COLLEGE of CHARLESTON
UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

2021 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 2021. Please join us in congratulating these students and their faculty mentors.

Summer Undergraduate Research with Faculty (SURF)

Student: Jessica Anderson

Major: Astrophysics

Mentor: Chris Fragile and Christopher Nolting

Department: Physics and Astronomy

Multi-energy Radiation Magnetohydrodynamics Simulations of Black Hole Accretion Disks in the Luminour Hard State

Black hole X-ray binary systems occur when a black hole is in orbit with an ordinary star and pulls material off that stellar companion. The infalling gas then form an "accretion disk," which is like a platter of plasma circling around the black hole. Paradoxically, black holes, which are known for swallowing everything that comes near them, actually produce jets of rapidly outflowing gas from close to their rotation poles. These X-ray binary systems as a whole emit both high- and low-energy X-rays, the low-energy X-rays coming from the disk itself, while the high-energy ones come primarily from the base of the jets or possibly a "corona" of gas near the black hole. We will be doing the first-ever computer simulations that incorporate the effects of both of these X-ray components. The goal is to investigate how these different spectral components interact with each other and the disk and jet. The project will allow us to produce spectra from our simulations to be compared with actual spectra of real X-ray binaries. By tracing where each component of the spectrum originates in our simulations, we hope to learn more about the geometry of the accretion disks, coronae, and jets.

Student: Samantha Andritsch

Major: Public Health

Mentor: Brian Bossak

Department: Health & Human Performance

COVID-19 Deaths and Air Pollution: A Spatial Analysis of Particulate Matter Concentration and Association with COVID-19 Mortality

The first worldwide pandemic in more than a century began in 2020. Early reports out of China around the new year suggested a respiratory virus of unknown origin that was spreading rapidly. A new strain of coronavirus was soon confirmed (SARS-CoV-2) with the corresponding disease termed COVID-19. Unlike the earlier strains like SARS and MERS, COVID-19 was effectively transmitted globally through transportation networks. However, despite widespread infection, COVID-19 mortality rates are not equivalent. The number of people who die from COVID-19 for every 1 million people in a country ranges from a high of 1930 in parts of Europe to less than 1 in parts of Asia and Africa. Why are there such significant discrepancies in COVID-19 deaths between regions? While many factors influence mortality, in this study, we plan to assess whether air pollution is associated with an increased risk of dying from COVID-19. This study was spurred

by observations that COVID-19 mortality in the Po Valley of Italy was exceedingly high compared to other parts of the country where there is less economic activity. Moreover, the geography of the Po Valley acts to trap air pollutants like particulate matter and this feature may have made COVID-19 cases more severe than perhaps otherwise. We will use data on COVID-19 deaths and airborne particulate matter to assess whether an association exists between these variables in selected counties in the USA. We will use statistics to analyze the strength of any associations and map "hotspots" and "coldspots" based on these results. Finally, we will create a predictive map of locations where COVID-9 mortality could be elevated due to particulate matter air pollution.

Student: Grace Bader
Major: Biology

Mentor: Jennifer Wilhelm
Department: Psychology

Is estrogen signaling responsible for the effects of exercise on synaptic reorganization in the spinal cord after peripheral nerve injury?

Peripheral nerve injury impacts hundreds of thousands of people each year. This type of injury can produce many debilitating physical effects such as muscle weakness or loss of sensation that require long-term rehabilitation. These deficits are caused at least in part by reorganization and loss of connections within the spinal cord. Previous research has shown that treatment with estrogen or with exercise in the form of treadmill training can reduce this reorganization and loss. Our current study proposes to examine whether estrogen signaling may be employed during treadmill exercise to mitigate the synaptic changes that occur after injury to the axons of motor neurons. Using a mouse model of sciatic nerve injury, we will examine whether pharmacologically blocking estrogen signaling during exercise will change the ability of exercise to prevent the synaptic loss seen in untreated animals. If we discover that estrogen signaling is involved in the process by which exercise exerts its effects, then we may be able to begin to translate our findings into new pharmacological treatments for patients suffering from peripheral nerve injury during periods when they are unable to engage in exercise.

Student: Mary Hope Ballou
Major: Scenic Design

Mentor: Jason Lyons
Department: Theater and Dance

Integration of Video Projections into Scenic & Lighting Design

Over the years, Video and Projection has begun to be integrated into theatrical design at a pace that has far outweighed the pipeline of trained professionals to fill the roles necessary to support and excel in this field. As these ideas apply to each production differently, the conversation always becomes the following: Is it an extension of scenery? Is it an addition to the lighting design? Is it an amalgamation of both? The answers to these questions are pored over by professionals and students alike. How do we answer them amongst a group of people who are already working in a medium known to be the most collaborative of arts?

