

## Stonehill Undergraduate Research Experience (SURE) Summer 2016 Awards

Fifty Stonehill College students will work with twenty-five faculty members on a variety of research projects during the summer of 2016. This will mark the 21st year of the Stonehill Undergraduate Research Experience (SURE) program, whose purpose is to provide students with an opportunity to perform significant, publishable research under the guidance of an experienced faculty researcher. The research experience will help to provide students with a competitive advantage in graduate and professional school applications and in post-college employment opportunities, as well as to provide assistance to faculty in research activities.

**James Cheney '17, Taylor Christiansen '17, Alex Guerrero '18 and Alison Smith '17** will work with **Bronwyn Bleakley**, Associate Professor of Biology, on the *Influence of Social Environment on Guppies*. Cheney will look at how environmental contaminants change the integration of social information across interactions in guppies (*Poecilia reticulata*). Christiansen and Guerrero will look at the role the lateral line (a sensory organ that detects vibrations in the water) may play in regulating the sensitivity a guppy has to its social environment. Smith will examine the influences of social environment on guppy endocrine physiology and link potential differences to responsiveness to social partners. The group of biology majors hopes that the results of this summer's research will build upon previous years' work and will be compiled and submitted for publication in a peer reviewed journal.

**Samantha Bertherman '17 and Matthew Marshall '17** 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 the number of species has decreased due to development in the Blue Hills and that they may see the presence of new southerly species due to climate change. Bertherman and Marshall, both biology majors, 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 during SURE 2015.

**Nicole Levesque '18 and Yaritza Sanchez '17** will work with **Kirk Buckman**, Assistant Professor of Political Science and International Studies, on *Democracy, Capitalism, and Corruption in Ecuador* and *Democracy, Capitalism, and Corruption in Colombia*. This study will examine the economic and political development of Ecuador and Columbia since the elections of President Rafael Correa to Ecuador in 2007 and President Manuel Santos to Columbia in 2010. Levesque, a political science and Spanish major, will explore the political stability, constitutional reforms and economic instability of Ecuador during Correa's presidency. Sanchez, an international business major, will focus on three policy areas of Santos's presidency. These include the Special Jurisdiction for Peace agreement, the Magistrates Tribunal portion of the Balance of Powers constitutional reform, and his more recent social and economic policies. The group hopes to present their papers at the Northeastern Political Science Association Annual Conference in November of 2016.

**Haley Bibaud '17** will work with **Kristin Burkholder**, Professor of Environmental Science and Studies, on *Changes in the Frequency and Intensity of Massachusetts Snowfall*. Last winter, Boston received a record breaking 110.6 inches of snow. This study will examine last years' snowfall in Massachusetts in relation to changing precipitation trends in the region. Bibaud, an environmental science major, will be responsible for analyzing snowfall data collected at 12 stations throughout the state and becoming proficient in the computer software program, MATLAB, which is used to perform detailed analysis of data. They hope the research will lead to a publication in a peer-reviewed journal and to present the results at a regional or national conference.

**Elaina McDowell '18** will work with **Kristin Burkholder**, Professor of Environmental Science and Studies, on *Interannual Variability in the Property Fields of the Gulf of Maine*. The Gulf of Maine (GOM) is a semi-enclosed marine environment that spans thirty-six thousand square miles off the coast of New England and southeastern Canada. The waters of GOM are warming at a greater rate than most locations, with increased temperatures presenting at both the surface and at various depths. This warming will affect both the biodiversity and food web structure of these waters. This summer, McDowell, an environmental science major, will examine data from previous sampling efforts in order to determine regions and depths with enough data to analyze warming trends and identify areas that would benefit from further sampling by the Burkholder lab and collaborators in the future. They hope to present their results at a regional or national conference.

**Lauren D'Intino '17** and **Margaret Flynn '17** will work with **Nicole Capezza**, Assistant Professor of Psychology, on *Perceptions of Female and Male Victims of Psychological Abuse*. Psychological abuse refers to non-physical behaviors aimed at exerting control over another person, the results of which can be severe and long lasting. Capezza's previous research has explored how psychological abuse is perceived. During this summer the group seeks to further investigate these perceptions by focusing on the sex of the perpetrator and victim. Is a male victim viewed the same as a female victim? What about a male perpetrator vs. a female perpetrator? D'Intino, a psychology and education double major, and Flynn, a neuroscience major, will analyze a large dataset collected from students at Purdue University. The findings will be presented at a national research conference in psychology and possibly published in a peer-reviewed journal.

