**Stonehill Undergraduate Research Experience (SURE) Summer 2021 Projects**

Forty-eight Stonehill College students will work with twenty-two faculty members on a variety of research projects during the summer of 2021, the twenty-fifth 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.

**Shannon Curran '22** and **Lindsey Walsh '23** will work with **Stephanie Ernestus**, Assistant Professor of Psychology, on *ALICE Training Literature Review and Research Design.* ALICE Training sessions, conducted by campus police officers, are designed to provide students with training on response options in the event of a school shooting. What is notable about ALICE Training is that officers simulate a live active shooting by firing blanks to replicate gunfire and shooting students in the body or head using Airsoft guns (ALICE Training Institute, 2020). The current proposal has two aims: 1) write a literature review paper on ALICE Training and other active shooter trainings, focusing specifically on elucidating the underlying theory and research on a) the psychological effects from trainings, and b) the trainings' efficacy. 2) Through the knowledge that will be gained from the literature review, and in consultation with Stonehill Campus Police Officers, they will develop an empirical research protocol to be implemented in Fall 2021. The designed study will examine the effects of ALICE Training on fear, anxiety, and preparedness of Stonehill students. These two aims will add to the extant research on active-shooter trainings, addressing a significant gap and helping to inform institutional participation in ALICE Training at Stonehill and beyond. They hope to publish their findings in a peer-reviewed journal and present at a major psychology conference.

**Deirdre Boyer '22, Evan Kennedy '22, Megan MacIver '22** and **Stephen Cobbs '23 will work with Nicole Cyr, Associate Professor of Biology, to continue previous summer research** on how biochemical pathways interact in the hypothalamus during obesity. MacIver, a neuroscience major, will investigate how changes in mTOR (a metabolic sensor) signaling during endoplasmic reticulum (ER) stress effect leptin production and body weight, in her project, *Interaction of mTOR and ER Stress to Regulate Metabolism in the Hypothalamus*. Boyer's project, *Effects of POMC Processing on Obesity and Metabolism,* will focus on the affect proopiomelanocortin (POMC) has on body weight. Specifically, the biology major will look at how cellular changes in the hypothalamus alter POMC processing, and the potent weight-loss peptide, αMSH. The Hypothalamus also controls our response to acute and chronic stress by regulating stress hormones like cortisol. In his project, *Effect of Stress Hormones on the Liver,* Cobbs, a Biology Major, will explore how stress alters liver function to increase the risk of Type 2 Diabetes. In his project, *A Review of the Growing Connection between Insulin Resistance and Alzheimer's Disease,* Kennedy, a neuroscience major, will examine the possible connection between ER stress caused by insulin resistance and the development of inflammation in the brain and Alzheimer's Disease.

The group hopes to present their findings at a Northeast Undergraduate/Graduate Research Organization for Neuroscience (NEURON) conference next year.

**Christopher Dennehy '22** will work with **John McCoy,** Professor of Psychology & Neuroscience on *A Newly Proposed Method to Prevent Progression of Alzheimer's Disease*. Alzheimer's disease (AD) is characterized by the buildup of amyloid-β (Aβ) proteins that aggregate into toxic plaques and lead to the formation of neurofibrillary tangles. Recently, it was discovered that entraining 40Hz cortical gamma oscillations (brain waves) in mouse models of AD reduced Aβ accumulation and restored cognitive function. Our laboratory has shown that a subgroup of basal forebrain (BF) neurons that express the calcium-binding protein parvalbumin (BF PV) control these gamma oscillations. The goal of this project is to establish BF PV as a potential target for novel AD treatments by demonstrating that 40Hz BF PV stimulation in a mouse model can reduce Aβ load in the brain. The results of this study will be presented at the Northeast Undergraduate / Graduate Research Organization for Neuroscience (NEURON) conference.