This project will explore the challenges designers face making these decisions, collaborating on content, and implementing ideas in a way that makes the production feel whole and of one mind, while also giving a student invaluable professional experience in designing Video and Projections for one of our largest and most recognized theatre companies in the Country.

Theatre Under the Stars in Houston will be producing *Rock of Ages* a popular rock musical at Sarofim Hall in The Hobby Center for the Performing Arts. The faculty mentor will serve as the lead designer, with the student experiencing and participating in every moment of the design process, culminating in an extensive addition to their portfolio of professional work and expanding their skill set to include the new tools and ideas involved in being a part of a production of this scale.

Student: Bryn Berry
Major: Computing in the Arts

Mentor: Barbara Duval
Department: Studio Art

Larger than Life Ink Wash

A scroll is a painting or drawing that is much longer than it is tall, giving artists the rare opportunity to use the passage of time as a component of the work. Scrolls create a space for the viewer to become a part of the artwork and move through the story it tells in an uniquely immersive way. My work draws influence from two time periods when scroll paintings were extremely popular--13th century Japan and 20th century America.

The drawing will feel timeless and speak to a level of human experience that transcends physical and temporal distances. This will be done by combining the grandiose moments of triumph and defeat in battle that is displayed in Japanese traditional scrolls with the peaceful recollections of childhood displayed in Park's scroll. These memories of both conflict and gentleness will shape my final work into a reflection of the breadth of human experience.

Working in ink wash will lend maturity and fluidity to the piece as a whole. In ink wash I begin by working lightly and slowly build up the darker values of the image as I work on it. This allows me to adjust the image as it takes form and create a more sophisticated end result.

Student: Hussain Bhagat
Major: Biochemistry

Mentor: Katherine Mullaugh
Department: Chemistry & Biochemistry

Magnetic nanoparticles for the removal of heavy metals from water

In recent years, as water supplies become more stressed, the purification of contaminated water supplies has become increasingly important. Of particular concern are micropollutants, compounds that are present at concentrations too low to be captured by traditional water treatment strategies, but are nevertheless still potentially harmful to human health. For example, heavy metals like lead and arsenic can poison the water of entire communities. The development of new methods to rid water these micropollutants will be necessary to meet our future water needs. One such method uses tiny iron-containing particles, or nanoparticles, which have large relative surface areas as a result of their small sizes. Micropollutants can adsorb or "stick" to this surface and then nanoparticles can be removed with a magnet, taking contaminants with them. By using a "green" method that uses safe and renewable resources, magnetic nanoparticles can be readily prepared in the lab. The goal of this research is to test the magnetic nanoparticles' effectiveness in removing toxic heavy metals from water, and making modifications as needed. We will also investigate how magnetic nanoparticles could be cleaned and recycled for repeated use. This research aims to further progress environmentally friendly techniques for water purification that can be applied to other contaminants while maintaining cost efficiency and maximizing sustainability.

Student: Connor Cozad
Major: Data Science

Mentor: Norman Levine & Lancie Affonso
Department: Geology & Environmental Geosciences

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

Citizens in the Lowcountry struggle to understand when and where tidally-induced and rainfall flooding is going to impact their daily routines. This SURF proposal is to fund an undergraduate researcher to work on a South Carolina Sea Grant-funded project to develop a platform-independent (phones or computers) flood mapping application. Last summer, the undergraduate researchers on the project made significant contributions to the project by building a data pipeline in Python to retrieve real-time tide data for use in the app. The research team has continued to make progress during the fall and spring semesters, developing a shell and methodology for presenting the tidal inundation data to the public. This spring and summer, the team will work to model precipitation-based flooding, which involves the development of a robust rainfall runoff model for the region. This SURF grant will fund an undergraduate researcher to spend the summer developing an implementation of the CN-Curve rainfall runoff relationship for the Charleston region in Jupyter Notebooks. Jupyter Notebook is an advanced programming environment where the student will use Python

and ArcGIS programming libraries to create a GIS-enabled method for determining precipitation-driven flooding in the region. The researcher will code the interface and implementing it in both the GIS environment and on the school's high-performance cluster computer. Together with the inundation tool developed last summer, our final grant product (flood mapping app) will provide a tool for the Charleston region to better understand where, when, and why flooding is occurring.

