tetrahydroxylated indolizidine of type 12 and analyzing her results. The findings will be presented at the ACS and be submitted to the *Journal of Organic Chemistry*.

Pierre Holmes '18 will work with **Anne Mattina**, Professor of Communication, on *The Rhetorical Power of Place in American Civil Rights*. The project will look at geographic locations and the memorials erected to commemorate historical moments of the Civil Rights Movement. They will use dramatism to explore the role the location played in response and overall impact to the movement. The team plans to travel to Washington D.C. in order to continue Mattina's 2016 research and visit the newly-opened Museum of African-American History and the monument dedicated to Dr. Martin Luther King. Holmes, a communication and philosophy double major, will be responsible for reviewing articles and books, gathering visual data, and co-writing an essay. They hope to submit the essay to the Eastern Communication Association's annual conference and to have the work published in a scholarly journal.

Anna Murphy '19 will work with **John McCoy**, Professor of Neuroscience and Psychology, on *Role of Basal Forebrain Neurons in Sleep Loss-induced Deficits*. This project will investigate the neural mechanisms of how sleep loss impairs arousal and cognition using mouse models, with a special focus on a brain area called the basal forebrain (BF). The overall goal of the project is to understand the precise role of each neurotransmitter class of cortically-projecting BF neurons in wakefulness and attention, as well as sleep loss induced deficits in vigilance and cognition. Murphy, a neuroscience major, will conduct the experiments, and will aid in analyzing and interpreting the data. The results will be presented at the NEURON Conference.

Lauren King '19, Samantha Mauro '19 and Matthew Moschella '18 will work with **Edward McGushin**, Associate Professor of Philosophy, on *Power, Freedom and the Aesthetics of Existence in Psychoanalysis after Foucault*. Their goal is to contribute to the tradition of critical theory for which social control is built into our very psychic structure as individuals. Drawing on recent work in developmental theory and on recent theories of psychoanalytic process as well as contemporary continental philosophy they will argue that subjectivity is never static and that therefore change, resistance, and freedom always remain possible within structures of domination. Their research builds on research conducted during the past two summers. Mauro, a mathematics and philosophy double major, will be responsible for researching dynamic systems theory and building her knowledge of research methods in philosophy and mathematics. King, a music and philosophy double major, will be responsible for serving as critical reader and dialogue partner. Moschella, a religious studies and interdisciplinary study in human ontology major, will be responsible for researching theories of free play and serving as a group mentor.

Meghan Ghazal '19 will work with **Irvin Pan**, Assistant Professor of Biology, on *Examination of Leaf Development Genes and Convergent Evolution in Three Unrelated Groups of Carnivorous Pitcher Plants*. Using carnivorous plants grown in the greenhouse on campus, the research team will use the plant tissue to examine several different candidate genes that are known to play a role in leaf development. These genes are known to control the identity of the different surfaces of leaves, and include *PHABULOS*, *FILAMENTOUS FLOWER*, and *KANADI*. Ghazal, a biology major, will be responsible for various tasks, including collecting tissue and extracting and isolating RNA and DNA and sequence analysis. The findings will be presented at the Eastern New England Biological Conference.

Parker Dunn '18, Emily Gibeault '19 Kyle Paquette '19 and Dan Stone '18 will work with **Dan Rogers**, Assistant Professor of Chemistry, on *Oyster Aquaculture Induced Changes in Flux of Carbon and Nitrogen to the Sediments*. Continuing last year's SURE project, the team will work at the oyster aquaculture demonstration project site located in Little Pond to estimate the particulate carbon and nitrogen fluxes to and from the sediments resulting from aquaculture activities. Sampling will take place every other week with each student examining a different aspect. Dunn, a chemistry major, will be responsible for processing and analyzing samples. Gibeault, a biochemistry major with a minor in philosophy, will extract DNA and RNA for quantification of marker genes. Paquette, a chemistry major, will process water samples and isotopic signatures. Stone, an engineering and environmental science double major, will model the 2016 and 2017 data and analyze gas samples. The team hopes to present their findings in a scientific and public outreach setting.

Mark Hamalian '18 and Michaela Sullivan '19 will work with **Cheryl Schnitzer**, Associate Professor of Chemistry, on *Measuring Ultrafast Phenomena with a Femtosecond Laser*. The team has set forth three goals for the project. First, they hope to determine the pulse length accurately of the laser system located in the Shields Science Building by building a device called GRENOUILLE. Next, they will use Second Harmonic Generation (SHG) to ensure the overlap of the pump and probe beams in space and time. Finally, they will strive to develop an appropriate detector for the laser system. Hamalian, a physics and mechanical engineering dual-degree major, will be responsible for understanding and operating the laser system and building the GRENOUILLE apparatus to measure ultrashort fs pulses. Sullivan, a chemistry major, will also be responsible for operating the laser system and will serve as an expert on the SHG experiment. The team will present their findings at the American Chemical Society meeting and hope to publish their work.

Erica Bigelow '18 will work with **Bettina Scholz**, Associate Professor of Political Science, on *Beyond Human Security: Addressing LGBTQ+ Security*. The project will focus on the insecurity of LGBTQ+ threats. The group will use subfields of political science and queer theory to collect data. Bigelow, a philosophy major with a double minor in English and political science, will read articles on human security to expand her knowledge and use her research to create a paper. The research will hopefully be published in an undergraduate research journal.

Elena Ciaramella '19 will work with **Bettina Scholz**, Associate Professor of Political Science, on *Beyond Human Security: Environmental Security and the Need for Sacrifice*. The research will focus on political environmental theorists and provide an understanding of what is needed to ensure human security from environmental dangers.

The pair will look at what people should be required to sacrifice to ensure safety. Ciaramella, a political science and sociology double major, will be responsible for keeping a research journal and drafting a paper. The findings are will be submitted to an undergraduate research journal.

Karina Craft '18, Laura Darr '19, and William Melahouris '18 will work with **Hsin-hao Su**, Associate Professor of Mathematics, and **Heiko Todt**, Assistant Professor of Mathematics, on *Mathematics Research Experience for Undergraduates*. The study allows the students to experience what they would encounter during a graduate school program in mathematics. The students will choose a problem to work on, as well as a mentor. The group of mathematics majors will conduct background research before proposing a problem that has never been solved before. The goal is to write a mathematical paper and present at a conference.

Gavin Giardino '19 will work with **Leon Tilley**, Professor of Chemistry, on *Synthesis of Acetylenic and Pyridyl Bicyclobutanes*. The long term goal of the project is to synthesize tetrahedrane, a potential high-energy fuel by continuing research conducted during SURE 2016. This summer, Giardino, a biochemistry major, will investigate the bicyclobutane-forming bridging reaction, and research methods of synthesizing tetrahedrane and electron-withdrawing group containing derivatives. They hope to present their findings at the ACS national meeting and be published in a peer-review journal.

Erin Hickey '19 will work with **Leon Tilley**, Professor of Chemistry, on *Synthesis of Methoxytetrahedrane and 1,4-addition to 4-TMS-cyclobutenone*. Hickey, a biochemistry major, will also research the synthesis of tetrahedrane by producing methoxytetrahedrane. She will do this by researching different methods of bromination and examining various reactions with bases. They plan to publish the results in a peer-reviewed journal and present the findings at an ACS national meeting.