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**Stonehill Undergraduate Research Experience (SURE) Summer 2022 Projects**

Forty Stonehill College students will work with twenty-one faculty members on a variety of research projects during the summer of 2022, the twenty-sixth year of the Stonehill Undergraduate Research Experience (SURE) program. SURE 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.

**Maeve Clifford, '23** will work with **Greg Maniero**, Associate Professor of Biology, on the on-going project *CD4 as an ancestral receptor for the cytokine IL-16; evidence from the from Xenopus laevis.* CD4 is a protein found on immune cells of all vertebrates, including humans. Cell that have CD4 on their surface are the master regulators of the immune response that is responsible for protecting organisms from disease. Although all vertebrates produce CD4, the protein varies considerably between distantly-related organisms. All of the varieties of CD4, in addition to their other functions, act as a receptor for the soluble immune factor IL-16. We have demonstrated that human IL-16 will activate CD4 cells from the frog. We are continuing to describe the effects of both human and frog IL-16 on frog immune cells. Our results will provide important and novel information about the evolution of the vertebrate immune system. We have reported results from previous SURE projects in three publications and hope to generate enough results to submit another paper to the journal, *Developmental and Comparative Anatomy*, and to present our work at international conferences in comparative immunology in 2023.

**Taylor Sprague, '23** will work with **Anwar Mhajne**, Assistant Professor of Political Science, on *Climate Change and (In)Security in the Israeli–Palestinian Context.* Climate change is one of the most pressing issues of our time. Due to the ongoing conflict between Israel and Palestine, Palestine will face severe implications as the region's natural resources continue to be controlled by Israel. For this project, we will research the effects of climate change on Palestinians while looking at the crisis through a feminist lens. Using a feminist lens is important because climate change impacts intersections of communities differently. For the outcome of this project, we would like to determine how climate change, inequality, and politics are interconnected. To determine the discriminatory ways climate change will impact Palestinians, we will conduct interviews with Palestinian scholars regarding climate change in this political climate. Our end goal is to present our findings at the Women Climate and Insecurity

Conference, which brings scholars from multidisciplinary backgrounds together to provide feminist analyses of climate change on marginalized populations.

**Megan Larrow '24, Isabella Rossetti '24, Ludimira Ribeiro-Silveira '23** and **Cristina Solorzano '23** will work with **Louis Liotta,** Professor of Chemistry, on *Development of Antidihydroxylation Methods for Polyhydroxylated Indolizidines* from various commercially available sugars. Larrow will start her synthesis from *D-Galactopyranoside*, Rossetti will start her synthesis from *D-Allopyranoside*, Ribeiro-Silveira will start her synthesis from *L-Allopyranoside*, and Solorzano with start her synthesis from *D-Glucopyranoside*. Over a period of several years, Liotta's research groups have developed ways in which to convert sugars into medicinally interesting sugar analogs known as iminosugars. Polyhydroxylated indolizidines are one class of iminosugars involving a six-atom ring structure fused to a five-atom ring structure with multiple hydroxyl groups (O-H groups) attached. Previous research has resulted in the ability to attach two of the O-H groups from the same side of the structure (called syn addition). This research hopes to expand upon this previous work by developing a means to add two O-H groups from opposite sides of the structure (called anti addition). Larrow, Rossetti, and Solorzano, all chemistry majors, and Ribeiro-Silveira, a biochemistry major, will be responsible for synthesizing, purifying and characterizing all intermediates as well as the final target iminosugars. The group hopes to publish their findings in the Journal of Organic Chemistry and/or present at an upcoming American Chemical Society (ACS) conference.