Student: Laura Maria Diaz Coronado
Major: Music

Mentor: Michael O'Brien & Yuriy Bekker
Department: Music

Uncovering Orellana: Guatemalan Vanguardist

Joaquín Orellana (1933 -) is an experimental Guatemalan composer, instrument creator, and violinist. His early work, while stylistically traditional, won several important international awards. His career was transformed, however, by a residence at the Latin American Center for Advanced Musical Studies at the Instituto Torcuato Di Tella in Buenos Aires, Argentina, where some of Latin America's most elite and imaginative composers shared their work with leading composers from the U.S. and Europe (Vazquez 2015). The graduates of the Di Tella Institute were characterized by both experimentalist techniques, and by their political convictions that their music should reflect and engage with the social realities of their own countries, rather than merely reflect European conventions and interests (Dewar 2018). Orellana was profoundly shaped by this experience, and spent the rest of his career embracing experimentalist techniques inspired by de-colonial ideologies and by Guatemala's cultural history and conflicted social context. While many of Orellana's fellow di Tella alumni have been the subject of musicological analysis, Orellana's post-Institute career, while breathtakingly inventive, remains little studied. This project seeks to address this lacuna, which is owed largely to Guatemala's troubled history during this period (1960s- 1980s), which interfered with both Orellana's musical production and with audiences' and scholars' ability to access it. Methodologically, we will draw on the disciplines of ethnomusicology (ethnographic interviews and performance study with the composer and his assistants, musicology (formal and structural analysis of his scores and instruments), and music performance.

Student: Chapman Lane Ellisor
Major: Mathematics

Mentor: Annalisa Calini
Department: Mathematics

Investigating Stability of Rogue Waves in Nonlinear Schrödinger Models of Deep Water Waves

Rogue waves are high amplitude waves that appear suddenly and unexpectedly, then disappearing without a trace in a variety of water conditions: deep and shallow water, calm and wind-swept seas, with or without currents. Up until the second half of the 1900s, despite the hundreds of tales of monster waves brought back by the seafarers who survived the encounters, rogue waves were thought to be impossible phenomena. It was not until after the development of nonlinear models of wave propagation, that scientists began to understand the various mechanisms for rogue wave formation. Only recently, the attention has turned to real-time predictive tools that can be used by ships to avoid ocean rogue waves.

This project, in collaboration with Dr. Constance Schober, a mathematician at the University of Central Florida (UCF), and her student Evelyn Smith, a junior at UCF, will explore mathematical models of rogue wave formation in the deep ocean, their solutions, and the robustness of such solutions to small changes in the initial state and/or in the models themselves. Robustness (stability) is an important criterion for the validation of the mathematical models as well as for the practical prediction of rogue wave formation. The project will involve a blend of modeling, theoretical investigations and numerical simulations, and will continue Dr. Calini and Schober's long-standing collaboration on rogue waves and history of co-training students in research.

Student: Brooke Emery
Major: Public Health

Mentor: Heather Fullerton
Department: Biology

Assessment of Antibiotic-Resistant Indicator Organisms in Charleston's Shem Creek: A Pilot Study

Charleston is a city that survives, thrives, and excites the collective imagination for two primary reasons: a historical legacy and proximity to water. The very nature of Charleston's coastal situation - an antebellum downtown peninsula at the intersection of two primary waterways and one of the busiest shipping harbors in the country - renders the city unique. Its surrounding environment is also tied to the water which flows ceaselessly in and out of its harbor and the two rivers which empty into it. Urban development and a system of overflow storm sewers that empty into these local waters present risks to this environment and potentially, human health. The Charleston Waterkeeper organization monitors water quality in local waterways, and tests indicate worrying levels of contamination. There is concern that some organisms in the water may possess resistance to antibiotics, the miracle of modern medicine. In fact, the Centers for Disease Control and Prevention (CDC) states that Carbapenem-Resistant Enterococci (CRE), an organism that lives in the human gut, is of “grave concern.” Thus, we propose to collect water samples at the Charleston Waterkeeper test site and conduct our own lab tests for the presence/absence of resistant organisms. We plan to plot detection of any such organisms over time and in relation to tidal status (high tide, low tide, etc). In addition, we aim to have any such organisms' genetic composition sequenced and report these results at conferences and through scientific channels. We anticipate that this research could serve as a pilot project in advance of an external funding proposal to carry this work forward to sample for more potentially resistant organisms over a longer duration of study.

