COLLEGE of CHARLESTON
UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

2019-2020 AWARD RECIPIENTS

The Office of Undergraduate Research and Creative Activities is pleased to announce the MAYS and RPG recipients for the 2019-2020 academic year. Please join us in congratulating these students and their faculty mentors.

Major Academic Year Support (MAYS)

Student: Kelly Ackerly
Major: Psychology

Mentor: Dr. Daniel Greenberg
Department: Psychology

An Exploration of Maternal Factors Affecting Children's Autobiographical Memory

In day-to-day interactions, mothers and their young children discuss memories of events they have experienced. Research has demonstrated the relationship between these interactions and the development of children's memories. It is through these interactions that children learn how to interpret personal experiences and develop the skill of talking about them with others in a coherent way. Additionally, studies have found that children are more likely to form false memories—that is, inaccurate "memories" of events that did not actually occur – because their memories are more easily manipulated. In this study, we will explore whether the way mothers talk to their children about ambiguous events affects the children's interpretations and memories of the event. We will also attempt to determine if there is a relationship between mothers' negativity during discussions and their child's formation of false memories. To explore this idea, mothers and their children (aged 3 to 6 years) are given a handful of ambiguous situations to interpret separately. Children are given the opportunity to make slime with a research assistant while a second research assistant acts out ambiguous situations that could have a positive or negative interpretation. The children are evaluated on the way they interpret the situations and whether they form a negative false memory. Negative interpretations of the events imply a negativity bias that carries over into memory formation. Similarly, mothers are given a digital task where they finish the ending of an ambiguous story. This is used to examine the mother's tendency towards negative interpretations and will allow us to see if the mother and child share a negative bias. Next, mothers are given scaffolded directions to ask their child about the specific ambiguous situations the child experienced. There will then be a follow up interview with the child to see if they did indeed form a false memory. Analyses will examine links between maternal negativity, mother and child memory sharing behaviors, and children's interpretive biases and memory during the ambiguous tasks.

Student: Bailey Borreson
Major: Anthropology

Mentor: Dr. Allison Foley
Department: Sociology & Anthropology

History, Ethics, and the Body: Establishing the Provenience of a Mummified Medical Specimen

Despite its long history, the trade in, and display of, mummified human remains, has increasingly been met with sound criticism. While many of these ethical discussions center around archaeological remains, human remains intended for medical display warrant their own ethical analysis. In this study, we present the case of a mummified medical specimen, a young juvenile fixed to a stand/base with musculature, nerves, circulatory system (colored), and various organs preserved and displayed. Rumored to have been seized as the illicit "souvenir" of a naval officer returning from Asia, the mummy was transferred to the longtime custody of forensic anthropologist Dr. Ted Rathbun before its transfer and extended storage in the Charleston County Coroner's Office. The College of Charleston retained custody of the mummy, which exhibited substantial deterioration, in 2017. The purpose of this case study is to not only analyze, understand, and conserve this mummy, but also to de-objectify this child, who, for the last several decades, has been passed around and displayed as a specimen rather than as a humanized individual. With respect to the first research goal, this presentation explores efforts to establish a provenience and health profile of the child through imaging, molecular analysis, and gross observation. In addition to these methods, we present on-going conservation and preservation efforts to diminish further decay of this individual. Providing greater context to this case study, we also present a history of medical mummification, a history of the trade in medical specimens, and an ethical analysis of this practice.

Student: Madison Crow
Major: Hispanic Studies

Mentor: Dr. Ricard Vinas-de-Puig
Department: Hispanic Studies

Expanding Indigenous Language Knowledge and Preservation in South Carolina: A Survey for Immigrant Indigenous Language Speakers in Charleston County

Article 30 of the United Nation's Convention on the Rights of the Child clearly states that any child "who is indigenous shall not be denied the right…to enjoy his or her own culture…or to use his or her own language" (UNICEF 1989). Beyond being an essential expression of identity and culture, language is a human right. However, many indigenous language speakers who have immigrated to Charleston are losing their native tongues as they assimilate into a predominantly English-speaking community. This research project focuses on immigrant, indigenous language speakers and their language use in Charleston with the objective of creating materials to promote language preservation. Utilizing a participatory action research approach, participants will take a collaborative position in informing the research by sharing their realities of being indigenous language speakers. In order to give these participants voice, an anonymous questionnaire will be used to identify indigenous languages in this area, the use of these languages and the attitudes towards language in the community. The data collected will be used to expand the knowledge on the presence and use of indigenous languages in Charleston and to create materials to support indigenous language preservation, including children's books in indigenous languages to promote the sharing of these languages with the next generation. This research aims to give voice to the members of the Hispanic immigrant community who speak indigenous languages and support their linguistic right to use their native tongues while expanding the knowledge on the presence of these speakers and languages.

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 and companion star, novae are frequent occurrences. These novae occur because Hydrogen is being 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 and have accumulated a vast number of observations of novae but after the excitement, they often change their focus to another target. This makes it hard to see what happens to the star after the eruption. Our project is proposing to collect and analyze data from various data sources that span over 100 years in order to try and better understand the long-term evolution of a white dwarf star. The main data sources we work with are those from the Harvard Plate Stacks and sky surveys. The Harvard Plate Stacks contain more than 500,000 photographic plates that go back as far as mid-1800's show observations of the sky like a picture from a telescope would today. The plates are then scanned and uploaded digitally in order to be analyzed. The sky surveys are similar in that observations are made with various telescopes but these observations are made digitally and are much easier to analyze. We then collect all the measurements made from the plates and the modern sky surveys to make a picture of the long-term evolution of our white dwarf stars. All of the combined data allows us to test a leading theory that says white dwarf stars should steadily decrease in brightness over time.

Research Presentation Grant (RPG)

Student: Hannah Addis
Major: Biochemistry

Mentor: Dr. Jennifer Fox
Department: Chemistry & Biochemistry

Interactions between Heme Biosynthetic Proteins in Mitochondria

The mitochondrial electron transport chain (ETC) is responsible for the production and storage of chemical energy in the cell. The fourth major component of the ETC is called cytochrome c oxidase (CcO), and it is assembled from a variety of proteins and non-protein components called cofactors. All these components of CcO need to interact properly for it to run smoothly, and errors can result in a myriad of human disorders and diseases. One component of CcO that is essential for its function is a cofactor called heme A. Heme A is made by the action of multiple enzymes in the cell, one of which we are specifically focusing on. We are investigating the interactions between this enzyme and many other proteins needed for proper CcO assembly to better understand the intricate process required for assembly of CcO.

Student: Miranda Badolato
Major: Exercise Science

Mentor: Dr. Kathleen McInvale
Department: Health & Human Performance

Exploring the Role of Social Support in Peruvian Women's Physical Activity Levels

Peruvians, similar to many other nations, are becoming less physically active and more overweight and obese, particularly Peruvian women of child-bearing age. Since Peru is a resource-limited nation, innovative approaches are needed to address populations at risk of developing diseases related to physical inactivity and overweight. Utilizing social networks is a new and innovative approach to promoting health behaviors. This study observed the relationship between Peruvian women's physical activity levels and their perceived social support from friends and family members for exercise in order to determine the potential for using social networks as an access point for physical activity interventions. This study was part of a larger study

that explored the role of social influences and social networks on obesity within the Peruvian population. Community health workers surveyed 573 women. Their physical activity was assessed using the IPAQ short form and their social support was assessed using Sallis' scales for social support for physical activity. The majority of the women were either overweight or obese (41.9% and 39.4% respectively). Additionally, 37.0% were not physically active. We found a significant and positive relationship between friend's support for exercise and the level of physical activity women engaged in, but did not find a significant relationship for family support and activity level. Although many health studies of Latino populations highlight the importance of the family in health behaviors (familismo) this study discovered that friendship networks may provide more effective points for promoting physical activity in Peruvian women than family networks.