**Madison Maiorano '23** will work with **Louis Liotta**, Professor of Chemistry on the *Synthesis of Casuarine and Its Isomers from $\alpha$ D-Glucopyranoside.* Over a period of several years, Liotta's research groups have developed ways in which to convert sugars into medicinally interesting sugar analogs known as iminosugars. Polyhydroxylated pyrrolizidines are one class of iminosugars involving a five-atom ring structure fused to a second five-atom ring structure with multiple hydroxyl groups (O-H groups) attached. Casuarine is a polyhydroxylatd pyrrolizidine iminosugar that is naturally found in the bark of coast sheoak trees which has been prescribed for the treatment of cancer in Western Samoa. It is also found in Jamun plants, traditionally used for treating diabetes in India, and in an African plant reported to help AIDS patients. Maiorano, a biochemistry major, will be responsible for synthesizing, purifying and characterizing all intermediates as well as the final target iminosugars. In addition to her chemical research, Madison will provide guidance to the less experienced students joining Professor Liotta's research group this summer. Madison hopes to publish her findings in the Journal of Organic Chemistry or similar journal.

**Gianna Barboza '23** and **Sadé Ratliff '23** will work with **Jungyun Gill**, Associate Professor of Sociology, on *From BTS to Squid Game: Can K-pop and K-dramas Build Interracial Solidarity?.* Korean pop music, also known as K-pop, is the most prominent element of the Korean Wave, Hallyu, referring to the global phenomenon that South Korean popular culture has been sweeping through nations around the world. The most popular K-pop group, BTS, holds a total

of 23 Guinness World Record titles across music and social media. Another example of the Korean Wave that hit the U.S. in 2021 is a K-drama, "Squid Game," the biggest show ever on Netflix. Why are so many people fascinated by Korean popular culture and what impacts may K-pop and K-drama have on people's world views? More specifically, this study aims at understanding consumption of K-pop and K-drama in the context of racial hierarchy in the United States and constant social activism challenging the racial status quo. Are people who enjoy K-pop and K-dramas more concerned about anti-Asian hate incidents and more likely to engage in the #StopeAAPIHate social activism? On the other hand, US Black culture and music genres such as hip-hop and R&B have heavily influenced many K-pop performers from their fashion to music, making K-pop more transnationally appealing from its beginning. Does the prominence of Black culture in K-pop influence its fans to have a more favorable view of the Black Lives Matter movement and get involved in it? To answer these research questions, we plan to conduct a survey and interview K-pop fans and K-drama viewers from the four racial/ethnic categories, Black, Latinix, Asian, and White.

**Bridget Ryan, '23** will work with **Teresa Villa-Ignacio**, Associate Professor of French and Francophone Studies, on *Sounding Translation*. *Sounding Translation* is an Internet-accessible podcast that archives translators' reflections on the experience of translating contemporary poetry While several excellent poetry podcasts are widely available today, very few are dedicated to the translation of poetry. This project aims to fill that void, to raise awareness about the role of translators in the dissemination of literature, and to highlight the importance of translation as a literary endeavor. Professor Villa-Ignacio conducted these interviews as initial research for her book manuscript-in-progress, *Translational Poethics: French-American Postlyric Communities Since 1968*. The interviews, which feature leading France- and U.S. based poets who translate between French and English, will be archived at PennSound, the largest independent U.S. archive of poetry and poetry-related recordings, based at the University of Pennsylvania's prestigious Kelly Writers' House. Working in French and English, Bridget will transcribe interviews, edit audio files, research and write interview summaries and poet-translator biographies, and record the introduction and conclusion to each podcast episode.

**Sophie Glidden '23** will work with **Linnea Carlson**, Assistant Professor of Anthropology, on *Investigating Cultural Understandings of Mental Health Among Haitian Americans and Cape Verdean Americans in Brockton, MA.* The project team will conduct community-engaged ethnographic research among Haitian and Cape Verdean populations in Brockton to more fully understand (1) the verbiage used to describe mental health problems like depression, anxiety, and mental distress in Creole languages; (2) the translations of these concepts from the language of origin into English; (3) stressors that contribute to mental health problems; and (4) existing coping strategies within these populations. The data collected for this study will also be used to create better quantitative survey instruments for data collection in assessing mental health statuses of Brockton residents from the Haitian and Cape Verdean communities. The desired outcomes of this project will be (1) a publishable article for an academic journal titled *Collaborations: A Journal of Community-Based Research and Practice* and (2) revised mental health survey instruments (for Cape Verdean Americans and Haitian Americans) using updated,

culturally appropriate measures and language to more accurately assess mental health on a broader scale.