Student: Shira Finke
Major: Psychology

Mentor: Beth Sundstrom
Department: Communication

Evaluating The WISE Telehealth Network

The COVID-19 pandemic increased healthcare disparities among women, including delayed or cancelled appointments, and difficulty accessing health services. These health disparities are exacerbated for women living in rural locations. The purpose of the WISE (Women in the South-East) Telehealth Network is to improve women’s health and well-being by providing preventive care through telehealth at local libraries in the rural Lowcountry. This project is made possible by funding from the South Carolina Center for Rural and Primary Healthcare and a partnership between Charleston County Public Libraries (CCPL) and the Medical University of South Carolina (MUSC), the S.C. Department of Health and Environmental Control (DHEC), and the College of Charleston. Formative audience research, including in-depth interviews with 52 women in the rural low country found that women wanted private, confidential telehealth services at an established, neutral, community location - a public library. The WISE Telehealth Network impacts rural areas in Charleston County by connecting women to healthcare resources in maternal and reproductive care, infectious disease, and mental health. WISE increases healthcare access and addresses health disparities through direct provision and referral, offering care management, and connecting women with available community and social services. On-going and longitudinal evaluation research monitors progress and opportunities to meet women’s needs. The overall goal of WISE is to develop a sustainable system that can be adopted by other rural libraries, easily scaled, and informs telehealth policy.

Student: Isabel Finnegan
Major: Biology

Mentor: Matthew Rhodes & Jay Forsythe
Department: Biology

Monitoring Steroid levels in maternal urine for the early detecti0n of SLOS

4. NON-TECHNICAL PROJECT ABSTRACT (1750 character limit with spaces):

Smith-Lemli-Opitz Syndrome (SLOS) is an autosomal recessive genetic disease resulting in an affected person's partial or complete nability to convert 7-dehydrocholesterol to cholesterol. This is due to a mutation that renders the final enzyme in the biosynthesis pathway of cholesterol dysfunctional. Currently, SLOS can only be tested following an invasive procedure such as an amniocentesis in a fetus after 10-weeks' gestation. Invasive testing is painful, requires a couple weeks of recovery, and carries up to a 1% chance of causing miscarriage. The goal of this research project is to be able to detect the disease even earlier and in a non-invasive manner by examining 7-dehydrocholesterol levels in a mother's urine samples. The beginning stages of this research will be focused on using mass spectrometry to determine the limits of detection and limits of quantitation of 7-dehydrocholesterol in control and experimental samples. Results of prior research suggest that an increase in 7-dehydrocholesterol levels during pregnancy could definitively point to SLOS, making this potential testing method an effective way to minim'ze impact on both the mother's and the fetus's health as it is both safer and potentially will provide an earlier diagnosis.

Student: Melanie Fischer **Mentor: Andrew Clark**
Major: Marine Biology **Department: Biology**

3D Morphology of the Cranio-Branchial Apparatus in Moray Eels

Moray eels appear to be the only group of bony fishes that can tie their bodies into knots and use the body knots for removing ingestible chunks of flesh from large prey. The knot is created at the tail end of the eel's body and then travels towards the eel's head. As the knot slides over and passed the head, it applies a compressive force to the prey's body. These movements provide additional leverage which can enhance the effectiveness of the biting attack. As the moray eel bites into the prey, its large recurved teeth apply tension to the prey's body, which counteracts the compression that the knot applies to the prey's body. Interestingly enough, the rigid bony skeleton of these animals does not constrain their ability to contort their bodies into knots. Moray eels face two important problems when attempting to create and manipulate a body knot: 1) the bony skeleton of the eel must be flexible enough to allow body to tie itself into knot and 2) the skeleton must also be robust enough to handle the forces applied by the teeth and body knot. We hypothesize that the anatomy of the vertebrae in the rear 50% of the body permits flexibility, while the skeleton in the head, jaws, and gills provides structural support. To address these hypotheses and determine how the moray eel skeleton is adapted for knotting, we will use micro computed tomography (micro CT scans) to examine and reconstruct the 3D morphology of the skull bones, jaw bones, dentition, and vertebrae from three moray eel species. These findings will be compared to similar data from American eels, a species that does not use knotting. All of the proposed summer research activities will be conducted at the Karel F. Liem Bioimaging Facility at Friday Harbor Laboratories in Washington. We are requesting funds for travel, room and board.

Student: Annie Forgette **Mentor: Bill Manaris**
Major: Computing in the Arta **Department: Computer Science**

Developing an Interactive Participatory Music Environment (IPaME) for Online Communities

We will be working to develop an Interactive Participatory Music Environment (IPaME) which will support a variety of interactive musical performances and experiences via the Internet. Due to the ongoing pandemic, there has been a societal shift in the way people communicate (assisted by the proliferation of Zoom and related technologies). This shift is here to stay. Artists and musicians have already been experimenting with online delivery mechanisms (e.g., live streaming, YouTube, Spotify, etc.) Given the complicated nature of music production and live performance during the

ongoing pandemic, we will design and experiment with a digital environment (which incorporates Zoom and Open Sound Control (OSC)) in which everyday people can take part in musical experiences and explore musical landscapes (similarly to playing an online computer game) using locally generated sounds via their smartphones (and other inexpensive devices, such as LeapMotion). While the inspiration for this project comes from some of the technology utilized during the pandemic, we hope to design and support a creative process that is interesting and engaging enough to be utilized long after the pandemic. Our goal is to create a seamless, bidirectional experience for the users (or "players") similar to that that of online gaming. This experience will allow music performance (and potentially composition) to be transformed to allow for the creative (or exploratory) interweaving of different options to create different outcomes; this will be accomplished through various low- or intermediate-level choices available to participants as they navigate with their smartphone screens, or other devices (such as LeapMotion). Timing issues will also be addressed.