**Cassandra Daisy '18**, and **Daniel Thadeio '17** will work with **Nicole Cyr**, Assistant Professor of Biology and Neuroscience, to determine *How Hypothalamic ER Stress and Sirtuin1 alter mTOR to Maintain Obesity*. The study aims to determine the interaction between physiological processes that control body weight. Daisy, a biology major, will research how endoplasmic reticulum (ER) stress interacts with mTOR to contribute to leptin resistance in the hypothalamus, an area of the brain that regulates body weight. ER stress induced by obesity may block mTOR's ability to increase leptin, thus leptin cannot do its job of stimulating neurohormones that suppress appetite. Thadeio, a neuroscience major, will investigate how the enzyme Sirtuin1 (Sirt1), a nutrient sensor that has been shown to regulate weight, interacts with the metabolic sensor mTOR. The group hypothesizes that an increase of Sirt1 during obesity blocks the mTOR pathway causing weight gain. Daisy and Thadeio hope to present their findings at the NEURON conference in February of 2017.

**Dean Melcher '17** and **Zal Sidhwa '17** will work with **Nicole Cyr**, Assistant Professor of Biology and Neuroscience, on *Does Sirtuin1 Regulate Fatty Acid-Induced Insulin Resistance in the Brain?* and *The Effect of Free Fatty Acids on the Appetite-Suppressor  $\alpha$ -MSH in the Brain*. As mentioned above, there are several hypothalamic neurohormones that suppress appetite and control body weight. One of these is the peptide  $\alpha$ -melanocyte stimulating hormone ( $\alpha$ -MSH), a strong appetite suppressant. Insulin binds to receptors in the hypothalamus increasing the production of  $\alpha$ -MSH. Studies have shown that in obesity, increased free-circulating fatty acids contributes to insulin resistance. In this case increased insulin does not correspond to an increased production of  $\alpha$ -MSH causing appetite and weight to increase. Sidhwa, a biology major will study how fatty-acids cause changes to the precursor protein called proopiomelanocortin (POMC) from which  $\alpha$ -MSH is derived. Melcher, a neuroscience major, will determine whether blocking Sirt1 will mitigate the effects of fatty-acids on insulin signaling in hypothalamic neurons. They hope to present their findings at the NEURON conference next year.

**Laurin Joseph '18** will work **Deno Del Sesto**, Assistant Professor of Chemistry, on *The Study of Metalloporphyrins on Gold and Silicon Surfaces via Scanning Tunneling Microscopy*. Self-assembled monolayers (SAMs) are often comprised of organic compounds that are adsorbed on a solid surface. This assembly takes place through interactions between the molecules and the surface. SAMs are of particular interest in the field of nanotechnology, specifically in the development of lower power electronics and faster processors. Metalloporphyrins have been studied on gold surfaces due to the strong affinity that they have for the surface and the ability for them to absorb and self-assemble in solution under ambient conditions. The goal of this study is to repeat previous studies and show that these systems can be studied using this technique and instrumentation. Once this is complete, new molecules will be used to try and influence the symmetry of the surface for possible use in stereospecific catalytic processes. Joseph, a chemistry major with a minor in music, will be responsible for learning the instrumentation and background of the research as well as reading past reports and reproducing simple experiments. The results will be presented at the spring 2017 ACS Conference.

**Paige Campbell '18** and **Linsey Malia '18** will work with **Jungyun Gill**, Assistant Professor of Sociology and Criminology, on *Is Gender Equality Good for Mental Health?* and *Racism and Mental Health: An Application of Critical Race Theory*. The group seeks to determine how gender inequality and racism affect mental health conditions. They will learn about existing scholarship on mental health and conduct secondary data analyses of the National Longitudinal Survey of Youth97 (NLSY97) to answer their research questions. As a framework, Campbell, a sociology and psychology major, will employ the feminist and life course approaches. Her research will focus on exploring if gender inequality experienced within a family during adolescence affects mental health during early adulthood and if this effect differs by gender. Malia, a psychology and sociology major, will employ the Critical Race Theory (CRT) and life course approaches as her theoretical framework. The focus of her research will be on examining if being arrested by police as an adolescent contributes to mental health issues in early adulthood and if this effect differs by race. They plan to present their findings at the Eastern Sociological Society annual meeting or Sociologists for Women in Society meeting in 2017 and submit papers to peer-reviewed journals.

**Alina Shklyarenko '17** will work with **John Golden**, Associate Professor of Foreign Languages, on *Translating Alexander Blok*. Blok was one of the greatest Russian poets of the 20<sup>th</sup> century and many of his poems have already been translated. Using Golden's theory of translation, the study will retranslate some poems and translate others for the first time, including the untranslated sections of Blok's "Retribution." Shklyarenko, a psychology and foreign languages major, is a native Russian speaker, while Golden has a reading knowledge of Russian. Shklyarenko will record the Russian originals, and the two will collaborate on the translations. They hope that their work will be included in an anthology of Russian poetry in translation or a journal or online site devoted to literary translation.