Student: Blaine Billings
Major: Computer Science
Mentor: Dr. Ricard Vinas-de-Puig
Department: Hispanic Studies

Modality and What Should Would Be Acceptable: Syntactic Promiscuity in Spanish and English Double Modal Constructions

Modals are those words that allow a speaker to express intention, belief, or interpretation, such as the English might, could, and would and the Spanish deber, poder, and tener que. In both languages, it is possible to combine two modals in order to express a different meaning such as in might could or puede tener que, though this is much more common in Spanish than in English where it is often considered a dialectical variety common in the Southern United States and Scotland. It has been proposed that modals can be separated into two separate classes and that members of the first class – might, must, may – must precede a modal of the second class – could, would, should, can – in sentences with a double modal. Based on survey results from native English and Spanish speakers on judging how natural a given sentence sounds, this research challenges that assertion within both languages. Furthermore, this research agrees with previously proposed structures for double modals but contends that modals can take on either role given a specific context, making their roles promiscuous.

Student: Andrew Bogatkevich
Major: Biochemistry
Mentor: Dr. Timothy Barker
Department: Chemistry & Biochemistry

Synthesis of Amines by Nucleophilic Ring Opening of Aziridines

A primary concern for pharmaceutical research is discovering efficient methods for synthesizing compounds. Pharmaceutical drugs tend to have very complex structures which means the steps required to make these drugs can be long and tedious. This research proposes an efficient reaction that forms a carbon-carbon bond with a nitrogen containing molecule. Nitrogen is found in every pharmaceutical class of drugs making this reaction very relevant to pharmaceutical research.

Student: Bailey Borreson
Major: Anthropology

Mentor: Dr. Allison Foley
Department: Sociology & Anthropology

History, Ethics, and the Body: Establishing the Provenience of a Mummified Medical Specimen

Despite its long history, the trade in, and display of, mummified human remains, has increasingly been met with sound criticism. While many of these ethical discussions center around archaeological remains, human remains intended for medical display warrant their own ethical analysis. In this study, we present the case of a mummified medical specimen, a young juvenile fixed to a stand/base with musculature, nerves, circulatory system (colored), and various organs preserved and displayed. Rumored to have been seized as the illicit "souvenir" of a naval officer returning from Asia, the mummy was transferred to the longtime custody of forensic anthropologist Dr. Ted Rathbun before its transfer and extended storage in the Charleston County Coroner's Office. The College of Charleston retained custody of the mummy, which exhibited substantial deterioration, in 2017. The purpose of this case study is to not only analyze, understand, and conserve this mummy, but also to de- objectify this child, who, for the last several decades, has been passed around and displayed as a specimen rather than as a humanized individual. With respect to the first research goal, this presentation explores efforts to establish a provenience and health profile of the child through imaging, molecular analysis, and gross observation. In addition to these methods, we present on-going conservation and preservation efforts to diminish further decay of this individual. Providing greater context to this case study, we also present a history of medical mummification, a history of the trade in medical specimens, and an ethical analysis of this practice.

Student: Niamh Cahill
Major: Biochemistry

Mentor: Dr. Wendy Cory
Department: Chemistry & Biochemistry

Investigating Meclizine Tablets for NASA Space Mission Planning

NASA is planning for the first manned mission to Mars in 2033. There are many considerations involved in the planning of this mission, including the health and safety of the astronauts onboard. Any manned spacecraft has a set of medications on board for the astronauts, including meclizine, an anti-motion sickness drug. In this study, four brands of meclizine were chemically analyzed after exposure to high heat and humidity and x-ray radiation, which are conditions that the tablets may be exposed to while in deep space. The tablets were analyzed to test their potency and purity and were compared to the FDA guidelines for pharmaceuticals. The potency of all of the meclizine tablets still met the FDA guidelines for potency, even after exposure to high heat, humidity, and radiation. Some degradation products were observed in the non-irradiated and irradiated tablets exposed to high heat and humidity for two months; however, they still met the FDA guidelines for purity. At this point in the research project, it appears that the meclizine tablets may remain stable, safe, and potent during the mission to Mars.

Student: Xandre Clementsmith
Major: Data Science & Mathematics

Mentor: Dr. Sorinel Oprisan
Department: Physics & Astronomy

Delay Embedding of Low-Dimensional Attractors of Local Field Potentials from Optogenetic Data

We investigated the effect of acute cocaine injection in conjunction with dopamine (DA) receptor antagonists on the medial prefrontal cortex (mPFC), which is believed to mediate addiction behavior but also learning and memory. Cocaine acts by inhibiting DA reuptake in the brain, which elevates the DA level. We investigated also the effect of blocking the two classes (D1 and D2) of DA receptors with SCH 23390 (D1) and sulpiride (D2). The goal of the study was to determine the changes in the gamma oscillations (25-

100 Hz) and their relationship to short term neuroadaptation that may mediate addiction. Gamma brain waves create the unity of conscious perception. We used 17 genetically modified mice such that their mPFC neurons are sensitive to light. We recorded the evoked local electrical activity of neurons, called local field potentials (LFPs), in vivo. The delay-embedding method was used for reconstructing neural activity attractor from LFPs. Basically, the method creates multiple copies of the same LFP shifted temporally to remove the linear correlation among the data, i.e. make them orthogonal to each other. We found that DA receptor antagonists applied before cocaine cancels out the effect of cocaine and leaves the correlations among trials at baseline values. On the other hand, cocaine applied after DA receptor antagonists shifts the correlations to longer durations, i.e. increase the correlation time of LFPs.

Student: Tanner Crunelle
Major: Women's & Gender Studies

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

Towards Equit/Ecology: One Student's Praxis

As a genre-bending, critical-creative work, Towards Equit/Ecology: One Student's Praxis presents a set of possibilities for understanding—and more specifically, theorizing—student leadership on college campuses. My time at College of Charleston has been focused on mobilizing students from across (and between, within, among) different identity categories, with the goal of shared institutional governance annihilation of oppressive mindsets. This presentation, then, focuses on the local and lived experience of student leadership, on the ad hoc strategies student activists devise, and in the way that student activism affects campus-wide operations. Unfolding in sketches, I first outline the emergence of the student-led Intersectional Cougar Action Network (I-CAN) on our campus as a coalitionist response to the destructive actions of white supremacist peers. Then, I detail a research project designed to document repeated and structural harm experienced by marginalized students, in the effort to establish a radically better sense of community in the process of institutionalizing restorative justice. Finally, I will call on autoethnographic meaning-making to "queer" my own assumptions: how the who (person) and what (non-person) divide functions to uphold our sense of who belongs on campus, and how the campus is deeply interdependent. I call this "Institutional Equit/ecology," or the deep inter-reliances and relationships, affinities and tendencies, conscious and subconscious create a social fabric—to which student activists strategically respond. This follows several vibrant discussions in critical race studies, queer studies, and new materialisms—all to show the agency and affective power held by minority student leaders.