Student: Lauren Kendall Graham
Major: Biochemistry
Mentor: Sarah Maness
Department: Health & Human Performance

Reframing the Conversation around Contraceptive Options: Tailoring the "Do You Want A Period?" Campaign Messages to a College Population

The "Do You Want a Period" Campaign is being launched in Spring 2021 by Dr. Beth Sundstrom, through the WISE (Women in the South-East) Telehealth Network. Most people who menstruate are not aware that they have a choice of whether or not to have a period using hormonal contraception. Our project will tailor the messages from this campaign for adults to be appropriate and relevant for college-age women. We plan to interview participants both individually and through the use of online focus groups to develop messages that promote choices in contraception that influence menstruation. The tailored campaign messages will be used to roll out a campaign at the College of Charleston in Fall 2021. The campaign is designed to change the conversation around contraceptive options and empowering women to realize they have a choice about whether or not to get a period.

Student: Anna Grace Greenho
Major: Psychology
Mentor: Chad Galuska
Department: Psychology

Assessing the Reinforcing Value of Alcohol During Favorable-to-Unfavorable Shifts in Reward

Frustration-stress resulting from reward loss is a trigger for problematic alcohol consumption in humans. Previous research in our laboratory has demonstrated that transitions from favorable to unfavorable reward contexts (i.e., negative incentive shifts) engender voluntary alcohol consumption in rats. Rats pressed a lever 100 times in order to earn food pellets. The size of the reward (either large or small) alternated within the same experimental session. The transition from a just-received large reward to a signaled upcoming small reward engendered consumption of a freely available ethanol solution. The proposed research extends these findings by determining if these negative incentive shifts will generate alcohol consumption when rats have to work to produce the alcohol by pressing on a second lever. This test will provide more powerful evidence that the reinforcing effects of alcohol are modulated by shifts in reinforcement context.

Student: Ethan Guthrie
Major: Psychology
Mentors: Gabrielle Principe & Daniel Greenberg
Department: Psychology

An Exploration of Biases in Mothers' and Children's Memory

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: McKenna King
Major: Chemistry

Mentor: David Boucher
Department: Chemistry & Biochemistry

Impact of Polymer Chain Microstructure on Solubility Parameters

This project entails the use of various instruments as well as experimental and computational techniques to determine the relationship between polymer chain structure and solubility as well as the polymer affinities for thirty different solvents. Analysis of the thermal properties of our specific polymer, poly(3-hexylthiophene) (P3HT), will be conducted as well to collect additional data on how the structure of the P3HT polymer affects its characteristics such as melting point temperature and enthalpy of melting i.e., how much heat and energy is added or removed as the polymer dissolves. Further data of the specific properties of each solvent will be used along with the P3HT absorption data to find relationships between these solvent properties and the P3HT solubility. After all data has been collected, solubility parameter calculations will be performed to finalize all information and draw conclusions about the nature of the dominant polymer-solvent interactions.

Student: Elle Kraichely
Major: Chemistry

Mentor: Tim Barker
Department: Chemistry & Biochemistry

Addition of Alkylboronic Esters to Electrophiles

Organic chemistry is comprised mostly of reactions between molecules that donate electron pairs and molecules that accept electron pairs to form new covalent bonds. These two types of molecules are known as nucleophiles and electrophiles. In regard to this project, the focus will be on exploring new nucleophiles and testing their reactivity to various electrophiles. The hopes for this project is to be able to develop a reaction that may be beneficial in the synthesis of biologically relevant molecules.

Student: Mary Lightsey
Major: Public Health

Mentor: Leslie Hart
Department: Health & Human Performance

An evaluation and comparison of leave-on personal care product use among students attending the College of Charleston and The Citadel.