**Nicholas Sangiovanni '18** will work with **Sarah Gracombe**, Associate Professor of English, on *Pledging Allegiance: Adapting the Book of Ruth, 1800-2000*. Building upon past research, the study will examine adaptations of the Biblical Ruth in English and American culture from 1800-2000. The two hypothesize that the numerous Ruths in nineteenth and twentieth-century literature illuminate views about immigration, conversion, assimilation, gender, and the complex interactions between them. Sangiovanni, an English and philosophy major, will be responsible for researching and reading various archival texts. Using the research, Gracombe will write a book chapter, "Pledging Allegiance: American Fictions of Ruth," while Sangiovanni will write a paper for the Undergraduate Literature Conference.

**Heather Bowditch '17, Christine Carroll '17 and Gloria Mahame '18** will work with **Marilena Hall**, Associate Professor Chemistry, on *Mutations Increase Propagation Rates in an M13 Bacteriophage Variant*. This project continues previous research into how genetic alterations affect the health of organisms using bacteriophage (phage). Specifically, the group of biochemistry majors will investigate the effect of the alteration of DNA in M13 phage and how mutations compensate for these effects. Bowditch will attempt to determine the conditions under which the mutations produce more pII (a phage protein), which is responsible for cutting the DNA so that it can be replicated. Carroll will express and purify pII and demonstrate that the protein is less active on genomes containing the DNA insert than on that of the WT-MT13 genome. Mahame will analyze the WT-M13 genome and determine if the insertion of DNA into a location other than the origin of replication is less disruptive to the propagation of the phage. They are hoping the work will lead to a student-authored publication as well as contribute to their senior theses and seminars.

**Caroline Rosinski '17**, will work with **Martha Hauff**, Assistant Professor of Biology, on the *Variability in Nursery Habitat and Its Influence on the Feeding, Growth, and Survival of the Early Life Stages of River Herring*. By looking at two species of river herrings, *Alosa pseudoharengus* and *A. aestivalis*, the group will examine the effect of nursery habitat quality and variability on larval feeding, growth and survival. This research is essential to implementing conservation and management practices to preserve these highly threatened species. Rosinski, a biology major, will assess prey availability, study gut contents and measure growth rates of the larvae. Rosinski hopes to have the opportunity to present her and Hauff's findings at the 40th Annual Larval Fish Conference.

**Kristen Lowder '17** will work with **Rachel Hirst**, Assistant Professor of Biology, on *Genomic Analysis of Methylobacteria Species Isolated from a Variety of Fungal Isolates*. This project will continue work from previous SURE summers to collect fungal samples and identify associated Methylobacteria species. Lowder, a biology major, will complete whole-genome sequencing and comparative genomic analysis on Methylobacteria samples collected last summer to determine if any of the isolates are novel species. The group hopes to present their findings at the 2016 Eastern New England Biology Conference.

**Ashlyn Czapiga '17 and Alexander Crowley '17** will work with **Magdalena James-Pederson**, Associate Professor of Biology and Biochemistry, on *Characterization of Methylobacteria Communities in Fungal Samples*. During SURE 2015, 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 each fungal sample and explore the differences between them. Czapiga and Crowley, both biology majors, will be responsible for collecting and analyzing fungal and bacterial samples. If a novel *Methylobacteria* species is found, its genome will be sequenced and submitted for publication.

**Taylor Vigneault '17**, will work with **Magdalena James-Pederson**, Associate Professor of Biology and Biochemistry, and with Dr. Hiroshi Mashimo, a physician in the Department of Internal Medicine at the VA Boston Healthcare System, on *Investigating the Mechanisms of Bile-Mediated Mutagenesis in Stem Cells of the Human Esophagus*. Studies have shown that bile reflux causes greater damage to the esophageal mucosa than acid alone. Most studies have overlooked the damage to the cells of the deep esophageal glands (dEG). The goal of this study is to test the validity of Dr. Hiroshi Mashimo's hypothesis that bile acids promote the genetic instability and activation of trans-differentiation pathways in the glandular epithelial cells of the dEG and the progenitor cells that reside within. Vigneault, a biochemistry major, will test biological markers related to early stages of esophageal cancer. Vigneault and Pederson will also collaborate to write a case study for the course Biochemistry II.