**Ariana Lencioni '23** and **Annabelle Rutherford '23** will work with **Lillian Reuman**, Assistant Professor of Psychology, on *Student/Parent Anxiety Views and Experiences (SAVE/PAVE)*. Given the increased prevalence of reported stress and anxiety among students, colleges need feasible and effective interventions that help students – and those who interact with them (e.g., peers, parents/guardians) – to learn coping skills and support strategies. Although a variety of brief, accessible interventions to address college students' anxiety exist, no research has intentionally explored the stated needs/preferences of stakeholders (i.e., college students and their peers and parents). To address this gap in the literature, our mixed methods study will gather quantitative and qualitative data from surveys, interviews, and in-person focus groups to better understand the experiences and preferences of college students with anxiety and their parents/guardians. Our end goal is to present our findings at a conference, publish a manuscript detailing our results, and use the information collected to develop on-campus programming to provide education and teach skills for managing anxiety to Stonehill college students and their family members.

**Alex VanHelene '23** will work with **Nicholas Block**, Assistant Professor of Biology, on *A Genetic Investigation of Species Limits in Meadowhawk Dragonflies.* This project will examine the gene flow and species-level relationship of the Cherry-faced Meadowhawk and Ruby Meadowhawk, two small, red dragonfly species found in Massachusetts. Despite small morphological differences between the two dragonflies, previous genetic work has not been able to distinguish between them. VanHelene, a biochemistry major, will use various bioinformatics techniques to analyze genome-level data from approximately 48 specimens collected across a possible hybrid zone between the two species on Cape Cod. The team hopes to use these data to determine if the species have hybridized and perhaps should be lumped into one species or if they are two distinct young species. The ultimate goal of this project is to produce a data set that will lead to a research journal publication, written jointly by Block and VanHelene.

**Jillian Callahan' 23** will work with **Martha Hauff**, Assistant Professor of Biology, to investigate the ***Dynamic Food Webs of the Northeast Continental Shelf.*** Callahan and Hauff will be joining collaborators at Woods Hole Oceanographic Institution in an ongoing National Science Foundation-funded Long Term Ecological Research project engaged in sustained monitoring of the NE Shelf ecosystem. These waters provide critical ecosystem services to humans (including a fishery worth over $100 billion per year) and are home to iconic endangered species such as Atlantic salmon, North Atlantic right whales, and Roseate Terns. With an eye toward conservation Callahan and Hauff's work will use stable isotope analysis to identify linkages and trace transfer of energy from the phytoplankton at the base of the food web up to higher trophic levels. This work will help to elucidate the drivers of seasonal and interannual dynamics, and will thereby inform our understanding of, and predictions about long-term climate- induced changes in this critically important marine community.

**Maeve Staab '23** will also work with **Martha Hauff**, Assistant Professor of Biology, on a project titled ***Illuminating the Twilight Zone.*** The Ocean Twilight Zone is a layer of open ocean around the world extending from about 200m to 1000m beneath the surface—depths to which only the tiniest bits of sunlight can penetrate. This region is cold and dim, but signs of life abound, including flashes of bioluminescence produced by a wide variety and large abundance of organisms. Much of the biomass there consists of small fishes only a few inches long. These twilight-zone fishes are major players in global ocean ecosystem function yet, despite their ecological importance, their basic life histories are poorly understood. This is particularly concerning given that new and emerging technologies for deep sea fish harvesting will soon allow for massive and widespread exploitation of Twilight Zone inhabitants. To understand the potential for human impact on this ecosystem, we will design and use novel, species-specific otolith analysis techniques. The otolith (ear stone) is a calcium carbonate structure in the head of a fish with visible rings that can be counted and measured like the rings of a tree. Generated data will be used to establish critical population and life history data, such as age distributions, size-at-age, age-at-maturity, lifespan, and growth rates of the numerically dominant twilight zone fish species.