**Tanya Abboud '22** and **Alexis DaSilva '22** will work with **Jacqueline Beatty**, Assistant Professor of Biology & Health Science, to collect information on college student behaviors related to risk factors associated with COVID-19 illness. Over 2.7 million lives globally and 550,000 lives in the United States have been claimed by complications associated with COVID-19, and young adults have become the most-infected age group in the U.S. With the highest rates of obesity compared to the rest of the world, the U.S. is also faring the worst though the COVID-19 pandemic, retaining approximately 20% of global deaths with 5% of the global population. Efforts to mediate the spread of this airborne virus began over one year ago and are ongoing; long-term social restrictions may further impede the often-tenuous mental health of college students. The group will collaborate with colleagues from Rowan University to collect and analyze data relating to nutrition and physical activity behaviors as well as mental health of college students. DaSilva, a Health Science major, will focus on exploring health-related behaviors to mitigate risk factors including obesity and diabetes on COVID-19 in her project, *Understanding Risk Factor Reduction Behaviors for COVID-19 in College Students.* Abboud, a Psychology major with a minor in Biology, will examine risk factors involved in stress, anxiety and depression in college students during the pandemic in her project, *Mental Health Awareness and Behavior Management in College Students during the COVID-19 Pandemic.* She will also explore the potential role of diet and physical activity to improve mental health. The group hopes to publish their results and present their findings at the American Society of Nutrition Conference.

**Emily Brady '22**, **Michaela Fitzgerald '23**, and **Robert McAlpine '23** will work with **Leyda Almodóvar Velázquez**, Assistant Professor of Mathematics, and **Heiko Todt**, Associate Professor of Mathematics, on *Design of Self-Assembling DNA Complexes*. Recent discoveries and laboratory advancements in the field of nanotechnology have highlighted the usefulness of formal graph theory in the study of self-assembling DNA complexes. For example, the formation of nanotubes, which are thought to have potential as containers for the transport and release of nano-cargos, can be modelled using a lattice graph. Brady, Fitzgerald, and McAlpine, all mathematics majors, will begin by reviewing introductory material to gain an understanding of graph theory. The intricate problem of DNA nanotube design can be divided into smaller problems, which the group will attempt to tackle during the summer. They will also learn how to write a mathematical paper and present it at a conference.

**Claire Thomas ’22, John Meawad ‘23** and **Madison Maiorano ‘23** will work with **Louis Liotta,** Professor of Chemistry, on various *organic synthesis projects*. 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. During this summer, his group hopes to expand synthetic methodologies to include tetrahydroxylated pyrrolizidines, the pentahydroxylated pyrrolizidine Casuarine and the potential anti-Covid drug Galidesivir. Thomas, Meawad, and Maiorano all biochemistry majors, will all 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.

**Megan Anderson ‘22** and **Jacquelin Sauer ‘23** will work with **Danielle Waldron**, Assistant Professor in Healthcare Administration, on two projects related to health and disability this summer: *Health Disparities across Race in Adults with Disabilities* and *A National Debrief for Developmental Disabilities Services (DDS).* Anderson will take the student leadership role on the *Health Disparities across Race in Adults with Disabilities* project, which will use National Core Indicators-Adult Consumer Survey data to assess disparities in health service utilization for adults with disabilities across races at different time points in accordance with varied stages of implementation of the Affordable Care Act (ACA). Sauer will take the student leadership role on the second project; she will identify significant findings from Waldron’s dissertation research on the associations between community engagement and aerobic and muscle strengthening physical activity of adults on the autism spectrum. Sauer will then work to disseminate these findings in a briefing to DDS across the United States. Additionally, Sauer, Anderson, and Waldron will facilitate a six-week Zoom social group for individuals with disabilities who have been isolated during the pandemic to promote social wellness.

**Adam Falcone**, **’23**, will work with **J. Timothy Balint**, Assistant Professor of Computer Science, and **Robert Harbert**, Assistant Professor of Biology, on *Procedural Generation of Vegetation Maps*. To create plausible natural landscapes, a program must know the type and placement of vegetation. While this placement is more tedious for a designer than changing high-level environmental effects, such as the average rainfall over the past century, vegetation generation can be easily procedurally generated. However, the generation removes all control a designer would have, and so far, ignores all high-level environmental effects. This project will bridge the gap between high-level environmental effects and low-level vegetation generation by mapping those parameters to satellite derived vegetation maps using Generative Adversarial Networks, a form of machine learning.

**Catherine Keating ’23** will work with **Rob Harbert,** Assistant Professor of Biology to develop new methods for sequencing ancient DNA (aDNA) from packrat (*Neotoma* spp.) midden plant macrofossils using real-time nanopore DNA sequencing. Biological materials preserved in dry, cold, or low-oxygen environments can be preserved for thousands of years. Building on past work in the Harbert lab on the analysis of DNA from packrat middens from up to 30,000 years ago we will explore methods for sequencing and identifying fragments of DNA from plants to improve characterizations of past environments.