**Marissa Licata '17** will work with **Pamela Lombardi**, Assistant Professor of Chemistry, on *Synthesis of New Chiral N-Heterocyclic Carbene Ligands for Catalysis*. Molecules are said to be chiral if they have a non-superimposable image. Reactions to produce these molecules often result in two mirror images, or enantiomers, which can be problematic if the biological activity of one is different the other. Therefore, producing one enantiomer is the preferred objective. Licata, a biochemistry major, will investigate a reductive amination strategy to create a new chiral N-heterocyclic carbene for use in catalytic asymmetric reactions to produce one enantiomer of a molecule preferentially. The findings presented in the study will provide Licata for a basis of her senior thesis.

**Catherine Giannetti '17** and **Dillon Neumann '18** will work **Louis Liotta**, Professor of Chemistry, on *Synthesis of Tetrahydroxylated Indolizidines from D-Glucose and Synthesis of Treahydroxylated Pyrrolizidines from D-Glucose*. Over the last several years, Dr. Liotta and previous students have developed the means to efficiently convert sugars into iminosugars, compounds that inhibit the glycosidases (enzymes that degrade carbohydrates). Giannetti, a biochemistry major, will continue her work from last summer by developing a way to add OH groups to an indolizidine iminosugar precursor compound in such a way that controls the exact direct the OH groups point in the final molecule. Meanwhile, Neumann, a biochemistry major, will be working to adapt the chemistry for synthesizing the indolizidine iminosugars to similar class of iminosugars but that have one fewer carbon atoms in the structure called pyrrolizidines. They hope to submit their findings to an academic journal.

**Taylor Uccello '17** will work with **Greg Maniero**, Professor of Biology, on *Characterization of Amphibian CD4 as a Receptor for IL-16*. Amphibian populations have been declining globally due in part to disease, possibly a consequence of diminished immune function. The amphibian immune system has been well-characterized and is almost identical to that of humans. This study will attempt to identify and characterize T cells known as CD4 cells in the frog, *Xenopus laevis*. Maniero and Uccello, a biology major, hope develop a monoclonal antibody to detect these cells. Their results will be submitted to the journal, *Developmental and Comparative Immunology*.

**Thomas Bellio '18** will work with **John McCoy**, Professor of Psychology and Neuroscience, on *Role of Glutamatergic Neurons of the Basal Forebrain (Part 2)*. The basal forebrain (BF) plays an important role in cortical activation, attention, and sleep-wake behavior and is impaired in instances of coma, sleep disorders, and Alzheimer's disease. There are three major BF neurotransmitters; and of which, glutamatergic neurons are the least understood. In this study, McCoy and Bellio, a neuroscience major, will investigate the specific efferent projections from the BF glutamatergic subpopulation to wake/arousal and cognition-related brain regions. Bellio hopes to present his research at the regional undergraduate neuroscience research conference, NEURON.

**Amanda DePasquale '17** will work with **John McCoy**, Professor of Psychology and Neuroscience, on *The Role of Sleep Spindles in Memory Consolidation*. This study will investigate the neural mechanisms of how sleep improves memory. By measuring electroencephalographic (EEG) activity from the brain during sleep, wave forms known as sleep spindles can be identified. These spindles are thought to mediate sleep-dependent memory consolidation. Sleep spindle abnormalities are common among patients diagnosed with schizophrenia. Through this study, McCoy and Depasquale, a neuroscience major, are hoping to identify brain regions and specific cell types that modulate sleep spindles and develop a therapeutic strategy for these patients. They will present their findings at the regional NEURON conference.

**Cassidy Ballard '18**, **Zack Colclasure '17**, and **Matthew Moschella '18** will work with **Edward McGushin**, Associate Professor of Philosophy, on *Eros, Power, and the Aesthetics of Existence*. Building on research from SURE 2015, the group will examine the role of aesthetics in contemporary critical theory. Does aesthetic experience – understood as “free play” – provide a model of social and existential freedom? Moschella, a religious studies major, will study the notion of aesthetic experience as free play in contemporary philosophy, psychology, and sociology. Ballard, a communication major, will examine the place of play in neo-liberal and bio-political discourses. Colclasure, a philosophy and political science double major, will question the way philosophers such as Plato and Marcuse theorize Eros (love) as a fundamental human drive for freedom and self-development. They hope to produce a journal article or conference paper and hopefully a book proposal.