Student: Samantha Czwalina
Major: Geology

Mentor: Dr. Chris Freeman
Department: Biology

An Investigation of Detritus Production by Caribbean Sponges

Many coral reef communities are highly productive and diverse, despite being found in low nutrient ecosystems likened to marine "deserts". Sponges (Porifera), a key member of these communities, may play a role in maintaining the productivity of these marine deserts through their recycling of nutrients in the form of dissolved organic matter (DOM). This process, known as the 'sponge-loop,' describes how sponges consume dissolved organic carbon (DOC), a dominant source of organic carbon in the water of coral reefs. Sponges then release this carbon as particulate organic carbon (POC) in the form of detritus. This shed detritus can then be consumed by other reef organisms, such as detritivores and suspension feeders. Despite emerging studies on the sponge-loop, much of the work has been limited to small, encrusting species, with little known on larger, emergent species. To address this knowledge gap, I measured detritus production in thirteen of the largest and most ecologically dominant Caribbean sponge species in Bocas

del Toro, Panama. All thirteen sponge species produced measureable amounts of detritus over the four-day experiment, with high levels of variation across species. On average, sponges produced detritus at approximately 0.1 % of their wet weight, suggesting that communities of large, emergent sponges would contribute substantial amounts of detritus to the nearby coral reef organisms.

Student: Jaclyn Dunne
Major: Biology

Mentors: Dr. Marcello Forconi &
Dr. Michael Giuliano
Department: Chemistry & Biochemistry

Modifications of Thiols via Nucleophilic Aromatic Substitution

Proteins are complex macromolecules that mediate several important biological processes. Proteins are composed by stretches of amino acids, but their biological structure is usually not linear -instead, they adopt a three-dimensional shape that is crucial for their function ("folded" protein). Because of the globular shape, different regions of folded proteins have different properties; thus, we cannot measure the average properties of proteins to determine the causes of their specific function. Although proteins possess a significant variety of chemical groups, they do not possess the diversity available to synthetic chemists. We have developed a method to quickly and selectively modify proteins to introduce chemical groups not found in natural proteins. These groups can act as reporters capable of retrieving information about the protein's local environment. Introduction of these reporters in different parts of the proteins will allow us to determine the characteristics of different regions of the protein. This knowledge will provide an additional, important layer to our understanding of how local properties contribute to the function of selected proteins.

Student: Gracie Eldridge
Major: Geology

Mentor: Dr. Barbara Beckingham
Department: Geology and Environmental Geosciences

Partitioning and Bioaccessability of Polycyclic Aromatic Hydrocarbons in Tire Materials

Extensive usage of tires leads to material shedding onto roadway surfaces. As these particles are dispersed throughout the environment, they are further broken down and subjected to potentially toxic chemicals. Polycyclic aromatic hydrocarbons, PAHs, are a class of hydrophobic organic contaminates that are often associated with tire wear particles (TWP) and crumb rubber (CR). The PAHs are first introduced to the tire-derived particles through production methods but can also sorb to them in the environment. This research determined the CR and TWP solid-water partitioning coefficients for native and spiked PAHs of fluorene and d-pyrene. Results show strong linear isotherms (R2=0.994-0.998) indicating partitioning to the rubber fraction dominates sorption. Other tests use 24-hour TENAX extractions to determine bioaccessibility, fraction of compounds that comes available overtime, of TWP and PAHs. Together, partitioning coefficients and bioaccessibility data will help us to understand contaminant fate and environmental risks from PAHs associated with tire materials.

Student: Bailey Fallon
Major: Marine Biology

Mentor: Dr. Chris Freeman
Department: Biology

Microplastics and Caribbean Sponges

Microplastics (MPs) are ubiquitous across global aquatic environments and are the subject of heavy research in recent years. These spheres, pellets, and fibers between 5 mm and 100 nm in size have been found in fish and other marine vertebrates, but little is known about their presence in marine invertebrates. Marine sponges are aquatic animals that attach themselves to seafloor substrate. They feed by filtering up to 10,000 times their volume of water in a single day, and trap food like microscopic bacteria in their internal canals and chambers. The ubiquity of MPs in marine ecosystems, together with the filter-feeding physiology of marine sponges, suggests that sponges may be taking up MPs as they filter. This study is the first to examine the presence of MPs in marine sponges. To search for microplastics in the environment and within sponge tissue, we sampled seawater and tissue from six common Caribbean sponge species in Saigon Bay, a heavily impacted, shallow-water coral reef in Bocas del Toro, Panamá. Water samples were filtered to retain microplastics and sponge tissue was digested and then filtered to collect microplastics. These filters were visualized under a microscope to identify and quantify plastic particles. Microplastics have been confirmed in water samples from Saigon Bay, and preliminary data suggests that MPs are indeed present in sponge tissues. These findings highlight that marine sponges are exposed to MPs in their environment and may be ingesting these particles as they filter feed.

Student: Bailey Fallon
Major: Marine Biology

Mentor: Dr. Robert Boessenecker
Department: Geology & Environmental Geosciences

Ancient Leatherbacks of the coastal United States: Fossil Ossicles from California and Carolina and the Stories They TellThe leatherback sea turtle (*Dermochelys coriacea*) is one of the most iconic marine organisms. With a shell comprised of a mosaic of bony plates, or ossicles, covered in leathery skin, *D. coriacea* is unique among all living marine turtles that otherwise have more bony shells. Though the modern leatherback sea turtle has received a good deal of scientific attention, its historical counterparts have received considerably less. With at least seven species existing ~23 to 66 million years ago, three likely occurring ~3 to 23 million years ago, and only one species existing today, leatherback diversity has declined over time. Therefore, studying ancient leatherbacks is essential to understanding past diversity and why it may have declined. We describe the fossil remains of ancient leatherbacks from Charleston, South Carolina and from Santa Cruz, California, USA. The Charleston fossils are Oligocene in age (~23.5 to 29 million years old) whereas the Californian fossil is Mio-Pliocene in age (~5 million years old). The fossils consist of ossicles from leatherback shells and represent four different extinct leatherback types: Natemys, Pseudosphargis, Egyptemys and Psephophorus. These ossicles indicate that multiple leatherback species occurred in the Charleston area during the Oligocene, making this the first multispecies assemblage of leatherback fossils reported to date. Further, the ossicles we describe suggest that differences in shell structure may have allowed different leatherback species to occupy separate niches during the Oligocene, allowing for high local diversity. Finally, we hypothesize that cooling global temperatures may have contributed to the decline in leatherback diversity over time.

Student: Phia Gierszal
Major: Biochemistry

Mentor: Dr. Timothy Barker
Department: Chemistry & Biochemistry

Reaction of Alkylboronic Esters with Epoxides

Pharmaceutical drugs are constantly being developed by many chemical industries all over the United States. Small differences of structure and alignment of atoms in different drugs can cause some drugs that appear to be similar in structure exhibit vastly different reactions in the human body. As a result, it is imperative that the structure and alignment of atoms in each drug are known and synthesized correctly. This research deals with a new way to make carbon-carbon bonds and analyzes the structures of products to see whether the alignments of atoms changes during the reaction or not. High yields were obtained in the research of this topic and conclusive data was gathered. The results of this research can help to further the development of synthetic methods for complex pharmaceutical drugs.

