COLLEGE of CHARLESTON
UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

# 2020 SURF AWARD RECIPIENTS

**The Office of Undergraduate Research and Creative Activities is pleased to announce the Summer Undergraduate Research with Faculty (SURF) award recipients for summer 2020. Please join us in congratulating these students and their faculty mentors.**

## Summer Undergraduate Research with Faculty (SURF)

**Student: Sophia Bernstein**
**Major: Biology**

**Mentor: Dr. Daniel McGlinn**
**Department: Biology**

### *Optimizing Indoor Saltwater Agriculture using Salicornia europaea*

The global human population is growing rapidly and new methods of food production are needed (IPCC 2016). The agricultural system for feeding all these humans and their livestock is strained. Freshwater depletion (Millennium Ecosystem Assessment), salinization of soils (Dehaan and Taylor, 2001), encroaching seawater (FAO, 2008), pest resistance (Ehler, 2006), and climate change (IPCC, 2016) are some of the factors creating demand for novel agricultural models. One method that has gained popularity in the last decade is seawater agriculture. This approach uses halophytic (salt-tolerant) plants such as *Salicornia europaea*. In this study, I will test if Salicornia can be grown hydroponically in a controlled indoor environment. Specifically, I will examine if light duration and frequency of pruning will influence plant yield and palatability for human consumption. This project will help to uncover the potential of Salicornia to provide a healthy and sustainable agricultural commodity in this time of rapid environmental change.

**Student: Chris Blouin**
**Major: Physics**

**Mentor: Dr. Michael Larsen**
**Department: Physics & Astronomy**

### *Investigations of Light Transmission through Clouds*

As sunlight travels through clouds, interactions with individual cloud droplets scatter (re-direct) the light, resulting in less light leaving the bottom of a cloud than entering the top of it. The classroom treatment of this phenomenon assumes that the only things that influence the total amount of light ultimately traveling fully through the cloud are the physical thickness of the cloud and the number and size of the cloud droplets inside. Recent work has revealed that the detailed spatial positions of the cloud droplets can matter; clumpy clouds let more light through. We know that real clouds are clumpy with small pockets of clusters and voids. The scientific community is aware that this implies clouds must transmit more light than theory predicts – but current theories do not allow us to link the degree of particle clustering to the amount of transmitted light. This summer, we will explore this link. Since different clouds have different degrees of particle clustering, we hope to develop and test theories about how cloud droplet clustering can be mathematically related to the amount of light fully passing through a cloud. Cloud droplet clustering has implications for our study of the Earth's atmosphere and climate. Reducing the large uncertainties related to light transmission through clouds may help us better understand related phenomena like the influence that humans have had on Earth's climate.

**Student: Katrina Bynum**
**Major: Astronomy**

**Mentor: Dr. Joe Carson**
**Department: Physics and Astronomy**

### *A Hubble Space Telescope Direct Imaging Investigation of Extrasolar Planets*

This project entails using the direct imaging technique to search for extrasolar planets among archival data from the Hubble Space Telescope NICMOS infrared camera. The use of infrared wavelengths permits the detection of gas giant planets via their thermal glow and allows for a favorable relative contrast between planet and star brightness. The main challenge of identifying the faint signal of an extrasolar planet is the overwhelming glare of the parent star. Hence, one must apply precision software techniques to digitally subtract the overwhelming glare of the parent star's light, while leaving intact the signal of the extrasolar planet. This procedure must be repeated for multiple images before combining the final images into a single high-sensitivity final frame. To enact these tasks, Bynum will apply machine learning algorithms, already developed by Carson's research group, to achieve the starlight subtraction and image combination, and therefore enable a search for gas-giant extrasolar planets around nearby stars. She will also optimize algorithm parameters to best match the data properties, such as those pertaining to telescope roll angle, numbers of images, and net exposure time. Bynum must also apply forwarding modeling procedures, already developed by Carson's group, to serve as a control for evaluating software effectiveness. Through these techniques, Bynum will be able to probe Hubble images for extrasolar planets at a level of sensitivity that has not been previously achieved for these Hubble data sets.