**John de Abreu '23** will work with **Rob Harbert**, Assistant Professor of Biology on *Ecological and economic valuation of the natural areas at Stonehill College.* The beauty of nature is always present on the Stonehill College campus, but just how much is that worth? We will collect and analyze biodiversity and ecological data for the campus property that will provide information on both biological and economic value of the natural areas on land owned by the College. Application of robust ecosystem valuation methods will allow us to categorize and estimate the precise areas of value. The data collected will serve as a tool for future conservation

**Mary Bussiere '22, Savanna Macaluso '22, Olivia O'Neil '23,** and **Brian Sharp '23** will work with **Marilena Hall**, Professor of Chemistry, on *Phage Display Applied to the Identification of Peptides that Bind Targets of Interest.* Most of the key biochemical processes that occur inside cells involve binding interactions between molecules. There is enormous interest in identifying which proteins and molecules bind one another, and how they do it, as it can not only elucidate how nature works but also contribute to the development of biopharmaceuticals. Phage display is a method used to identify proteins and peptides that bind to a target molecule of interest. In this method, the target molecule is exposed to a library of ~2 billion different peptide sequences, and the few peptides that bind strongly to the target are identified in a process called "panning." Because the peptides in the library are displayed on the outside of small viral particles called phage, the successfully binding peptides can be easily identified by sequencing the DNA of the phage that encodes the displayed peptides. This summer, the SURE students will choose molecular targets that are of interest to them for their biochemical significance. They will use phage display to identify peptides that bind to these targets, and they will confirm binding affinities using ELISA assays. We hope that our work will contribute to a better understanding of binding interactions in nature.

**Thomas Langer '22** will work with **Kirk Buckman**, Assistant Professor of Political Science and International Studies, on *Whither the Middle Class? Capitalism, the Middle Class, and Democracy..*. Our research is fundamentally about the fragility or resilience of liberal democracy and will explore competing definitions of the middle class and contending studies about its significance for sustainable democratic development. The project will compare and categorize theoretical arguments about the different ways in which middle class performance contributes to democratic consolidation. We will build our categories around theoretical arguments about how the financial crisis of 2008 and the economic consequences of the COVID-19 pandemic have contributed to a perception of economic insecurity among the middle class and fueled support for populist and extreme right- and left-wing parties, ultimately contributing to democratic backsliding in many countries around the world. The goal of this work is to produce an article for publication.

**Lauren Correa '22** will work with **Kirk Buckman**, Assistant Professor of Political Science and International Studies, on *Lusophone Communities and the American Dream? An inquiry into the* *political economy of lusophone immigrant communities in Rhode Island and the South Shore of Massachusetts*. This project explores lusophone communities attaining Middle Class status in the United States. The goal is to identify patterns of socioeconomic achievement across generations of lusophone communities in the South Shore of Massachusetts and Rhode Island. We will gather intergenerational data on educational achievement, employment, income, and wealth accumulation. We will also gather data on the diversity of these lusophone communities, exploring the literature for explanations of how ethnic identities persist and change over time and across generations. The project seeks to identify diversity along lines of identity within and between lusophone communities. The working hypothesis for the project is that country of origin, conditions of migration, and socioeconomic status before migrating will correlate with subsequent intergenerational integration and financial achievement in the US political economy, but that these correlations will diminish across generations. This project seeks to initiate an inquiry into an understudied topic of importance to Stonehill's student body and surrounding community, eventually leading to publication.

**Brett Cushing '22** and **Kate Frazee '22** will work with **Cheryl Schnitzer**, Professor of Chemistry, on *Measuring the Effects of Gold Nanoparticles on Femtosecond Laser Pulses*. The team will re-measure the pulse length of laser light with greater accuracy due to a new prim pair compressor to counter material dispersion. In addition, they will continue the work from previous students to use Second Harmonic Generation (SHG) to ensure the overlap of pump and probe beams in space and time. Finally, working with Ruby Gu (Physics Department, Stonehill College) and Xuejun Lu (Electrical and Computer Engineering, UMass Lowell), they will determine how gold nanoparticles affect pulse duration. The team will present their findings as a talk or poster presentation at the American Chemical Society (ACS) meeting and the Education and Training in Optics and Photonics (ETOP) conference in 2022.