Student: Hawken Hass
Major: Psychology

Mentor: Dr. Adam Doughty
Department: Psychology

Effects of Changeover Requirement on Between-Sequence Variation in Pigeons

Research in behavior analysis examines ways we can reinforce particular actions in humans and other animals. Identifying the circumstances that cause certain behaviors allows researchers to further understand and predict behavior. While it is common to study predictable and reoccurring behaviors, it is essential to also examine unpredictable, or variable, behavior. The present experiment addresses questions about the causes of behavioral variability. For example, we are working to identify how much variation is learned in a specific environment versus how much is elicited by that environment. Specifically, variability levels were examined in two groups of pigeons producing four-peck sequences. One group (first changeover) received food if their sequence contained a switch during the first two pecks. Another group (last changeover) received food if their sequence contained a switch during the final two pecks. Neither group was required to vary their behavior, but elevated variability levels occurred for the pigeons in the last changeover group. These findings help us understand some of the causes of elicited variation. Said simply, unlearned variation is partly the result of reducing repetition that can occur just before reinforcement. It is important to understand the causes of variation because variation can aid in creativity and problem solving and often is at abnormal levels in certain clinical populations (e.g., people with autism, depression, or attention deficit hyperactivity disorder).

Student: Elizabeth High
Major: Public Health

Mentor: Dr. Kathleen McInvale
Department: Health & Human Performance

Presenting Social Support as a Predictor of Obesity Related Behaviors in Peru

Peru is a resource-limited country going through a nutrition transition. Peru is facing a sharp decline in physical activity coupled with an increase in excess weight, with women of childbearing age being at the greatest risk. As Peru is a resource-limited setting, utilizing social networks may be an effective way to influence health behaviors related and leading to excessive weight gain. This study seeks to see if the social support women receive for engaging in exercise has any relationship with their physical activity levels, ultimately trying to understand how social networks might positively influence physical activity behaviors. This was done as part of a larger study examining social influences on nutrition and physical activity. This study was completed using the Sallis's social support for exercise scales and the IPAQ short form physical activity questionnaire. Community health workers conducted interviews in the participant's homes in three

rural northern Peruvian villages. There was a total of 573 women interviewed. Of these 573 women, 39.4% were obese, 41.9% were overweight, and 37.0% reported not being physically active. We found that the relationship between social support from friends for exercise was positively associated with physical activity behaviors. This study found that friendship networks played a greater role in positively influencing physical activity in women than familial networks. To summarize this implies that friendship-network interventions in this particular population has a greater chance in promoting physical activity than family based interventions in order to reduce the risk of disease.

Student: Catherine Hill
Major: Political Science

Mentor: Professor Megan Goettsches
Department: Women's & Gender Studies

Systematically Counted and Silenced: Exploring the Effects of Prison Gerrymandering

This project seeks to fill a gaping hole in the present literature on prison systems and their effects by examining popular opinion and prisoner opinion on the consequences of prison gerrymandering. Because prisoners have been stripped of their voice in the political process, politicians largely ignore these populations, despite using them for political gain and strategy. Prisoners are then further stripped of any political influence, having thus lost the right to vote for their representative while simultaneously being included in census data utilized to redraw district lines. Their bodies being used as pawns on the political chess board should be equally disconcerting to those residing in districts to and from which they are moved, as the implications of voter disenfranchisement reach far beyond prison bars. Given the expectation that those most affected- prisoners and the communities from which they come- will be concerned or even outraged at this long-overlooked form of gerrymandering, we will use both surveys and interviews to gauge perceptions on the issue from both of these populations. While we hope these communities will be knowledgeable about this situation and will express frustration at the systematic use of prisoners to enhance the political power of some at the expense of others, we expect to find that the public and incarcerated populations will have little to no knowledge of this widespread issue.

Student: Mason Huebsch
Major: Biochemistry

Mentor: Dr. Jennifer Fox
Department: Chemistry & Biochemistry

Investigating the Mechanism of Eukaryotic Heme A Synthase

Mitochondria are organelles found in eukaryotic cells tasked with production of energy. Mitochondrial dysfunction has been tied to many diseases such as Alzheimer's and Parkinson's disease. In my project, I aim to better understand the structure, function, and interactions of a vital protein found in mitochondria to obtain a more complete understanding of the inner workings of mitochondria in the hopes of contributing to the correction of mitochondrial disorders and mutations. The protein I study is known as heme A synthase, and it is responsible for the formation of a molecule called heme A, which is necessary for proper mitochondrial function. In my presentation I will summarize the experiments conducted to study the heme A synthase protein, such as the structure of the protein and relative locations of important amino acids, as well as the detection of a molecule found within the protein, known as heme B, which is suggested to be vital to the protein's function. Understanding the mechanism of heme A synthase function and the protein's interactions within mitochondria is a small contribution to the overarching goal of creating cures and therapies for mitochondrial disorders that affect many people across the world.

Student: Skye Jacobson
Major: Biochemistry

Mentor: Dr. Amy Rogers
Department: Chemistry & Biochemistry

Expression and Purification of the Endothelial Nitric Oxide Synthase Heme Domain R367K Mutant

Time and again you hear about harmful molecules that should be avoided. But have you ever heard of a dangerous molecule that the body needs? Nitric oxide (NO), a toxic gas similar to carbon monoxide, is just that molecule. In fact, it was awarded Molecule of the Year in 1992 for its surprising role as a neurotransmitter, vasodilator, and anti-cancer agent. So how this toxic molecule delivers Dr. Jekyll's effect and not evil Mr. Hyde's has always been puzzling since its discovery. The enzyme nitric oxide synthase (NOS) produces NO in vivo by converting the substrate L-arginine into L-citrulline and NO but exactly how this is done is not well understood. There are several cofactors that are needed by NOS in order for the reaction to produce product; one of them is called tetrahydrobiopterin (BH4). Without BH4, the reaction does not produce product and reactive oxygen radicals are formed instead. But the exact role of the BH4 is unknown. We believe that one key factor in understanding how NOS produces NO lies in understanding how BH4 binds to NOS and what it is doing during catalysis. Herein, we report protein expression and purification of native NOS and its R367K mutant and spectroscopic assays and X-ray crystallography studies with purified protein and BH4. Uncovering the role of BH4 could provide insights into how NOS produces a toxic gas in a perfect orchestration as to provide essential biological functions like neurotransmission or cardiac blood flow.

Student: Dashiell Jay
Major: Biochemistry

Mentor: Dr. Michael Giuliano
Department: Chemistry & Biochemistry

Bilayer Interactions of the Endogenous Opioids

The endogenous opioids are a class of naturally occurring neuropeptides, which are protein-like signaling molecules in the nervous system. In addition to their ability to lessen the sensation of pain, neuropeptides are known to have numerous other psychological and physiological functions related to memory, metabolism, and mood disorders. These peptides bind to the three opioid receptors: μ, δ, and κ. Common to all of these opioids is a four amino acid message sequence, referred to as "YGGF" for its amino acid code; this message sequence is identical in opioids of all 3 receptor subtypes. This study explores a range of YGGF-peptides, featuring structural analyses of the δ-selective Enkephalins, μ/κ-selective adrenorphin, and κ-selective α-neoendorphin. We are investigating how additional amino acids outside of this message sequence affect the structure of YGGF, perhaps pre-organizing the opioid message sequence in three-dimensions for specific receptor binding. We also wonder if these other amino acids might affect how and/or whether opioids interact with models of cell membranes, whether such interactions are general to all opioid peptides, and what they might mean for how they activate their receptors. The opioids are studied in water as well as conditions which mimic cell membranes, primarily using Nuclear Magnetic Resonance [NMR] techniques to carry out our experiments.