Endocrine disrupting chemicals (EDCs) interfere with hormone production, secretion, and transport, and they have been associated with cancer, reduced fertility, and impaired growth and development. EDCs are commonly added to personal care products (PCPs), cleaning products, pesticides, and plastics. Studies have demonstrated an increased risk of EDC exposure among frequent users of PCPs, and the degree of chemical exposure appears to be influenced by the frequency and quantity of product use, as well as product type. PCPs that are not immediately rinsed off following use

("leave-on") may chronically expose users to harmful EDCs, and co-use of multiple PCPs at once may increase the risk of exposure to a complex mixture of EDCs. PCP-related EDC exposure has been examined among many populations including children and adolescents, women (pregnant and non-pregnant), mother-child pairs, and adult men. Surprisingly, very few studies have studied PCP use among U.S. college students despite the unique social and economic pressures that may influence healthy choices and habits. The proposed study seeks to quantify "leave-on" PCP use and co-use among students attending two universities (military vs. non-military). These institutions differ in restrictions related to PCP use, which likely impacts exposure to EDCs. Comparisons of "leave-on" PCP use between these schools provide a unique opportunity to enhance our understanding of EDC-exposing behaviors and identify pathways for intervention and education to protect the future health of this reproductively vulnerable study population.

Student: Liza Malcom
Major: Public Health

Mentor: Beth Sundstrom
Department: Communication

HPV Vaccination NOW: Evaluating a health promotion initiative

The Human Papillomavirus (HPV) vaccine protects girls and boys from six HPV-related cancers. Approximately half of South Carolina adolescents have not completed the vaccination series, representing a missed opportunity to prevent cancer. The HPV Vaccination NOW: This is Our Moment social media campaign is an initiative of the South Carolina Cancer Alliance (SCCA) and Hollings Cancer Center at the Medical University of South Carolina (MUSC). This statewide social media campaign aims to increase awareness of and positive attitudes toward HPV vaccination in S.C. The ten-week campaign is strategically implemented between June and August to encourage HPV vaccination at back-to-school medical appointments. For the first time this year, we will also be implementing a health education program in collaboration with the WISE (Women in the South-East) Telehealth Network. To evaluate the success of the health promotion initiative, we will conduct a process evaluation and a qualitative content analysis of the social media campaign, as well as a pretest/posttest survey of women participating in the WISE Telehealth Network.

Student: Gabriele Molloseau
Major: Biology

Mentor: Michael Giuliano
Department: Chemistry & Biochemistry

Direct Measurement of the Properties of Cell Membrane Mimics

The environments of cell surfaces are notoriously complex and play a large role in intercellular communication and other biological processes. The interaction between water molecules embedded in the cell's membrane and other molecules is what creates such a convoluted environment, that has yet to be researched fully. It is believed that the surface of the cell near the membrane will reflect similar properties to organic solvents, since most of the nearby water is bound up by the membrane itself. Previous work in the lab has allowed us to synthesize small organic reporter molecules that will now be used to embed into mimics of the membrane of a cell. Atoms in the reporter molecule will give unique spectroscopic signals, due to their sensitivity to the solvent surrounding the cell's surface. These signals will allow for a better understanding of the properties of the environment of the cell's membrane. Understanding the intricate nature of cell surfaces will allow for a better understanding of cell signaling and communication, the binding of medicines to cellular targets and how it affects their designed purpose, and how structure and function of biomolecules are related to their environment.

Student: Anne Payne
Major: Psychology

Mentors: Daniel Greenberg &
Gabrielle Principe
Department: Psychology

An Exploration of Maternal Factors Affecting Children's Memory

In everyday life, young children and their parents frequently discuss memories of past events. The research literature demonstrates that mother-guided reminiscing fosters the development of children's autobiographical remembering skills. Through these exchanges, young children learn how to structure and share their memories in narrative form. Children also depend on parents to help them evaluate the past. Yet little is known about how variations in the ways

that parents frame and guide conversations about earlier events may shape how children come to interpret and remember personal experiences.

To examine these issues, we (e.g. Principe, Greenberg, Shymanski, West, & Cibischino, 2019) carried out two studies where mothers and their children reminisced about three recent shared events. Later, children independently experienced a scripted event made up of a series of ambiguous social interactions. Results indicated that mothers who framed the reminiscing conversations in a more emotionally negative manner had children who were especially likely to interpret the ambiguous experiences in a negative manner and misremember them in a way that that incorporated the meaning of their previous negative interpretation.

The proposed study aims to replicate and extend these initial findings to determine if this relation remains in mothers who have been diagnosed with emotional disorders, such as anxiety or depression. This is an important extension because studies of adults demonstrate that negative interpretation and memory biases contribute to emotional disorders such as depression and anxiety (Hertel & Mathews, 2011), but little is known about what sorts of early experiences might contribute to the development of these biases.