**Stephen Cobbs '23, Kirstin Drainville '23, Molly Quattrucci '23, Hailey Romero '23, Hannah Tran '23** and **Meghan Doherty '24 will work with Nicole Cyr, Associate Professor of Biology, to continue previous summer research** on how obesity alters neuron structure and function as well as biochemical pathways in the brain and liver. For his project titled *Stress and Obesity,* Biology Major Cobbs will investigate how stress alters liver function to increase the risk of obesity and Type 2 Diabetes. Similarly, Doherty, a Neuroscience major, will study how obesity causes cellular stress in the liver for her project *Obesity-induced ER stress in the Liver*. Kirstin Drainville, a Biology Major, and Molly Quattrucci, a Neuroscience major, will team up to better understand how obesity alters prohormone processing and biochemical signaling in the brain for their research projects titled *POMC Processing and Obesity* and *How Obesity Alters Signaling in the Brain*, respectively. In her project, *How Obesity Alters Synapses*, Neuroscience Major Tran will examine changes in synapses and synaptic proteins under obese conditions. Romero, a Neuroscience major, will study the possible connection between ER stress caused by insulin resistance and the development of brain inflammation and Alzheimer's Disease. The group hopes to present their findings at a Northeast Undergraduate/Graduate Research Organization for Neuroscience (NEURON) conference next year.

**Marissa Such '25** will work with **Malkaye Kpante**, Post Doctorate Fellow, on C-H activation as it relates to predicting product selectivity in some unusual chemical reactions. Despite many advances in C-H bond activation studies, there are still present significant challenges for predicting selectivity. The objectives of the project are to determine the physical origins of the selectivity for functionally different substrates using density functional theory (DFT) in combination with energy decomposition analysis (EDA) as an aid. Initial focus has been placed on the oxidation of $sp^3$ C-H bonds using methyl(trifluoromethyl) dioxirane (TFDO, an electron-deficient activator). Interaction energy components (orbital, electrostatic, steric, dispersion) will all be analyzed against molecular distortion ($E_{dist}$) in order to relate the interaction terms without a distortion bias. Analysis of the individual orbital interactions between the reacting components (alkane and dioxirane) using second order perturbation theory should in principal reveal that the C-H orbital engages in greater overlap with the O-O σ* antibonding orbital of the dioxirane in the equatorial position, corresponding to the HOMO of the alkane and the LUMO of the TFDO. While an orbital preference has been suggested for equatorial abstraction in prior studies, here we will try to quantify the

effects in relation to electrostatic, steric, and as well as dispersion interaction contributions. We hope to publish our findings in the Journal of Organic Chemistry or similar journal.

**Sophie Kripp '23** and **Lucy Paul '23** will work with **Nicole Capezza**, Associate Professor of Psychology, on *The Intersectionality of Race and Gender through the Lens of Intimate Partner Violence*. While Intimate Partner Violence (IPV) can occur in any type of relationship, research shows that transgender women (and especially transgender women of color) are at an increased risk as 54% of trans women have reported some form of lifetime IPV. During this project, we will analyze a rich dataset that consists of 725 participants and 110 questions. We will be conducting statistical analyses, coding open ended responses, and examining the impact of individual difference variables of our participants (such as gender identity, age, education, region within the U.S., etc.). Through analyzing our dataset, we will gain insights into how the general public perceives violence against Asian transgender women. We plan to submit a manuscript for publication and to present our findings at a national psychology conference. We believe that our research project is vital as understanding perceptions of violence toward marginalized groups can provide abuse victims with much needed support.

**Adam Bertherman '23** will collaborate with **Magda James-Pederson**, Associate Professor of Biochemistry, on *Mapping Genetic Differences between the AFP gene locus in healthy vs Hep 1-6 mouse cells*. Alpha-fetoprotein (AFP) is a specialized protein that plays an important role in stimulating cell growth during the early stages of mammalian development but has no function in healthy adult tissue. The AFP gene is actively expressed in fetal tissue, but it becomes inactive soon after birth. Interestingly, the AFP gene is reactivated in various types of liver cancer (hepatomas) and the cellular mechanisms by which this reactivation occurs in somatic cells are poorly understood. Adam, a biology major, will characterize the DNA structure of the AFP locus from a mouse hepatoma cell line (Hep 1-6 cells) and compare it to the locus from healthy cells. The goal is to analyze both the primary sequence, the epigenetic markers, and the transposable elements around the regulatory region of the AFP locus to determine if there are differences that can account for the observed differences in gene expression. Studying the structural differences associated with AFP gene reactivation might provide new insights into the mechanisms of tumorigenesis in mammalian hepatomas. The goal is to present the findings at the annual Eastern New England Biological Conference and to submit a manuscript to *BIOS*.