**Student: Hannah Collins**
**Major: Exercise Science**

**Mentor: Dr. Kate Pfile**
**Department: Health & Human Performance**

### *Lower Extremity Jump-Landing Biomechanics after Anterior Cruciate Ligament Reconstruction with Quadriceps Tendon versus Patellar Tendon Autografts*

Sixty-six percent of all sports-related injuries occur to the legs. The knee is the most commonly injured joint. Injury to a significant knee joint structure, the anterior cruciate ligament (ACL), affects 250,000 people annually in the United States. Treatment typically includes surgery to repair the injured ACL. Surgeons may perform the surgery using a longstanding technique taking tissue from below the kneecap, the patellar tendon (PT), or elect a newer technique taking tissue from the front thigh muscles, the quadriceps tendon (QT). Restoring movement patterns for walking, jumping, and landing are key aspects of post-surgery rehabilitation and restoring physical activity. As a newer technique, research examining QT surgical outcomes is limited. Our purpose is to compare jump-landing movement patterns between participants who received either the PT or QT ACL surgery and rehabilitation. Data were previously collected on 26 physically active participants who had ACL surgery (12 PT, 14 QT) and completed rehabilitation. Laboratory markers worn by the participants measured limb position, velocity, and acceleration of their legs. Participants performed three jump-landing trials from a 20 cm box landing on two feet on separate force plates. Data (joint angles and forces) have been collected but not analyzed. This summer we will reduce and analyze the data to compare joint angles and forces between the PT and QT groups. We hypothesize there will be no significant differences between groups for any of the variables, indicating that the newer QT technique is sufficient at restoring movement compared to the longstanding PT technique.

**Student: Connor Cozad**
**Major: Computer Science**

**Mentors: Dr. Norman Levine &**
**Professor Lancie Affonso**
**Department: Geology & Environmental GeoSciences; Computer Science**

***Developing a Mobile Application for Flood Warning in the Charleston, SC Region***

Citizens in the coastal South Carolina region face an ever-growing struggle with understanding when and where tidally-induced and rainfall flooding are going to impact their daily routines. This project SURF proposal is to fund an undergraduate researcher to participate in a South Carolina Sea Grant funded project that helps with the regional flooding problem by creating a map application (M-App) that will: 1) tie current and predicted gauge station tidal heights to associated inland flooding, 2) tie current and predicted rainfall conditions to associated precipitation-based flooding, 3) communicate those current and predicted present-day flood hazards to stakeholders, 4) visualize present-day flood hazards under future sea level rise conditions, and 5) provide information on the drivers of flood hazards as well as information on how to strengthen your individual resilience to those hazards. The student portion of the projects will be designing and testing algorithms for collecting the tidal gauging station information provided by NOAA populate maps of tidal flooding on streets in both real time and predictive modes. Currently graduate students are working on creating high resolution GIS-based flooding maps of the area which will be dynamically linked using the algorithms developed here to move the project from predictive to Realtime flood mapping.

**Student: Madison Davis**
**Major: Biology**

**Mentor: Dr. Christine Byrum**
**Department: Biology**

***Mapping Importin Distribution in the Developing Sea Urchin***

The Byrum lab studies cellular transport of molecules from the cytoplasm into the nucleus, a process aided by proteins called importins. Just as students first graduate from high school with a general skill set and then specialize as they pursue their careers, cells do the same sort of thing in a process called differentiation. Cell differentiation allows for efficient production of cell components, which become progressively more specialized as a cell matures. We hypothesize that importins aid in cell differentiation by regulating access of transcription factors to the nucleus. To better understand potential roles of these importins, we must first determine when and where each importin is produced in the developing embryo. This summer, we will stain sea urchin embryos to track the location of importin transcripts (mRNA precursors to the importins) at different developmental stages. In a previous study, we showed that similar importins are present in both sea urchins and humans. This summer, by learning when and where these importins are produced in sea urchin embryos, we hope to gain insights concerning their potential roles in development. Our goal is to confirm the preliminary findings of previous lab members and to produce a manuscript for publication.