Student: Vernon Kennedy
Major: Biology

Mentor: Dr. Jennifer Wilhelm
Department: Psychology

Estrogen Signaling is required for Treadmill Exercise Mediated Effects on Synaptic Plasticity around Axotomized Spinal Motoneurons

Each year 100,000 Americans experience injuries to their peripheral nerves. Most of these patients don't fully recover and are left with physical deficits. This inadequate healing often results from reorganization of connections in the spinal cord, even though the spinal cord isn't directly injured. Following peripheral nerve injury, many synaptic connections within the spinal cord can be lost or remodeled. These changes in excitatory (glutamatergic) and inhibitory (GABAergic) connections result in miscommunication between the spinal cord and muscles, leading to muscle spasms and muscle degeneration. Previous research suggests that treatments with sex steroids (testosterone) can mitigate this reorganization. In this study, we explored whether estrogen could potentially reduce and/or eliminate the unwanted reconstruction in the spinal cord after injury. Using a mouse model, we surgically injured the sciatic nerve of the right hind limb. Injured neurons were marked by a fluorescent dye that traveled retrogradely towards the cell body. Immediately after the injury, the animals were treated with estrogen for two weeks. Following this period, tissue samples from the spinal cord were harvested and sliced with a cryostat. Spinal cord sections were stained for glutamatergic and GABAergic synapses. Changes in these connections onto the injured neurons were observed via fluorescent microscopy. We observed a decrease in the reorganization of glutamatergic and GABAergic synapses after estrogen treatments are applied compared to untreated animals. These findings are significant because they further illuminate the relationship between sex hormones and neurotherapy in a way that could birth effective treatment plans for humans.

Student: Marissa Knight
Major: Geology

Mentor: Dr. Theodore Them
Department: Geology & Environmental Geosciences

Assessing the Chemostratigraphic Record of Sedimentary Mercury Concentrations across the End-Cretaceous Mass Extinction Event

The primary driver of most mass extinction events throughout Earth history has probably been large-scale volcanism. Scientists study mercury in ancient marine sediments to track volcanic activity because volcanoes release mercury to the atmosphere. It is quite possible and even probable, however, that large-scale volcanism was not the sole origin of the mercury anomalies previously observed because there are other additional natural sources of mercury in earth's surface environment. These other important sources include the oceans, rocks, soils, and plants. Furthermore, many of the previous studies that have identified increases in the amount of mercury in sediments from each mass extinction event came from locations that were close to land. Also, these study sites have changes in the type of rock deposited during the mass extinction event, which can be problematic. We plan to generate mercury concentration data in sediments deposited in a sequence from land to offshore, with only minor changes in lithology, across one of the largest mass extinction events, the end-Cretaceous mass extinction. These new records will enhance our knowledge of mercury cycling through an ancient interval of time with major environmental and biological disturbances. Therefore, the impending results may suggest that ancient mercury anomalies need to be reevaluated as a proxy that only infers volcanism.

Student: James Linzel
Major: Chemistry

Mentor: Dr. Marcello Forconi
Department: Chemistry & Biochemistry

Introduction of Fluoroaromatic Probes into Peptides and Proteins via Nucleophilic Aromatic Substitution

Proteins are biological macromolecules that perform a multitude of functions in living organisms. Despite their structural complexity and the thousands of atoms present, it is possible to selectively attach tags to proteins by exploiting the intrinsic chemical reactivity of some of the rare atoms present. We have used a simple chemical reaction to attach a "tag" not found in Nature to sulfur atoms contained in proteins. Herein, we have used nuclear magnetic resonance (NMR) to measure the degree of modification of a simple chemical compound that contains the sulfur atom present in proteins when reacted with a variety of commercially available potential tags. We found that a particular compound, 3,4,5-trifluorobenzonitrile, reacts very well with sulfur atoms to yield only one product. This compound contains chemical groups that can be used to investigate the chemical properties of the environment surrounding them. Such measurements will provide important information about the properties of proteins in their folded, active state.

Student: Mary Britt McDonald
Major: Biochemistry

Mentor: Dr. Jay Forsythe
Department: Chemistry & Biochemistry

Investigating the Role of Chirality in the Formation and Hydrolysis of Model Prebiotic Peptides

A key concept in chemistry is chirality, or the handedness of molecules. Many molecules have right-handed (D) and left-handed (L) forms which resemble mirror images, though they are not superimposable. Amino acids in peptides and proteins are almost always in L-form, except for glycine which has no handedness (achiral). The question of why biology selected for left-handed amino acids and not right-handed amino acids is of great interest to origins-of-life researchers. The majority of model prebiotic reactions and meteorites suggest early amino acid mixtures contained both forms; therefore, it is unclear how L-amino acids emerged. In order to study this, we heated solutions containing D and L amino acids with similar molecules called hydroxy acids to form peptides of varying chirality. Amino acids were combined in different ratios and all L-forms were isotopically-labeled with carbon-13 so that we differentiate the two. Various techniques were used to investigate whether D, L, or mixed D/L peptides had different molecular properties and stability in water. Analyzing such differences in model primordial earth conditions may help to explain why L-chirality arose.

Student: Emily McGee
Major: Biochemistry

Mentor: Dr. Michael Giuliano
Department: Chemistry & Biochemistry

Toward an Understanding of the Relationship between Sequence, Acylation, and Solution Behavior in Human Ghrelin

Ghrelin is a growth hormone and a neurological signaling molecule whose activity depends on the modification of the third amino acid in its sequence. The peptide is modified with an eight-carbon fatty acid, and this modification is crucial to the function of the peptide. Ghrelin is the only known peptide hormone that is modified with this fatty acid, which makes it notable peptide to study. Ghrelin has a role in many physiological functions, including appetite regulation. Ghrelin is active even when only small fragments of the peptide are present, provided that the fatty acid modification is preserved. Our group is interested in looking at the interplay between three-dimensional structure, sequence length, and the role of ghrelin's

unique modification. Thus far, we have synthesized and purified five-residue and ten-residue fragments of ghrelin with and without the fatty acid modification, optimized conditions for synthesis, and run some initial experiments to begin understanding solution behavior in these molecules.

Student: Clara Meier
Major: Geology

Mentor: Dr. Theodore Them
Department: Geology & Environmental Geosciences

Ocean, Atmosphere, Land: Assessing the Source(s) of Mercury across the Paleocene-Eocene Thermal Maximum

The Paleocene-Eocene Thermal Maximum (PETM) is an extreme global warming event that occurred ~56 Ma and is considered a climate change event similar to what we are facing today. Many ideas have been proposed to explain what triggered this rapid warming event. Extensive volcanism has remained at the forefront due to the presence of Large Igneous Provinces (LIP) that are found during this time interval. Recently, mercury (Hg) concentrations found in ancient ocean sediments have been used to track volcanic activity during the PETM. Previously, the presence of Hg in these sediments has been directly attributed to volcanic activity. However, Hg can be deposited by a variety of sources (weathering, soil loss, biomass burning), and therefore, these other mechanisms must be considered when trying to determine the source of Hg in the marine sediments. Here, we use samples of sediment from sites in the New Jersey Coastal Plain and analyze them to figure out how much Hg is at each site within the time interval of the PETM as well as the time leading up to the event. This research will extend the current records to represent multiple environments that were close to and far from land. The results of this research have a distinct possibility of challenging the current perception that ancient sedimentary mercury anomalies are the product of only volcanic activity, which has major ramifications for our quest to directly link massive volcanism to climate change and mass extinction events.