**Julia Barry '22**, **Kelsey MacKinnon '22**, and **Baily McNeil '22** will work with **Hsin-hao Su**, 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. Julia, Kelsey and Baily, all mathematics majors, 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.

**Cassandra Calabro '22** and **Meredith Kime '22** will work with **Kristin Burkholder**, Associate Professor of Environmental Science, on two projects focusing on the waters of the Gulf of Maine (GOM): *Analyzing Model Skill: A Comparative Study of Pathways in the Gulf of Maine* (Calabro) and *Analyzing Variability in the Gulf of Maine's Spring Bloom* (Kime). The GOM is one of the most dynamic and valuable marine ecosystems on our planet. Over the past few years, students in the Burkholder lab have used output from a high-resolution model of ocean circulation to examine the pathways followed by nutrient rich waters within the GOM. The location and variability in nutrient pathways can have major impacts on life within the GOM at all trophic levels. As such, Calabro and Kime will both be investigating how well the high-resolution model used by the

Burkholder lab does at representing pathways that may be found in the real ocean. Specifically, Calabro will compare pathways predicted by the model with pathways of real ocean drifters launched by NOAA. She will work to determine how skilled the model is at recreating the observed pathways. Kime will work with satellite imagery of the GOM in order to determine the spatial variability of the spring bloom, whose location is tied to the availability of surface nutrients. The variability determined by Kime will be compared with the locations predicted to be nutrient rich by the model. The researchers hope to share their work at the Ocean Sciences Meeting being held in Honolulu, HI in Spring, 2022.

**Hailey Romero '23** will work with **Deno Del Sesto**, Assistant Professor of Chemistry, on various computational chemistry projects. The goal of the principal research is to determine the effects of molecular vibrations on the reactivity of methane on low temperature single-crystal metal surfaces. Other goals will include studying how different substituents on ringed compounds alter molecular structure, and how to effectively bring computational chemistry research and experiments into the undergraduate chemistry classroom. The group hopes to publish their work in the Journal of Chemical Education, The Journal of Computational Chemistry, and/or present at a future American Chemical Society conference.

**John Freeman '23** will work with **Leon Tilley**, Professor of Chemistry, on the *Synthesis of a Difluoromethyl Derivative of Bobbitt's Salt*. 4-Acetylamino-2,2,6,6-tetramethylpiperidine-1-oxoammonium tetrafluoroborate, also known as "Bobbitt's salt" is recently emerging as an important heavy-metal-free green oxidant. It can be utilized for a variety of purposes including oxidation of alcohols to aldehydes, ketones, and carboxylic acids. Unfortunately, it will not oxidize trifluoromethyl alcohols to the corresponding trifluoromethyl ketones (TFMKs) unless it is used in large excess, and then only with some difficulty. The ability to accomplish this transformation would be quite desirable as a new route to compounds of potential pharmaceutical interest. Consequently, Freeman will work to synthesize a difluoromethyl derivative of "Bobbitt's salt" which may accomplish the desired oxidation with greater facility. Once prepared, the oxidizing capability of the compound will be examined. The group will present its findings at an ACS national meeting and ultimately hopes to publish in a peer-reviewed journal.

**Nwanne Dominic Banor '22** will work with **Leon Tilley**, Professor of Chemistry, on *Investigation of Alkoxide Initiators for Difluoromethylation.* The difluoromethyl group is finding increasing use in pharmaceuticals as it has the capability to improve the properties of potential drug candidates by enhancing their stability and lipophilicity. The goal of this project is to develop a novel initiator for nucleophilic addition of the difluoromethyl ($CF_2H$) group to enolizable ketones in order to prepare the corresponding alcohols. This reaction provides a useful route for introducing the difluoromethyl group into organic compounds. The reaction requires the use of (difluoromethyl)trimethylsilane as a nucleophilic source of $CF_2H$ in the presence of an initiator. Our group has found current literature procedures to be either ineffective or undesirable as a result of requiring toxic co-solvents. We have recently found that potassium trifluoroethoxide, $KOCH_2CF_3$, seems to cleanly initiate this reaction. Banor will continue to test this initiator on a variety of substrates, will optimize its preparation, and will also search for other potential initiators. Once we have optimized this reaction on a variety of ketones and aldehydes, we plan to present our findings at and ACS national meeting and publish it in a peer-reviewed journal.