**Dan Stone '18** will work with **Dan Rogers**, Assistant Professor of Chemistry, on *Quantifying Denitrification and Anammox in Sediments Underlying Oyster Aquaculture*. In coastal communities, anthropogenic nitrogen (N) loading has had both an ecological and economic effect on water quality, resulting in among other issues harmful algal blooms, habitat alteration/loss, and coastal hypoxia and anoxia. Nitrogen can be removed from the water through shellfish harvesting and anammox, a microbial process through which nitrogen is transformed from a dissolved species to an atmospheric gas. Rogers proposes that oyster aquaculture increases anammox. During this summer, Stone, an engineering and environmental engineering double major, and Rogers will quantify the effect of oyster aquaculture strategies on bacterially mediated nitrogen removal in a coastal pond located in Falmouth, MA.

**Janelle Shea '18** will work with **Dan Rogers**, Assistant Professor of Chemistry, on *Hormones Effect on Developing Organisms in Aquatic Environments*. High coastal populations have resulted in the introduction of pollutants that have a negative effect on aquatic and human populations. These pollutants include high levels of pharmaceuticals, such as hormone-like endocrine disrupting chemicals (EDC). In coastal ecosystems there has been reproductive changes in commercial fish stocks, an increase in populations of antibiotic resistant bacteria due to EDC, as well as elevated levels of cancer in humans. This study proposes to develop a method to measure specific EDCs related to estrogens using a Ultra High Performance Liquid Chromatograph. Shea, a biology major, and Rogers will develop a method to quantify 17beta-estradiol, ketotestosterone and cortisol levels and explore the effect of different environmental conditions on the ability to measure these analytes. They are hoping to submit their findings to a peer-reviewed publication and present at a local conference.

**Mark Hamalian '18, Praveen Kumar Jain '17, and Michael Maggio '17** will work with **David Simon**, Associate Professor of Physics and Astronomy, on *Bessel Beams and Light Petals*. Quantum communication uses photons to carry information while quantum mechanics can prevent undetected eavesdropping of these communications. However, these methods can be ineffective for long distance use due to atmospheric turbulence. Bessel beams (specialized variations of laser beams) can be used to create petal formations, which may be able to withstand turbulence. The group's research strives to develop a method for encoding information into the petal structure for communication, to see how it is affected by turbulence, and to investigate the possibility that the structures could be used as an optical container. Hamalian, a physics and aerospace engineering major, Jain, a physics and mechanical engineering major, and Maggio, a physics major, will expand on last summer's SURE research and hope to publish their results in a scientific journal and present at a conference.

**Catello Battinelli '18, Jason Dimmick '18, Kelly Powers '18 and Matthew Young '18** will work with **Hsin-hao Su**, Associate Professor of Mathematics, and **Heiko Todt**, Assistant Professor of Mathematics on *Mathematics Research Experiences for Undergraduates*. The study allows undergraduate students experience what they will encounter during a graduate program in mathematics. Battinelli, Dimmick, and Powers, all mathematics majors, and Young, a computer science major, will collaboratively study introductory material on graph labeling and then will attempt to solve one of three problems of their choosing. If they find a solution for the previously unsolved problem, they will collaborate to write a paper to be published and presented at a national or regional conference, as well as within a peer-reviewed journal.

**Samuel Johnston '17** will work with **Leon Tilley**, Professor of Chemistry, on *Enhancing the Oxidizing Power of Bobbitt's Salt*. "Bobbitt's salt" is emerging as an important green oxidant that can be used for a variety of purposes. Johnston, a chemistry major, will work with Tilley to attempt to oxidize alkyl trifluoromethyl alcohols using synthesized derivatives of the salt. They plan to present their findings at an American Chemical Society national meeting and to ultimately publish them in a peer-reviewed journal.

**Anthony Moriondo '18** will work with **Leon Tilley**, Professor of Chemistry, on *Bicyclobutyl Bridging en Route to Synthesis of Tetrahedrane*. Synthesis of tetrahedrane 1 has been proven to be elusive due to its large ring strain. This compound has potential to be a high-energy fuel or feedstock for fuel cells. Building off last summer's research, Moriondo, a chemistry major, will explore a bicyclobutane-forming reaction using electron-withdrawing derivatives of cis cyclobutyl systems, and investigate other methods of synthesizing tetrahedrane 1. They plan to present their findings at an American Chemical Society national meeting and publish them in a peer-reviewed journal.

**Melissa Mardo '17** will work with **Chris Wetzel**, Associate Professor of Sociology, on *Students in Action*. Some scholars have argued that student activism is expanding on college campuses while others suggest that it is in decline. This study will concentrate on the shift in focus and form of student activism. Wetzel and Mardo, a sociology and interdisciplinary studies double major, will build on previous findings from SURE research in 2012 and 2014. Mardo will conduct semi-structured interviews with students involved in social justice issues at colleges and universities around the U.S. They plan to present a paper on their research at the Eastern Sociological Society annual meeting in February 2017 and communicate their conclusions to Stonehill students.