Student: Gabrielle Mullins
Major: Psychology

Mentor: Dr. Stephen Short
Department: Psychology

The Role of Place Attachment and Message Framing on Climate Change Risk Perception

According to a poll conducted by Yale University, 58% of U.S. adults are concerned about climate change, but only 40% of U.S. adults think it will personally impact them (Howe et al., 2016). Past research indicates that individuals' emotional and cognitive bonds with a particular place (i.e., place attachment) can influence their perception of the risks of climate change. Additionally, the contexts in which climate change risks are communicated (i.e., message framing) can affect individuals' perceived risk. Examined together, research has shown that individuals possessing higher levels of place attachment and receiving locally framed messages on the impacts of climate change demonstrate higher perceived risk (Scannell & Gifford, 2013). The goal of the current study was to explore if the effect of place attachment on climate change risk perception is moderated by the type of message framing received. A sample of undergraduate students from a mid-size Southeastern U.S. college completed online surveys measuring their place attachment and perceived risks of climate change both locally and globally. Although data analysis is still ongoing, a series of statistical tests will be conducted to determine if the relationship between climate change risk perception and place attachment is moderated by message framing. Locally framed messages are hypothesized to be more strongly associated with increased place attachment and climate change risk perception compared to globally framed messages.

Student: Claire Natiez
Major: Dance

Mentor: Dr. Gretchen McLaine
Department: Theatre & Dance

Senesce

The piece I am choreographing is a modem dance trio. The trio explores individual identity, and how we as humans pick and choose behavior we have inherited from our parents to keep or let go of, whether that may be a conscious or unconscious decision. This personal growth can be represented in three stages: early childhood- not being aware of our surroundings or our place in the world, early adolescence- wanting to conform/ copy those around us, young adulthood- experiencing independence which then feeds individuality and exploration. Each dancer will represent one of these stages, and my three music choices will reinforce this idea. I plan to include my dancers by having them reflect on their own search of identity and sharing these reflections in order to influence movement patterns and vocabulary. In preparation for ACDA, I will be holding two three-hour rehearsals each week with the dancers, as well as an average of two additional hours of independent study to create choreography. My creative process began in late October and will culminate with the conference performance. I am looking forward to creating this piece of embodied research as I feel it reflects the stage of my life I am going through and creates a piece to which the audience can relate.

Student: Lauren Nelson
Major: Public Health

Mentor: Dr. Kathleen McInvale
Department: Health & Human Performance

Presenting Social Support as a Predictor of Obesity Related Behaviors in Peru

The research project aimed to examine the influence of social support on physical activity and diet habits leading to obesity. As obesity levels in Peru grow, the disease must be thoroughly inspected to determine root causes. The issue has been a prominent health determinant in the United States and other high-income areas, but has recently traveled into low and middle income countries and affected the global health status. An obesity-prone Peruvian region in northern coastal Peru was investigated and 573 women were interviewed. Adults were surveyed by trained community health workers about their diet and physical activity choices. IPAQ's short form survey was utilized to measure physical activity, and Sallis's social support scale was utilized to determine social relationships to examine the connection between social relationships and physical activity behaviors. Body fat percentages and body mass index were used as physical measurements to further assess weight status of the individuals. 41.9% of the 573 women were overweight, 39.4% were obese, and 37.0% were physically inactive. Results showed that social support for exercise from friends positively correlated to increased physical activity while familial support was found to be statistically insignificant. Friendship networks were found to play a more significant role in the Peruvian women's physical activity. This study is useful as it shows the importance of friend support when creating interventions to increase physical activity among Peruvian women.

Student: Bach Nguyen
Major: Biochemistry

Mentor: Dr. Katherine Mullaugh
Department: Chemistry & Biochemistry

Sulfidation of Silver Nanoparticles by Zinc Sulfide

Silver nanoparticles (Ag NPs) are commonly used in consumer products because of their antimicrobial properties, but concerns have been raised about their toxicity in the aquatic environment. Previous studies have shown that reaction between Ag NPs and metal sulfide can result in the formation of silver sulfide, a stable product that mitigates Ag NP toxicity. Therefore, a complete understanding of the ecological risk of

Ag NPs requires careful study of these so called "sulfidation" reactions. This reaction results from the competitive displacement of another metal by silver to form the sulfide product, and this study aims to explore how the characteristics of Ag NPs and water condition affect the reaction of Ag NPs with zinc sulfide. Our approach follows adding Ag NPs to zinc sulfide then monitoring the release of zinc as it is displaced by silver. The results showed that small Ag NPs reacted faster than those with larger size due to their greater relative surface area. Additionally, different capping agents of Ag NPs also affect their reaction rate, but none of the coating investigated was able to prevent sulfidation from occurring. These studies not only provide further insight into an important fate of Ag NPs, but also demonstrate how the environmental release of Ag NPs could impact the chemical form of other metals in natural waters.

Student: Andrew Pampu
Major: Biochemistry

Mentor: Dr. Frederick Heldrich
Department: Chemistry & Biochemistry

Metal Catalyzed Coupling in the Synthesis of Bis-Para-Anisyl Alkanes

This project involves using metal to make a reaction possible. Taking two different types of organic molecules and combining them, we hope to use a new methodology published by Weix to make this possible in a more efficient manner. This task has been done before by Dr. Heldrich and his previous students, however, this new method should limit the labor-intensive issues associated with the previous method. When we isolate our desired compound and the different derivatives of it, which vary in the length of a chain of atoms within the compound, we can analyze it to see how the change in length influences how easily the compound can form. We will also be able to use our desired compound and the different derivatives to use it to model a compound found in nature. This is important because scientists are extremely unsure how this compound we hope to model can be made in a lab versus in nature by natural processes. We hope to contribute to this conversation using our model to demonstrate certain chemistry tricks to obtain the features within the compound that are similar to the one found in nature.

Student: Lyndsey Prosser
Major: Biochemistry

Mentor: Dr. Richard Himes
Department: Chemistry & Biochemistry

Vitamin K2 Analogs as Anti-Epilepsy Therapeutics

Epilepsy is a disease that causes incapacitating seizures in patients. There are treatments currently available that control seizures for many people, but for thirty percent of epilepsy patients there are no available drugs that are effective. These patients have a form of epilepsy called "medication-resistant" epilepsy. One theory for the cause of medication-resistant epilepsy is that the patients' brain cells have an impairment that makes it impossible to maintain a proper energy balance in the cells, occasionally leading to a burst of seizure activity. To try to develop a successful treatment for medication-resistant epilepsy, we have prepared a number of chemical compounds that have a structure similar to that of Vitamin K. Literature and our own work has shown that molecules of this type have a beneficial effect on energy imbalance in cells. We have tested these compounds for potential effectiveness against epilepsy in a zebrafish model of the disease. A chemical is used to induce sudden, sporadic swimming similar to a seizure. Several of our molecules are able to slow or prevent this uncontrolled swimming, which is promising for potential anti-seizure activity in patients. We will present results related to the preparation of the active chemical compounds, the results of the studies in zebrafish, as well as future directions for developing one or more of the compounds into a potential drug for people.