**Student: Emily Dombrowski**
**Major: Marine Biology**

**Mentor: Dr. Jody Beers**
**Department: Biology**

***Physiological Effects of Temperature and Parasite Load on Metabolism of Spotted Seatrout***

The spotted seatrout, *Cynoscion nebulosus,* is one of South Carolina's most sought-after game fish. Upwards of 90% of the adult population in state waters is reported to be infected with the myxosporean parasite, Kudoa *inornata*. Approximately 100 parasitic *Kudoa* species have been identified, some of which are associated with gross muscular tissue damage and postmortem myo liquefaction. In addition to possibly inducing muscle softening, infection by K. *inornata*, increases seatrout swimming performance. This

surprising atypical relationship warrants further investigation. This study hopes to provide a better understanding of the seatrout-*Kudoa* relationship, with an overarching interest in physiological effects of infection on the fish, potential benefits to the parasite, and how seatrout with different myxospore loads might deal with the high physiological costs of life-history events such as reproduction and overwintering. The primary goal is to examine the physiological relationship between K. *inornata* myxospore density and seatrout host swimming performance, with an emphasis on the additional effects of temperature. We will take an integrative approach, examining a range of processes from whole animals to cells. Furthermore, this work may provide evidence for changes in metabolism due to alterations in swim performance, thus giving insights into the impact of infection and temperature on the energetic demands and level of physiological stress of spotted seatrout.

**Student: Ashley Dowd**
**Major: Astrophysics**

**Mentor: Dr. Ashley Pagnotta**
**Department: Physics & Astronomy**

### *Long-Term Evolution of Novae*

In star systems that contain a white dwarf star (the remnant left over after a star uses up all its fuel) and companion star, novae are frequent occurrences. Novae occur because Hydrogen is transferred from the companion star to the surface of the white dwarf. Eventually, the pressure at the surface of the white dwarf becomes too high for the star to withstand and an eruption occurs. Astronomers can see the eruption because the star rapidly gets brighter. Astronomers have accumulated a vast number of observations of novae, but after the excitement, they often look towards other targets. This makes it hard to understand what happens to the star after the eruption, because we do not have observations. Our project proposes to collect and analyze data from various sources that span over 100 years to better understand the long-term evolution of novae. Our main data sources are the Harvard Plate Stacks and sky surveys. The Harvard Plate Stacks contain >500,000 photographic images of the sky that date back to the 1890s. Many plates have been scanned and uploaded to allow public access. Sky surveys are similar in that observations are made with telescopes, but they are recorded digitally and are easier to analyze. We collect all the measurements from the plates and the modern sky surveys to make a picture of the long-term evolution of our novae. The combined data allows us to test a leading theory which says that novae should steadily decrease in brightness over time.

**Student: Sydney Eiland**
**Major: International Studies**

**Mentor: Dr. Eric McElroy**
**Department: Biology**

### *Evolution of Pelvis Musculoskeletal Anatomy in Lizards*

The pelvis (hip bone) plays a crucial role in body movement, support, and reproduction. Vital to the understanding of the physiology of lizards is a foundational comprehension of the various pelvic and muscular structures found amongst different species. Because form impacts function, it is important to first figure out the form, or anatomy, of the pelvis in lizards to then develop hypotheses about the different functions. The pelvis and associated musculature of several lizard species will be digitally dissected using micro CT scans that are stained to show the specimen in great detail. The dissected models will be used to explore the relationships between the pelvis and musculature surrounding it. Through the use of 3D imagery, this study will provide unique insight on the different shapes of each lizard species' pelvis, allow for a more comprehensive view of each structure, and present the opportunity for the development of hypotheses regarding the evolutionary explanations of the structures.

**Student: Jonathan Ellwood**
**Major: Computer Science**

**Mentor: Dr. Kris Ghosh**
**Department: Computer Science**

***Automated Repair of Programs***

This project is to define a process in which software that has a potential vector of attack of memory manipulation, will be able to detect the vulnerability and take steps to prevent an attacker to gain access to the system. This process of detection of a software vulnerability will be represented using language that is represented by mathematic expression (consisting of Boolean logic). Using these mathematical expressions, the process will design constraints by expressing the specifications that the software must abide by in order to continue operation. Another major goal of project is to ensure that any software that uses the process incurs minimal memory usage and that the computational power required to run is not a significant strain on the system itself. In doing this, the process will be tested on programs that are known to have these vulnerabilities, obtained from the website http://cwe.mitre.org/. The testing will measure the time and accuracy of the process on different problem sizes and compare it to other processes that are known to be capable of solving this problem.