**Cheyenne Zinnkosko ’22** will work with **Erica Tucker,** Associate Professor of Anthropology, on *An Exploration for Genetic Ancestry Testing.* We are living in the midst of a genealogy craze and this project will examine the growing popularity of genetic ancestry testing by examining what motivates people from different social backgrounds to use these services. We will interview people who use genetic testing as a *starting point* in their ancestry research to explore their motivations for buying these services, their understandings of what such tests reveal, and how test results have shaped individuals’ understandings of their own identities. Attention will also be paid to what, if anything, consumers of genetic ancestry kits do with their newfound information (for example, seek to connect with newly discovered relatives; explore genealogy through more traditional means, read up on the history or culture of a group, or place). Once we’ve conducted interviews and analyzed our data, we plan to submit a conference paper based on our findings to the Eastern Sociological Conference or the Northeastern Anthropological Association Meetings and publish it in a peer-reviewed journal.

**Kelly Mendoza ’23** and **Michaela Ta ’22** will work with **Jenn Segawa**, Assistant Professor of Neuroscience and Biology to study the *Efficacy of Diversity and Inclusion Coursework on Implicit Bias*. The goal of the project is to quantify neural and physiological changes as students take coursework focusing on topics of diversity, equity, and inclusion. Traditionally, behavioral measures such as the Implicit Associate Test have been used to measure implicit racial bias; however recent findings have raised questions about these tests’ validity, and they may not capture the kinds of gains made from DEI courses. Michaela Ta will measure empathy-related brain activity – as measured by electroencephalography (EEG) – while white students view pictures of people’s faces when they are in pain, comparing their responses to seeing pictures of white people to seeing pictures of people of color. Kelly Mendoza will measure the students’ physiological stress – from the skin’s electrodermal activity and cortisol from saliva, both measures of the body’s stress response – when they are asked to talk about issues of race and privilege in front of a panel of people of color. Both Mendoza and Ta will compare their findings to the traditional behavioral measures and compare changes in students who have taken DEI courses to those who have not. They hope to help to develop quantitative tools appropriate for higher education to measuring changes in racial implicit bias, and they plan to present their work at the Northeast Undergraduate/Graduate Research Organization for Neuroscience (NEURON) conference next year.

**Nik Dorgan ’22** will work with **Jenn Segawa**, Assistant Professor of Neuroscience and Biology to study the *Effect of Musical Familiarity on the Perception of Rudimentary Tones.* This project will study the relationship between a person’s familiarity with specific musical intervals and how they process those sounds. A person’s emotional reaction to musical intervals (usually measured by how much they “like” the sounds) are strongly linked to their cultural familiarity with an interval. In contrast, fusing describes the phenomenon in which the notes of a consonant interval – one in which the harmonics of the notes’ frequencies align – are heard as a single contained sound, while the notes of a dissonant interval – when the harmonics don’t align – are correctly identified as two sounds played simultaneously. Unlike “liking” ratings, perceptual fusing ratings are similar in Western and non-Western cultures. There is a large body of research on each of these factors individually, and each has their own neural and physiological signature that can be measured from the brain with electroencephalography (EEG) or from the skin with electrodermal activity (EDA), however, there has been little analysis on the potential interaction between them. In this study, Dorgan will measure the behavioral, neural, and physiological responses to music before and after participants repeated listen to songs prominently featuring various musical intervals to quantify the interaction between familiarity, fusing, and liking. The results of this work will be presented at the Northeast Undergraduate/Graduate Research Organization for Neuroscience (NEURON) conference next year.

**Savannah Spivey '22** will work with **Jenn Segawa**, Assistant Professor of Neuroscience and Biology, to study *Meditation and Academic Stress.* The primary goal of this study is to test if short-term guided meditation training lowers students' stress and improves their academic performance. Past research has shown many positive physiological effects of mindfulness meditation, including reduced anxiety, improved sleep, and lowered blood pressure. And there are many studies that have demonstrated this effect specifically for undergraduate students' mental health. This is unquestionably an important area of study, but we are specifically interested in the role of meditation on academic performance. Research has shown that low-stress students perform better academically than high-stress students, and meditation training improves cognitive processes that are important to success on academic evaluations, such as visuospatial processing, working memory, and attentional processing, however the role of short-term training on academic success has not been directly assessed in college students. Students will receive four weeks of meditation training, and Spivey will assess their stress with behavioral, physiological, and neural measures as well as their performance on a stressful mathematical task. The results of this work will be presented at the Northeast Undergraduate/Graduate Research Organization for Neuroscience (NEURON) conference next year.