Student: Emily Ramsayer
Major: Biochemistry

Mentor: Dr. Katherine Mullaugh
Department: Chemistry & Biochemistry

Influence of Ligands and pH on Dissolution of Zinc Oxide Nanoparticles

Zinc oxide (ZnO) and copper oxide (CuO) nanomaterials have been incorporated into a variety of consumer products due to their UV absorbing and antimicrobial properties. The rapidly increasing used of these novel materials has generated concern about their potential environmental impact. When these metal-containing nanoparticles are leached into aquatic ecosystems, they undergo a variety of changes, one of the most important of which is dissolution. When nanoparticles dissolve into their component metal ions, aquatic life can be threatened due to the increased bioavailability in the ionic form. To investigate how the composition of the surrounding water influence ZnO and CuO nanoparticle dissolution, an electrochemical technique was used that allowed dissolution to be monitored in real time. The dissolution of ZnO nanoparticles was significantly faster and more complete in neutral conditions (pH = 7.0) compared to those that were slightly basic. Results indicate that both ZnO and CuO nanoparticles dissolve more rapidly and to a greater extent in higher concentrations of molecules that are capable of binding and further stabilizing the ionic forms of zinc and copper. These laboratory studies provide valuable insight into how ambient conditions in natural waters can control nanoparticle behavior and can be used to predict the potential environmental impact of ZnO and
CuO NPs.

Student: Abigail Reeves
Major: Biochemistry

Mentors: Dr. Jennifer Fox &
Dr. Marcello Forconi
Department: Chemistry & Biochemistry

Predicting Reactivity of Homologous Sulfohydrolases via Bioinformatics

Enzymes are biological molecules that enable all the chemical reactions necessary for life. One type of enzyme called sulfohydrolases is found in a wide variety of organisms and allows them to perform reactions that release free sulfate, an important component needed for metabolic processes in cells. One sulfohydrolase called SdsA1 is found in a bacterial species that acts as a human pathogen. SdsA1 reacts with the man-made detergent sodium dodecyl sulfate (SDS), which is used in shampoo among other products. There are relatives of SdsA1 in other organisms, including multicellular life as diverse as cucumbers and antelopes, suggesting it is likely that there is a more biologically relevant molecule than SDS that this enzyme reacts with in the cell. We have experimentally examined the reactivity of two SdsA1 relatives called Bds1 and CddY, which are found in baker's yeast and a bacterium, respectively. We are now taking a bioinformatics approach, that is, an approach utilizing accessible databases and computer programs that allow us to compare these related enzymes and thus predict their function. One such method of bioinformatics research is the examination of gene clusters, or regions of the genetic code that result in the production of multiple proteins at the same time. We have identified that the CddY enzyme produced by two distinct bacterial species is located in different gene clusters and that this enzyme may be involved in a pathway that allows bacterial cells of differing species to communicate.

Student: Keon Rezaeerod
Major: Biochemistry

Mentor: Dr. Jay Forsythe
Department: Chemistry & Biochemistry

Development and Validation of a Differential FTIR Method for the Analysis of Model Prebiotic Peptides

A major goal of origins-of-life research is to determine how amino acids formed peptides, or small chunks of protein, in prebiotic times. The formation of a peptide bond between two amino acids requires getting rid of water; therefore, water is often heated to evaporation in model prebiotic reactions. However, small cyclic peptides known as diketopiperazines (DKPs) can result from this reaction and hinder growth of longer chains. Previous work has shown that mixing amino acids with hydroxy acids, similar in structure and also thought to have been on the early Earth, can bypass this barrier by forming mixed peptides called "depsipeptides." These begin to resemble biological peptides when subjected to repeated cycles of hydration and evaporation (known as "wet-dry cycles"). The purpose of our research was to develop an infrared (IR) spectroscopy method to characterize complex mixtures of depsipeptides. Specifically, IR spectroscopy helped us to quantify the abundances of amide and ester chemical bonds in the molecules. Depsipeptides were formed by subjecting amino acids and hydroxy acids to wet-dry cycles and both amide and ester functional groups were monitored over time. FTIR spectra were validated using an orthogonal technique, mass spectrometry (MS), which is typically used to determine depsipeptide lengths, compositions, and sequences.

Student: Casey Roche
Major: Psychology

Mentor: Dr. Amy Kolak
Department: Psychology

The Perfect Narcissist

This project examined the role of age in the correlation of narcissism and perfectionism. Narcissism (a personality trait characterized by an inflated sense of self) and perfectionism (an inflexible set of high standards for oneself and others) have been shown to be related to each other in a way such that high levels of narcissism lead to high levels of perfectionism and vice versa. With a sample of 248 participants, ages ranging in 18-71, it was found that age in fact moderates the relationship between narcissism and perfectionism. For our age groups that range from 18-24 and from 30-39, a steeper relationship was seen (meaning that for these age groups, perfectionism is a better predictor of levels of narcissism). Further research is needed to understand if this is a cohort effect or an effect of change over time, and if these findings hold up over multiple trials.

Student: Emmaline Sheahan
Major: Marine Biology

Mentor: Dr. Gretchen McLaine
Department: Theatre & Dance

Cogito: An Undergraduate Modern Dance Work

My piece is a modem dance detailing the evolution of human consciousness and the ordeal of navigating the faculty of will, especially with regards to interacting with others. The theme was inspired by the writings of Renee Descartes and Immanuel Kant, and the title is a reference to Descartes' proof of his own existence via his awareness of his own cognition in the Meditations: "I think, therefore I am," a sentiment usually portrayed in the Latin *cogito ergo sum*. The piece is also a reflection of Kant's estimation that the rational animal is no longer naturally inclined towards happiness given its self-awareness and necessity to make decisions, an ordeal which latently induces concepts of uncertainty and dread regarding what one should

do at any given moment. The piece involves four dancers who encapsulate different methods of utilizing their own consciousness and will, as well as a black box prop which represents the gradual accumulation of higher states of cognition. I choreographed and taught this piece to my cast over the course of three months during the spring 2019 semester, a process which involved two one and a half hour rehearsals a week. These rehearsals continued during the fall semester as we prepared for the fall dance concert, and in preparation for presenting the piece at ACDA, we will be rehearsing the dance for an hour a week so as to refine movement between dancers and revise issues.

Student: Elizabeth Smolenski
Major: Biochemistry

Mentor: Dr. Marcello Forconi
Department: Chemistry & Biochemistry

Kinetic Isotope Effect on the Kemp Elimination

We are studying a class of catalysts, known as enzymes, which are used to efficiently increase reaction rates. These are ubiquitous in living organisms, and are able to increase the rate of a reaction by acting on a substrate without actually going through any change themselves. We also observe the effect of exchanging one atom on a substrate for one of its stable isotopes. An isotope is a version of an atom that is different only by its mass; to be stable, an isotope may not be drastically altered by the mass difference. Specifically, we study the rates of these enzymatic reactions on substrates and their isotopic counterparts in the presence of different catalysts. The measurements observed give us an understanding of what type of mechanism the reaction may undergo.