**Student: Andre Gagliano**
**Major: Biology**

**Mentor: Dr. Gamil Guirgis**
**Department: Chemistry & Biochemistry**

***Preparation, Characterization and Conformational Analysis of 1,1-dichlorocyclohept-2-ene, 1,1-dicholoro-1-silcyclohex-2-ene.***

Carbon atoms can bond with other atoms to form linear and cyclic structures. Our laboratory at the College of Charleston has longstanding research program investigation the structural preferences of cyclic organosilicon and germanium compounds (i.e., carbon-containing compounds incorporating silicon and germanium atoms). From these studies, we have published more than 200 papers in international journals, demonstrating the capability of the College of Charleston to produce world-class research on organo-metalloid chemistry (the chemistry of carbon- and semimetal such as silicon and germanium-containing compounds). Our previous studies examined saturated cyclic silicon and germanium compounds composed of three to six membered rings (i.e., the atoms constituting the ring "skeleton"). Our attention is presently directed towards novel research on five to seven-membered partially unsaturated rings incorporating silicon or germanium atoms within the ring structure. The biological activity and structure of five-, six-, and seven membered partially unsaturated rings composed only of carbon, nitrogen, and oxygen are already elucidated in chemical literature. However, five-to seven membered rings incorporating silicon or germanium are poorly understood and rarely investigated, possibly due to difficulties inherent in their synthesis. Indeed, many five to seven-membered, silicon-containing rings have never been synthesized or theoretically examined. Our technical knowledge of the synthetic routes to these compounds, as well as our experience with advanced instrumental analysis and theoretical calculation required, will help us to successfully characterize their preferred three-dimensional structure. Our established partnerships with laboratories at the University of Virginia at Charlottesville, The University of Missouri Kansas-City, and the University of Eastern Illinois at Charleston for highly specialized instrumentation will help in interpreting the structure of these molecules with no cost to the College of Charleston.

**Student: Pearce Hamilton**
**Major: Physics**

**Mentor: Dr. Michael Larsen**
**Department: Physics & Astronomy**

***Studies of Heterogeneous Ice Nucleation on Treated Mica***

The freezing of water on microscopic surfaces is a crucial process in cloud physics. It has been shown that surface chemistry may affect the temperature at which water will freeze. We will explore this relationship between surface chemistry and freezing water by treating samples with salt solutions to create surfaces with altered chemical properties. To see if the treatment duration or the concentration of the solution influences

our results, the treatment time and salt concentration in the solutions will be systematically varied. Water droplets will then be frozen on the treated surfaces to see if the temperature at which water freezes depends on these variables. We hope to use our results to better understand the underlying mechanism driving the freezing process.

**Student: Hawken Hass**
**Major: Psychology**

**Mentor: Dr. Adam Doughty**
**Department: Psychology**

***Revisiting the Relation between Derived-Relations Testing and Transfer of Function***

Transfer of function refers to the untrained acquisition of stimulus function through derived stimulus relations. Transfer of function is an important source of complex human behavior. Dymond and Rehfeldt (2000) reviewed the literature surrounding transfer of function and raised many significant questions. One such question was whether derived-relations testing was necessary and/or sufficient to generate transfer of function. Our laboratory has conducted several studies across the last decade investigating the necessary and sufficient conditions that establish derived relations. The purpose of the present project is to extend these recent findings to transfer of function per se. Analyzing the necessary and sufficient conditions that establish transfer of function is critical to understanding human behavior across a range of areas including education, creative problem solving, and treatments of socially undesirable behavior.

**Student: Raija Haughn**
**Major: Communication & Women's & Gender Studies**

**Mentor: Dr. Beth Sundstrom**
**Department: Communication**

***Women with HIV's Perception of Coercion during Contraceptive and Infant Feeding Counseling***

Reproductive care coercion has historically been associated with forced sterilization, but may also include contraceptive counseling. In addition to contraceptive counseling, women with HIV are likely to receive mixed messages related infant feeding. The purpose of this study is to investigate women with HIV's perception of coercion related to (1) long-active reversible contraceptives (LARC), sterilization, and other methods of contraception and (2) infant feeding, either breast or bottle feeding, for HIV-exposed infants. Patient perceptions of coercion related to infant feeding and contraception will be assessed through quantitative and qualitative data. In addition to collecting data at the Medical University of South Carolina (MUSC), this multi-site trial will recruit participants from additional academic medical center sites nationwide. Findings from this study will help HIV care providers understand patient-perceived barriers related to patient counseling in regards to infant feeding and contraception.