**Matt Keefe '22** will work with **Edward McGushin**, Professor of Philosophy, to explore an under-appreciated aspect of twentieth century French philosopher Michel Foucault's critical dialogue with the work of Sigmund Freud, namely his indirect engagement with Freud's masterwork, *The Interpretation of Dreams*. The analysis and interpretation of dreams was absolutely central to Freud's discovery and development of psychoanalysis as a therapeutic practice and a theory of the psyche. Foucault first sought to challenge Freud by defending and advancing existential psychoanalysis as an alternative approach to questions of mental illness and dream interpretation. But, Foucault soon rejected this approach and began to investigate the historical conditions within which psychology as such became possible. This is the subject of Foucault's book, *The History of Madness*. Matt, a philosophy and psychology double-major, will work through this daunting text with an eye to what it says about the relations between the dream and history, politics, ethics, and scientific knowledge. How is our experience of dreaming captured by interpretative discourses? Do dreams 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? Our work will lead to scholarly article or book chapter on the theoretical shift in Foucault's work from existential psychoanalysis to a historical ontology of dreams.

**Alex Bejarano '22** 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 relationships of the Cherry-faced Meadowhawk and the Ruby Meadowhawk. Despite small morphological differences between the two dragonflies, previous genetic work has not been able to distinguish between them. Bejarano, a biology major, will collect and analyze genome-level date from approximately 48 specimens. The team hopes to use this 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 Bejarano.

**Quentin Odom-Lewis '23** will work with **Bronwyn Bleakley**, Associate Professor of Biology, to investigate the *Effect of light pollution on burying beetle behavior and immune function*. Insect populations have declined by as much as 40% the world over. Burying beetles in the genus *Nicrophorus* provide critical ecosystem services, helping to remove carrion and return nutrients to the soil. The American Burying beetle (*N. americanus*) is among the most critically endangered animal species in North America. Its closest relative, the roundneck sexton beetle (*N. orbicollis*), is abundant on Stonehill's campus, providing an opportunity to investigate both the decline of the American Burying beetle and the causes of insect decline more broadly. Light pollution is known to impact the immune function, development, and behavior of many species. This project will investigate how exposure to different wavelengths of light affects beetle immune function, parental care and foraging behavior, as well as their distribution on Stonehill's campus.

**Samantha Ormesher '22** and **Maeve Staab '23** will work with **Bronwyn Bleakley**, Associate Professor of Biology, to investigate the *Physiology of friendship – How do guppies become familiar enough to cooperate?* Trinidadian guppies perform a suite of cooperative antipredator behavior that allows them to obtain information about predatory threats and potentially deter predation. To do so, fish form long term associations with partners that are well-matched with them for cooperative tendencies, becoming familiar enough with a new social partner to cooperate effectively over the course of about seven days. Fish excrete steroid hormones, including estrogen, across their gills continuously, chemically communicating with partners about physiological state and behavior. This project will investigate whether fish that are well matched for estrogen levels initially form pair bonds more rapidly than fish that are not matched for estrogen levels, whether unmatched fish coalesce to similar hormone levels as they become familiar with one another, and whether the match or mismatch of estrogen levels affects the degree to which the fish are ultimately able to cooperate with one another.

**Cierra Terceiro-Ciavatta '22** and **Camryn Thompson '22** will work with **Bronwyn Bleakley**, Associate Professor of Biology, *Quantifying variation in sensory sensitivity, responsiveness to social partners, and cooperative antipredator behavior in Trinidadian guppies.* Trinidadian guppies perform a suite of cooperative antipredator behavior that is influenced by a variety of factors, including the predation history of the population, the behavior of a fish's social partner, and the fish's own genetic background. Whether or not a cooperative interaction is successful depends in part on the influence of one partner and the responsiveness of the other, interactions that are mediated through visual, chemical, and mechanosensory communication. This project will first quantify variation in lateral line morphology, estrogen (pheromone) excretion, and visual acuity in wild and wildtype domestic fish. Second, we will train new automatic tracking software to follow guppy movements, including partner interactions, and verify that it accurately records behavior. We will then quantify which sensory systems best predict the fine-scale details of cooperative interactions. Lastly, we will quantify how different combinations of partners lead to different cooperative outcomes.