**Mariam Antoine '23** will collaborate with **Megan Mitchell**, Associate Professor of Philosophy on the *Affective Experience of MENA People in the U.S.* with respect to racialization. In the United States, Middle Eastern/North African (MENA) people exist in a racially gray area. They are racialized as a non-white other by American society and portrayed negatively in media and popular consciousness as terrorist, infidels, and extremists. At the same time, MENA people are not formally recognized as a non-white ethnic minority in the US; They do not appear on the U.S. census. This juxtaposition between negative representation, on the one hand, and lack of representation, on the other, appears to give rise to a shared negative affective experience, potentially unique to MENA people. MENA people have testified to the existence and various aspects of this affective experience, but it is undertheorized in the academic literature. The aim of this project is to begin to bridge that gap between the lived experience of a racialized

phenomenon and academic research, by investigating and offering an initial conceptualization of it. By describing and situating this affective experience within the wider literature on negative racialized experiences, we will facilitate more robust empirical research into its precise nature and extent, which can then inform and revise our initial conceptual analysis. Our final product will be a conference presentation in the Fall of the 2022-23 academic year.

**Andrew Carusi '24, Antony Hanna '24,** and **Rofail Wassef '24** will work with **Irvin Pan**, Associate Professor of Biology on the *Isolation and Characterization of Local Soil Bacteriophages.* This project will examine the amazing world of bacteriophages, a remarkably numerous and diverse group of viruses that infect bacteria. We plan to perfect and utilize existing lab techniques to isolate, purify, amplify, and characterize unique bacteriophages obtained directly from the soil samples taken on campus. We will use molecular biology techniques to isolate the DNA of our phages. We hope to sequence important diagnostic genes and plan to use existing bioinformatic tools to analyze genome data. After identifying species and genes of interest, we also plant to take advantage of the fast replication of these viruses to observe evolutionary changes they may be undergoing during selection experiments.

**Christy Bogan '23** and **Edward McGushin**, Professor of Philosophy, on *Dreams, History, Ethopoiesis*. will study a crucial stage in the development of twentieth century French philosopher Michel Foucault's thought. We will examine Foucault's move away from his early commitment to existential psychoanalysis and his shift towards the investigation of the historical conditions within which psychology – including its therapeutic techniques and institutions, such as asylums, as well as its concepts of mental health and illness – became possible. Brogan and McGushin will work through the implications of Foucault's shift to history for an understanding of dreams and dream interpretation. We will ask questions such as: how has the relation between dreams, history, politics, ethics, and scientific knowledge transformed over time? How is our experience of dreaming captured by interpretative discourses? Does dreaming represent a form of freedom from political domination or social alienation? What is the ethical meaning of our dreams – how important are they for helping us become aware of the meaning and value of our lives?

**Anh Hoang '23** will work with **Deno Del Sesto**, Assistant Professor of Chemistry, will develop computational methods to model the possible isomers in the synthesis of oxoammonium salts. These compounds are currently being synthesized by Anh in the lab, but the differentiation of the isomers is experimentally difficult. The proposed theoretical calculations along with the experimental data will help to fully characterize the products of the synthesis and lead to novel compounds for use as chemical oxidants in many reactions. These types of oxidants are attractive because they efficient and more environmentally friendly than many current oxidants. In addition to aiding in the characterization of currently synthesized compounds, the developed methods will help to inform future work and possible compounds that can be made using similar methods.