**Student: Timothy Hunter**
**Major: Chemistry**

**Mentor: Dr. Rick Heldrich**
**Department: Chemistry & Biochemistry**

***Part I – Modeling Substitution Elimination Reaction Manifold. Part II -Preparation of bis-para-anisylalkanes and [n.0]-metacyclophanes***

In Part I of this project we will develop a simulation to help students in introductory organic chemistry better understand the controlling factors for competing chemical processes. When we are allowed to reenter the chemistry laboratory our work will shift to Part II, focusing on a vein of chemistry known as Methods Development. In this methods research we focus on finding new ways of making organic compounds known as: [n.0]-*meta*-cyclophanes. Under the right conditions these compounds act as precursors for the synthesis of natural occurring products known as herquline A and herquline B. Herqulines are alkaloids that normally exist within the fungus *Penicillium herqui*. The importance of these herquline compounds lies in

their, as well as their derivatives' potential for, possible medical applications. These compounds have been shown to exhibit inhibitory properties towards certain strains of the influenza virus, strong inhibitors of platelet aggregations, which could help combat blood clots, strokes, and heart attacks. Despite the complexity of these compounds, chemists strive to find new methods for their synthesis because of their strong potential for several medical applications.

**Student: Vernon Kennedy**
**Major: Biology**

**Mentor: Dr. Jennifer Wilhelm**
**Department: Psychology**

### *The Effects of Estradiol Treatment on Synaptic Reorganization and Plasticity around Motoneurons after Traumatic Peripheral Nerve Injury in Mice*

Each year 100,000 Americans experience injuries to their nerves. Most of these patients don't fully recover and are left with various physical deficits. This inadequate healing often results from the negative changes that take place in the spinal cord after injury. Following peripheral nerve injury, many of the connections within the spinal cord can be lost or remodeled. These changes result in miscommunication between the spinal cord and muscles, leading to muscle spasms and muscle degeneration. Previous research suggests that exercise coupled with testosterone treatments can mitigate this reorganization. In this study, we explored whether estrogen could potentially have similar effects. Using a mouse model, we surgically injured the sciatic nerve of the right hind limb. Injured nerves were marked with a fluorescent dye and the animals were treated with various combinations of estrogen, exercise and an estrogen receptor blocking agent. Following this period, tissue samples from the spinal cord were harvested and sliced into sections. Spinal cord sections were stained for certain connections and changes in these connections were observed via fluorescent microscopy. Preliminary results show a decrease in the reorganization of connections after estrogen treatments are applied compared to untreated animals. We also observed that preventing estrogen signaling during exercise eliminates the positive effects of exercise therapy. These findings are significant because they suggest that estrogen signaling is essential for exercise-dependent recovery methods. Further illuminating the relationship between sex hormones and the recovery of injured nerves can potentially lead to effective therapeutic methods for humans.

**Student: Harrison Koller**
**Major: Biochemistry**

**Mentor: Dr. Brooke Van Horn**
**Department: Chemistry & Biochemistry**

### *Toward Antimicrobial Materials: Synthesis and Characterization of Cl-Hydantoin-PCL*

The search for molecules that are health- and recovery-friendly has always been a key goal for pharmaceutical scientists. Our main objective for this proposed SURF 2020 is to see conclusion to the synthetic portion of the biomedical polymeric system (pursued in the Van Horn lab since spring 2017) and begin testing its anticipated antimicrobial nature. Specifically we seek to (1) perform optimization of the 4-step synthesis and purification of an antimicrobial small molecule (a hydantoin derivative), (2) successfully achieve its attachment to a biodegradable polymer backbone with efficient chemistry called an oxime reaction as well as (3) characterize the size of the polymer samples and number of attached units within those materials with in-house tools, and (4) begin their testing for antimicrobial activity against bacterial growth. During the summer, Harrison will continue to hone his synthetic and purification skills as a chemist while adding more polymer synthesis and characterization and begin biochemical testing of the final materials. Additionally, he will be working alongside two other undergraduates, and as the upperclassmen, will gain experience in mentoring fellow students working parallel parts of the project.