Student: Shawn Spann
Major: Chemistry

Mentor: Dr. Richard Lavrich
Department: Chemistry & Biochemistry

Origin of Conformational Flexibility in Linear Amino Alcohols

Linear amino alcohols are a class of molecules that contain alcohol (OH) and amino (NH2) functional groups separated by CH2 groups. The amino and alcohol groups interact through what is termed an intramolecular hydrogen bond in which the hydrogen atom of the OH group is attracted to the lone pair of electrons on the nitrogen of the NH2 group. This intramolecular hydrogen bonding interaction serves to stabilize the conformation, or three dimensional shape, of the molecule. Recent experimental studies in our lab have determined the conformations of a series of amino alcohols. They differ in the distance separating the hydrogen bonding groups by increasing the number of CH2 groups present. For linear amino alcohols with up to four CH2 groups between the amino and alcohol groups only one conformation is observed. Two conformations were observed for the amino alcohol with five CH2 groups. The current study seeks to correlate the appearance of this conformational flexibility to a reduction in calculated energy barriers that must be overcome in order for the molecule to change its shape for the larger amino alcohol.

Student: Abigail Stephens
Major: Marine Biology

Mentor: Dr. Chris Freeman
Department: Biology

Sponge Babies: Larval Survey of Caribbean Sea Sponges

Sponges (Porifera) are an ecologically important group of marine organisms with a global distribution. This group has been particularly successful within the Caribbean Sea, but there is still minimal information about their reproduction, even for the most dominant species in the area. To improve our understanding of this, last summer, a larval survey was conducted on eight dominant species of Caribbean sponges in Bocas del

Toro, Panama. Larvae were found in four of these species, with only two species containing swimming larvae, generally indicating further development. This study showed that these four sponges are actively brooding and reproducing during the month of July in this region. These results that will be presented at the Benthic Ecology Meeting, along with detailed microscopic photography of the larvae. More work is being done during the school year with microscopy, taking detailed images of different layers of the larvae found to reveal internal structures, further determining their developmental stage. In addition to this, samples of larvae and adult sponge tissue are currently being analyzed for their microbiome content, in order to determine whether microbial symbionts in the larvae are passed on from their parent sponge (vertically transmitted) or from the environment (horizontally transmitted). These results will increase our understanding of how sponges reproduce and highlight the importance of microbial symbionts to early sponge development. As we gain a more complete timeline of sponge reproduction in the Caribbean, we will also be able to plan and execute additional hypothesis-driven research on this topic.

Student: Briana Taormina
Major: Biochemistry

Mentor: Dr. Marcello Forconi
Department: Chemistry & Biochemistry

Kinetic Isotope Effect in the Kemp Elimination Catalyzed by Heme Systems

Chemical reactions can be made faster through the use of substances called catalysts. One of the most efficient classes of catalysts are macromolecules called enzymes. Enzymes accelerate chemical reactions in the body up to the speed that is needed for that organism to sustain life. An important factor to note when studying a reaction is to ensure that the reaction proceeds in the same manner with and without the enzyme. Because we are not able to see chemical reactions, we have to use reporters to determine their properties. The reporter that we used to investigate the pathway of our target reactions are stable isotopes, or versions of the same atom that vary in mass, because they do not usually change a reaction's characteristics. The isotope pair that we used is the simplest chemical element (hydrogen), and its isotope, deuterium. In this project we measured the effect of substituting a hydrogen atom with a deuterium one using different catalysts, and the magnitude of these effects has been used to compare reaction mechanisms in different conditions and with different catalysts.

Student: Reilly Walker
Major: Exercise Science

Mentors: Dr. Michelle McLeod
& Dr. Tom Parry
Department: Health & Human Performance

Effects of Yoga Participation on Dynamic Balance and Core Strength

Yoga is identified by the NIH as a top-10 complementary health approach and continues to grow in popularity and practice. Previous studies investigated physical changes in older adult populations related to stroke recovery, cancer, and fall prevention. Yet, few studies have studied college-aged populations and much evidence is limited to outcomes of perceived stress. The purpose of this study was to investigate the effects of participation in a structured yoga class on dynamic balance and core endurance. 17 students enrolled in introductory yoga participated. We used a pretest-posttest design in a controlled laboratory setting. Within the first 2 weeks we assessed balance in 3 directions. Participants completed a series of single-leg reaches in each direction for maximal distance, in a randomized order. Up to 6 practice trials were allowed, followed by 3 test trials that were averaged and normalized to true limb length. To assess core endurance, participants held a high plank and side planks bilaterally, during a single trial for maximal time, with 1-minute of rest between trials. All participants reported for follow- up testing 8-weeks later. Separate 2x2 repeated measures ANOVAs were used to assess for limb (or side) by time differences. A

paired t-test was used to determine differences in high plank performance. There were no significant interactions or effects for any of our outcome measures. However; large variances in performance likely limited our findings. Future directions of study include assessments of strength, flexibility and using modified methods for progressively assessing core endurance.

Student: Emma Watt
Major: Biochemistry

Mentor: Dr. Richard Himes
Department: Chemistry & Biochemistry

Vitamin K2 Analogs in Toxicant-Induced and Genetic Models of Parkinson's Disease

Parkinson's disease (PD) is a neurodegenerative disease that is characterized by the gradual death of brain cells and development of common physical symptoms, such as body tremors. This disease is greatly affecting our elderly population today. Drugs that are currently on the market can temporarily help control the tremors associated with the disease. But there are not treatments available to stop or slow the death of brain cells, which causes and advances the disease in patients. The goal of this research is to create a compound that can protect brain cells in Parkinson's patients and slow the development of the disease. Scientific literature suggests that molecules with structures resembling Vitamin K may help protect brain cells. We have produced a number of new compounds like this and have begun testing their activity in an animal model of Parkinson's. This model is a zebrafish with a genetic mutation that causes inherited forms of Parkinson's in people. These fish display neuron death and motor symptoms. We will describe our results of how our molecules are able to alleviate or reverse the physical symptoms associated with this mutation.

Student: Kristen Weeks
Major: Biochemistry

Mentor: Dr. Neal Tonks
Department: Chemistry & Biochemistry

Synthesis and Analysis of Biologically Compatible Drug Delivery Systems

Polyurethanes are being developed for medically implanted devices which incorporate drug delivery systems. Polyurethanes are produced from the reaction between a diisocyanate and a polyol. For this study, four different diisocyanates were used along with a soy-based polyol to synthesize the polyurethanes. Soy-based polyols break down into fatty acids inside the body as opposed to petroleum based polyurethanes which break down into glycol ethers which are not as easily eliminated under physiological conditions. By incorporating a drug-delivery pro-drug diol into the polyurethane matrix, a material is produced that slowly releases the drug under physiological conditions. The pro-drug was produced via the esterification with solketal followed by cleavage of the acetal to form a diol. The diol allows the pro-drug to be covalently incorporated into the polyurethane backbone, while the ester is easily cleaved under physiological conditions for drug releasing purposes. The focus of this study was on the synthesis and degradation of nalidixic acid and naproxen prodrug delivery when incorporated into different polyurethanes and analyzed by high performance liquid chromatography (HPLC) to analyze the release kinetics of the drugs under physiological conditions.