**Emily Hartford '23** and **Jacquelin Saur '23** will work with **Danielle Waldron**, Assistant Professor of Healthcare Administration, on *At the Intersection of Disability and Race: An Analysis of Health Services Utilization (HSU) in the Era of the Affordable Care Act.* Adults with intellectual and developmental disabilities (I/DD) encounter greater disparities in many facets of their healthcare compared to the general population, but disparities within this population across race/ethnicity, age, gender, and type of I/DD are not well understood. The Affordable Care Act (ACA) has the potential to help remedy some of these disparities. This project aims to 1) parse out the intersectional factors, such as race, age, gender, and type of I/DD impacting disparities in HSU of adults with I/DD, and 2) examine changes in HSU in this population throughout varying stages of ACA implementation. This study will employ data from the National Core Indicators-In Person Survey and Compilation of State Data on the Affordable Care Act (2016). Researchers will estimate multilevel mixed effects logistic regressions, which examine both fixed and random effects across states. The team intends to draft and submit 1-2 peer reviewed journal submissions on this research by the end of the summer/early fall. They will also spend time at the House of Possibilities, an organization serving people with I/DD located on the grounds of our campus, to gain real-world experience working with this population and learn about their healthcare needs.

**Cesy Diaz Martinez, '23** will work with **Francesca Fornasini**, Assistant Professor of Physics & Astronomy, on *Mapping interstellar dust using X-rays.* While it is easy to map the 2D positions of astronomical objects, it is more challenging to determine their distances and 3D distributions. One technique that can be used to determine the distances and properties of interstellar dust clouds in our Galaxy is by analyzing the X-ray scattering echoes visible around bright, variable X-ray sources. The way in which the 2D images of the X-ray ring echoes can be used to map the 3D distribution of interstellar dust is similar to how CT Scans and MRIs use a series of 2D images to build up a 3D view of the human body. Understanding the distribution and properties of dust in our Galaxy is very important, because interstellar dust clouds impact our observations of objects at different wavelengths and it is critical for the formation of stars and planets. Cesy will analyze observations from the *Swift X-ray Telescope* of the best-observed dust echo to date, which was produced by the outburst of an X-ray source called V404 Cygni in 2015. She will measure the time evolution of the X-ray rings and their brightness at different X-ray energies. We plan to present the results at an astronomy conference, and to produce valuable material for educational and public outreach purposes.

**Kyle Grewal, '24** will work with **Francesca Fornasini**, Assistant Professor of Physics & Astronomy, on *Classifying high-energy X-ray sources near the Galactic Plane.* Objects that are energetic enough to emit substantial amounts of high-energy X-ray light are relatively rare in the Universe. Since its launch in 2012, the *Nuclear Spectroscopic Telescope Array* (*NuSTAR*) has discovered new high-energy X-ray sources at an unprecedented rate. The majority of these new sources are likely supermassive black holes in other galaxies, but the physical nature of sources located near the Milky Way Galactic plane is less clear. Many of the sources near the Galactic plane may be the leftover compact remnants of stars, such as black holes or neutron stars, within our own Galaxy. Such sources can provide valuable insights into stellar evolution and further our understanding of the different types of processes that can produce high-energy

X-rays. Kyle will expand on a research project begun by another student to determine the nature of 15 unclassified NuSTAR sources near the Galactic plane. He will analyze the broadband X-ray spectrum of the sources, search for counterparts to the X-ray sources in infrared images, and compile together all the information we have learned about these sources to classify them. We plan to present the results at an astronomy conference, and incorporate them into a publication.

**Timothy Woelfle, '24** will work with **Francesca Fornasini**, Assistant Professor of Physics & Astronomy, on *Is black hole accretion enhanced in dwarf galaxy mergers?.* A major open question in astrophysics is how supermassive black holes have formed and grown over cosmic time. In large galaxies, it has been observed that supermassive black hole growth is enhanced during major galaxy mergers, when multiple galaxies merge together. However, it is unknown whether the mergers of dwarf galaxies can similarly result in substantial black hole growth. According to some theoretical simulations, it is possible that in small galaxies, the black holes formed in the early Universe may not have grown much over cosmic time, and thus may be representative of the first generations of black holes in the early Universe. This research will build on a previous student project which discovered four black hole candidates in a sample of about 100 pairs of merging dwarf galaxies. This summer, Tim will identify a comparison sample of isolated (non-merging) dwarf galaxies and search for black hole candidates in this sample in order to determine whether there is a higher fraction of active black holes in merging dwarf galaxies. We plan to present the results of this project at an astronomy conference and potentially in a publication.