Student: Jennifer Sella **Mentors: Morgan Hughey**
Major: Exercise Science **Department: Health & Human Performance**

It's Electric! Quantifying the Energy Expenditure Differences Between Bicycles and Electric-assist Bicycles for Charleston's bike share program

Though seemingly insignificant, any physical movement made throughout the day offers health benefits. Experts recommend at least 150 minutes of activity per week, yet over half of American adults do not meet this guideline. One way to promote movement is to create more opportunities for popular activities, such as bicycling. Bike share programs are a growing trend in cities around the world; individuals can rent, use, and return bicycles. Alongside the surge of bike share programs, companies are innovating by offering electric-assist pedal bicycles (e-bike). These bicycles are equipped with a battery and motor that kick in when pedaling to give a boost. Along with making your ride to work easier, there is a difference in the intensity of physical activity while using an e-bike. The study aims to 1) quantify the differences in energy needed to use a regular bike share bicycle compared to an e-bike and 2) to examine differences in individual perceptions of difficulty between the two bike types. Compared to regular bikes, we hypothesize that e-bike rides will use about 25% less energy, yet individuals will report greater enjoyment on the e-bike. To test this, a total of 15 research participants will complete a 1-hour bicycle ride with both the conventional and e-bike, measuring heart rate continuously throughout the ride. Following each ride, participants will fill out a brief survey reporting their perceived exertion and enjoyment. Results will highlight the physical and cognitive differences between riding the two types of bicycles. With a growing trend in bike share programs, these results will significantly contribute to the knowledge of a growing transportation and recreation trend to promote physical activity.

Student: Thomas Sinkway **Mentor: Jay Forsythe**
Major: Biochemistry **Department: Chemistry & Biochemistry**

Analysis of Model Prebiotic Reactions by Mass Spectrometry Imaging

Amino acids are building blocks of proteins, the biochemical machinery of life as we know it. When amino acids are linked together, they form peptides, or short pieces of protein, consisting of amide linkages between them. However, on ancient Earth, it is unclear how peptides and proteins could have formed before biological ribosomes, as it is thermodynamically unfavorable for amino acids to link together. Recently, it was shown that hydroxy acids, similar molecules to amino acids, can help amino acids link together to form amide bonds. When amino acids and hydroxy acids are mixed together, placed in water, and subjected to repeated processes of evaporation and rehydration, it creates polymers that are mixtures of peptides and polyesters known as “depsipeptides.” Depsipeptides are seen as a possible

bridge to the first proteins on prebiotic Earth. Here, we want to use a technique known as mass spectrometry (MS) to investigate how depsipeptides spread out on surfaces when they are formed. Similar to how spilled coffee forms rings on a table, we hypothesize that depsipeptides will spread out unevenly on surfaces. This could have important implications for chemical reactions on rocks and meteorites both on ancient Earth and in outer space.

Student: Jenna Snead
Major: Astrophysics

Mentor: Joe Carson
Department: Physics and Astronomy

A Novel 3D Imaging System for Improved Screening of Cervical Pre-Cancers

CervImage, developed by Carson's research group, is a 3D medical imaging device that represents a simple-to-use screening device for early-stage cancer detection, with a primary focus on cervical cancer. Borrowing techniques from astronomy imaging, the device's power lies in its ability to quantitatively measure the cervix's 3D shape, including potential surface growths. While amenable to telemedicine, the device's primary target demographic is populations in developing countries, specifically sub-Saharan Africa, where around 50,000 deaths occur from the cancer each year (Mboumba Bouassa, 2017). The low-cost, portable, battery-powered CervImage device is simple-to-use by a non-expert; a handheld, inexpensive (<$50), touchscreen computer controls the device and stores the data. Unlike conventional cervical pre-cancer screening methods, which typically require multiple visits and accompanying laboratory support (e.g. Pap Smear + colposcopy), CervImage can achieve effective screening in a single patient visit. This is important since patients in developing countries often don't return after the initial visit (Martin et al. 2014).
The proposed project would improve the current CervImage design through the creation of an augmented battery power supply unit. The new unit would allow CervImage to have a battery life longer than its current ~2.5 hour time length. The unit's custom electronic hardware and software would ensure that power delivery is uninterrupted during switches from battery to wall outlet power, and also that the amount of time left on the battery displays directly on the clinician-friendly Graphical User Interface (GUI), so that the clinician can incorporate this information in their daily clinical plans. Since CervImage is designed to be used in resource limited settings, including parts of the world without reliable electricity, the expanded battery life may directly impact the number of patient lives that can be saved.

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Adult Neurogenesis in the Snapping Shrimp.