**Student: Katherine Martin**
**Major: Biology**

**Mentor: Dr. Kris de Welde**
**Department: Women's & Gender Studies**

### *Expanding LGBTQ+ Responsiveness at CofC Student Health Services*

According to Riley Center For Livable Communities' Charleston YOUth Count data (2017), nearly one in five College of Charleston students identifies as LGBTQ+. CofC's Student Health Services (SHS) currently engages in LGBTQ+ friendly and accepting practices to make students on that spectrum feel comfortable and accepted. Despite efforts made at SHS, LGBTQ+ students still sometimes report feeling unwelcome or unsafe to express their identities to the staff, and thus receive appropriate care. This project aims to expand SHS's responsiveness to LGBTQ+ students in the clinical environment. The approach involves multiple, yet complimentary, components. Our project objectives will be accomplished through communicating with staff about resources offered, examining SHS's messaging towards members of the LGBTQ+ community, determining the levels of support they offer, and familiarity and comfort with LGBTQ+ issues. In addition and with approval from SHS already obtained, an analysis will be conducted of data being collected this semester by SHS through post-appointment surveys to find areas in which SHS is achieving their goals of supporting and treating LGBTQ+ students/patients equitably and responsively. These data will be compared to findings from research into other higher education institutions' health services and through websites, peer-reviewed literature and advocacy organizations. We will determine best practices for being inclusive to members of the LGBTQ+ community and present those to CofC's SHS. Overall, the findings of this research will enable CofC's Student Health Services to expand LGBTQ+ responsiveness and present a more inclusive, welcoming environment to our LGBTQ+ population on campus.

**Student: Chloe Mattila**
**Major: Mathematics**

**Mentor: Dr. Stéphane Lafortune**
**Department: Mathematics**

### *Pattern Observed on Mussel Bed Formation*

The general goal of the project is to study a model which describes the formation of mussel beds on soft sediments. The model, which we will call the Mussel Model, captures the evolution of mussel biomass on the sediment and algae concentration in the water layer overlying the mussel bed. The model is used to give an explanation to interesting patterns observed in mussel beds on soft sediments in the Wadden Sea. The Mussel Model consists of two differential equations, that is they are equations involving derivatives. The solutions to those equations represent possible behaviors for the mussel biomass as it interacts with the surrounding algae. The goal is to study the stability properties of the solutions. Stability is a fundamental concept, which can be illustrated by trying to make a pencil stand on its lead. Because it is such an unstable state, it is possible in theory only and cannot be observed in reality. The concept of stability carries over to differential equations and its study often involves sophisticated mathematical tools. The study of stability is important because it can distinguish the solutions that be observed in nature from the ones that cannot. In the research described in this proposal, we will tackle the problem of studying the stability of the solutions of the Mussel Model.

**Student: Fabio Najjar**
**Major: Biochemistry**

**Mentors: Dr. Kate Mullaugh**
**Department: Chemistry & Biochemistry**

### *Synthesis, Efficiency and Recyclability of Magnetic Nanoparticles the Removal of Micropollutants from Water*

Water contamination has been an emerging topic in recent years, and research towards methods of purifying the water supply has grown to become an increasingly important branch in environmental research. New methods for ridding wastewaters of micropollutants, molecules that cannot be removed with traditional wastewater treatments, need to be developed. This study investigates the use of magnetic nanoparticles, tiny particles that usually contain some form of iron, that is synthesized from renewable resources. Nanoparticles are small particles with diameters less than a thousand times the width of a human hair, which gives them a large surface area on which pollutants can stick. Various "green" methods of producing magnetic nanoparticles have been demonstrated in the scientific literature. After adopting one of these strategies, we propose to test the nanoparticle efficacy at removing pollutants from water. This will be demonstrated using triclosan, an antibacterial agent used in personal care products such as toothpaste and soaps, as a model micropollutant. Triclosan was banned by the FDA because companies could not prove its safety, and studies suggest that triclosan is highly toxic to humans and aquatic ecosystems in high concentrations. To improve the overall sustainability of this water treatment approach, we will also study how the nanoparticles, after being removed with a magnetic, can be cleaned and recycled for repeated use. This research could lead to a valuable new technique for water treatment that is both cost-effective and environmentally friendly.