This project will examine the cellular process of neurogenesis. It has been firmly established that a variety of adult animals produce new neurons through a process known as neurogenesis. These new neurons can help modulate critical aspects of nervous system function. However, much remains unknown about this process. The goal of this project is to understand more about the cellular mechanisms of neurogenesis using a unique model, the snapping shrimp. The snapping shrimp has several qualities which make it ideal for providing a deeper understanding of neurogenesis. The snapping shrimp has the remarkable ability to regenerate a lost claw, necessarily involving regenerating the neurons that will allow that claw to function. Additionally, the snapping shrimp undergoes seasonal changes in overall body growth. These changes are likely accompanied by overall systemic changes in its nervous system. These properties give us a model organism that provides a window into a process of neurogenesis that is `turned-on' and `turned-off' relative to environmental conditions throughout this animal's life span. Our main goal is to compare rates of neurogenesis with seasonal changes (breeding vs. non-breeding shrimp). Importantly, our investigation is not only intended as a descriptive study of the snapping shrimp. The translational value of this mechanism may be particularly relevant for addressing diseases characterized by the death or deterioration of neurons in humans. In other words, the cellular processes that occur during shrimp neurogenesis may be ones that can be mimicked or replicated to address disease conditions in humans, as we have far more limited rates of adult neurogenesis.

Student: Emma Van Horne
Major: Biochemistry

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Role of the porphyrin ring in the redox-catalyzed Kemp elimination.

Catalysts are substances that enable chemical reactions to proceed at a faster rate than otherwise possible. They can be as small as simple chemical compounds, but most of Nature's catalysts (enzymes) are larger macromolecules, usually made of amino acids (such as proteins). Sometimes proteins are helped by smaller compounds that connect to the protein but are not made of amino acids. In order to understand the power of enzymes, sometimes it is necessary to separate these small helpers from the rest of the protein. In this work, we will use such approach to study a reaction that has been used extensively as benchmark for the computer-assisted design of enzymes. We will vary the nature of the helper molecule in order to study what features are important for catalysis. Because these molecules are commercially available, we will be able to purchase them and use them as they are to study their effect on the rate of the reaction using instruments present in our Department. It has been previously known that the specific reaction we are studying, known as Kemp Elimination, followed a specific chemical mechanism that is referred to as base-catalyzed; however, our work explores the possibility that Kemp Elimination could happen through another chemical mechanism known as redox. By understanding these catalysts and reactions more, it will give us more insight into the specific type of chemical reaction and mechanism that is occurring: base-catalyzed or redox.

Student: Anna Walter
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Experiences and Expressions in Irish Women's Reproductive Histories

In "Experiences and Expressions in Irish Women's Reproductive Histories," we explore Irish women's reproductive history through an examination of criminal (illegal) abortion in the twentieth century (c. 1900-1967). Through an interrogation of courtroom trial narratives and other primary sources such as letters, newspapers, and folklore accounts, this research analyzes women's abortion attempts, focusing on their experiences and expressions: how women discovered an abortion practitioner, the process they went through, their bodily experiences and emotions during the abortion process, and how they talked about fertility control with their friends, families, and in court. We ask in particular how and why women constructed their courtroom narratives, revealing that, unlike judges and physicians, they did not view their abortion experiences through the lens of modern legal or medical discourses. Neither did they reference religion or morality. Instead, they placed their experiences in familiar contexts, including traditions of domestic health care and community connections.

With this project, we hope to shed light on Irish women's sexual and reproductive experiences in the past. Our contention is that if we carefully analyze women's courtroom narratives, we can see that women framed their experiences in contexts that related directly to their embodied and sensory experiences as well as their ordinary lives. As such, we hope to move beyond what one scholar has called "the fetish of legality" in abortion scholarship and instead place women's experiences, emotions, and words at the center of analysis.

Student: Patrick Wohlscheid
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Passion and Terror: Victorian Monsters and the Gothic Sublime

Early Romantic Gothic texts like Mary Shelley's Frankenstein heavily feature the philosophical concept of the sublime. The sublime is most commonly known in the context of an awe-inspiring and terrible natural landscape. Gothic texts, however, deploy the sublime in a markedly different manner. The Gothic monster comes to embody the sublime. This leads to the question, how exactly does the idea of the natural sublime correspond to monstrosity, something entirely unnatural? By investigating eighteenth- and nineteenth-century philosophical treatises on the sublime, nineteenth-century Gothic literature, and contemporary literary criticism, I hope to carry forward the conversation that theorists such as Vijay Mishra begins in his book, The Gothic Sublime. By exploring the ways in which the natural sublime

transforms into a “monstrous” or Gothic sublime, I aim to argue that “mindscape” of Gothic monsters holds the same kind of mesmerizing terror associated with the natural landscape.