**Student: Vershelle Peterson**
**Major: Biology**

**Mentor: Dr. Jennifer Wilhelm**
**Department: Psychology**

### Effects of steroid hormones on voluntary physical activity levels

In preliminary studies we have found an interaction between sex steroid hormone levels and willingness to engage in voluntary wheel running in mice. The purpose of this project is to investigate the effects of supraphysiological doses of 17 beta-estradiol on wheel running in male and female wild type C57BL/6J mice. Mice were given free access to running wheels attached to their cages. Distance and duration of running as measured by the number of wheel rotations was recorded every 12 hours in sync with the changes in the light/dark cycle in the animal housing room, measured every 12 hours for 2 weeks. After a period of acclimation, the mice received Silastic capsule implants filled with estrogen or nothing (left blank). We hypothesize that mice receiving supraphysiological doses of estrogen and testosterone will engage in less physical activity compared to untreated mice. The findings of this study will give us insight into the relationship between steroid hormones and willingness to engage in physical exercise. If a relationship is found, we will plan to investigate the molecular mechanisms that link steroid hormones to physical activity drive/motivation.

**Student: Ethan Pierce**
**Major: Exercise Science**

**Mentor: Dr. J.D. Adams**
**Department: Health & Human Performance**

### *Time-Course Decay of Urine Electrolytes: Effect of Environment and Time*

The goal of this research is to investigate the stability of urine electrolytes in different storage environments for various lengths of time. In clinical sciences, urine electrolytes are used for a variety of diagnoses such as chronic kidney disease, acute kidney injury, and kidney stones. Although urine electrolytes are widely used in diagnostic medicine, there have never been any set of guidelines on the storage of urine specimens following sample obtainment by the patient. To establish recommendations for the proper environment for the storage of urine electrolytes, researchers will obtain a high number of urine samples and store each sample in various environments (i.e., freezer, deep freezer, etc.) for a period of time (1 day, 2 days, etc.) up

to seven days. After each day, the urine samples will be assessed for electrolytes to observe the changes since the fresh sample was obtained. This research is important because it may reveal how environmental conditions impact overall urinalysis; therefore, it may potentially allow clinicians to better diagnose various renal conditions when a fresh urine sample cannot be provided.

**Student: Natalie Sorrem**
**Major: Geology & Marine Biology**

**Mentor: Dr. Theodore Them**
**Department: Geology & Environmental GeoSciences**

### *High-resolution sedimentary [Hg] records across the PETM from a terrestrial latitudinal transect in North America*

The Paleocene-Eocene Thermal Maximum (PETM) is considered by many geologists to represent the only geologic analog to modern environmental and climatic change. The PETM is associated with rapid increases in atmospheric greenhouse gases, global warming, increased wildfires, and extinctions. Some mechanisms that have been hypothesized as a driver of the PETM include an extraterrestrial impact, large-scale volcanism, methane release from the oceans and land, and many others. It is possible to test the possible contribution of each of these potential mechanisms by measuring the mercury concentrations from sediments that were deposited across the PETM. To-date, the only published mercury concentration datasets have come from marine sediments and are too low resolution to have resolved a geologically instantaneous event such as an extraterrestrial impact. Furthermore, the results from these studies are ambiguous and are not able to pinpoint which mechanism is responsible for causing the PETM. For this project, I will work on ancient soil samples that accumulated across a latitudinal transect in Colorado and Wyoming across the PETM. Specifically, I will measure the amount of mercury in these samples to reconstruct the ancient mercury cycle. I will then compare my data to other geochemical datasets from the same samples to determine what controlled mercury accumulation at these sites. The ultimate goal is to constrain what caused the PETM.

**Student: Ryland Talmadge**
**Major: Marine Biology**

**Mentor: Dr. Jody Beers**
**Department: Biology**

### *Physiological Effects of Temperature and Parasite Load on Swimming Performance of Spotted Seatrout*

There are a variety of factors that can alter a fish's behavior, including both biotic and abiotic considerations. The spotted seatrout, *Cynoscion nebulosis*, is an important recreational fisheries species in South Carolina and is notably influenced by environmental temperature. Of particular interest, this fish is also affected by a parasite, *Kudoa inornata*, that is lodged in its muscle tissues. Atypically, the parasite load of *K. inornata* seems to have a positive correlation with enhanced swim performance for the seatrout. Thus, our study seeks to understand the parasite's relationship to the seatrouts' swim performance and to analyze the effects temperature may have on the host-parasite dynamics. We plan to acclimate seatrout to three different temperatures; high, low and intermediate, respective to their environment. Then, we will perform acute-burst swim tests to assess swimming performance, and carry out tissue level analyses via microscopy to assess parasite load. Our primary objective is to correlate swim performance of seatrout with parasite load at different temperatures. Secondarily, we hope to learn more about the physiological costs of muscle parasites in the species and in relation to variable environmental temperature. Ultimately, this research will help us learn more about the effects of biotic and abiotic factors on the potential health and fitness of an important local fisheries species.

**Student: Gabi Tutelo**
**Major: Marine Biology**

**Mentor: Dr. Allison Welch**
**Department: Biology**

***Growing up Salty: The Effects of Transient Salinity Stress on Tadpole Growth and Development***

Freshwater ecosystems are undergoing significant degradation due to human activity. Road deicing, agricultural practices, and rising sea levels have been linked to the salinization of freshwater environments. Elevated salinity levels can have lethal and sublethal effects on freshwater organisms. Amphibians are exceptionally vulnerable to these conditions because of their semi-permeable skin, low salinity tolerance, and complex life cycle. Tadpoles exposed to elevated salinity have an increased mortality rate and, in milder cases, suppressed growth and development. These effects increase chances of predation and can ultimately have a negative impact on reproduction. When exposed to these stressors, amphibians may experience a phenomenon known as developmental plasticity which causes them to alter the trajectory of their development in the presence of a stressor, for example by accelerating development when conditions in the larval environment are stressful. After a stressor is alleviated, the tadpole may experience a period of compensatory growth allowing them to accelerate their growth in order to "catch-up" in size. Both compensatory growth and developmental plasticity, as well as their link to one another, are poorly understood in amphibians, particularly in relation to salinity stress. In this study, we will expose tadpoles to elevated salinity for different portions of development in order to monitor the effects on size and developmental stage before, during, and after the exposure. This experiment will lead to a better understanding of compensatory growth and developmental plasticity in amphibians as well as the consequences of salinity stress on amphibian development and the risks of freshwater salinization.

**Student: Duncan Weller**
**Major: Marine Biology**

**Mentors: Dr. Sarah Hatteberg &**
**Dr. Christy Kollath-Cattano**
**Department: Sociology & Anthropology;**
**Health & Human Performance**

***Encountering Overdose: How College Students Are Impacted by Overdose Experiences***

Research indicates there has been a gradual and steady increase in the number of non-fatal and fatal drug overdoses in the U.S. (NIH; 2019: Paulozzi, 2012; Vivolo-Kantor, 2018). Young adults have been particularly impacted by overdose (Reis, 2004; Silva et al., 2013), considering they have the highest rates of substance use and abuse among all age groups (SAMHSA, 2018). Research on overdose has mainly focused on personal overdose, such as documenting prevalence, identifying risk factors, including which demographic groups are at highest risk, or on evaluating the effectiveness of overdose prevention and treatment. There has been less attention paid to the impact of witnessing an overdose or having a friend or family member overdose, especially among college students. Therefore, this project will focus on college students who have experienced an overdose, either personally, or through witnessing an overdose or having a friend or family member overdose, and explore how they perceive this experience to have impacted their lives. This project will also quantitatively assess the relationship between overdose and mental health outcomes, such as depression and anxiety. Data will be drawn from the annual CofC Student Health Survey, to be conducted in April 2020, which will include open and closed-ended questions about drug overdose.

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***The Use and Abuse of Philosophy in History: James Warley Miles 'Hegelian' Defense of Slavery***

Throughout the history of the College of Charleston, little to nothing has been written about the history of the Philosophy Department, presumably because of its assumed irrelevance to the development of the institution. However, through rigorous historical and philosophical analysis, this project will explore the ways in which Professor James Warley Miles, a 19th century College of Charleston philosopher, reflects an important moment in the history of American philosophy. More specifically, Miles' critical, public, and private works closely resembles the small American philosophical movement that heavily drew from the work of German philosopher G.W.F Hegel and to a lesser degree Friedrich Schleiermacher. Along with a form of transcendentalism, Miles uses these German Idealist arguments in his philosophical discussions of theology and humanity's place in history, particularly to defend slavery in the United States. Therefore, along with conducting historical research on Miles' surviving texts and secondary analysis, I will engage with Hegel's and Schleiermacher's philosophy of history, politics, and theology to better understand the theories that Miles dishonestly interprets to advance the cause of racial subjugation. The methodology of this project raises philosophical questions of its own. While historical analysis serves as an essential component in any research on the history of philosophy, the philosophy addressed in this case deals with the various ways we can and should think about "history" as a concept and its own methods.