COLLEGE of CHARLESTON
UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

2015 - 2016 Award Recipients

The office of Undergraduate Research and Creative Activities is pleased to announce the Grant Award Recipients for the 2015–2016 academic year. Please join us in congratulating these students and their mentors.

Major Academic Year Support (MAYS)

1. **Student: Claire Ahlin** — **Major:** Theatre
   Mentor: Charles Calvert — **Department:** Theatre and Dance
   Title: *Digitizing the Design Process*

The 21st century has introduced us to the future of communication for theatrical design with the advent of tools like the interactive pen display. This tool enables designers to create works of art faster and with more precision than ever before. The interactive pen display can be used with web applications like SyncPad, which allows two people to draw and paint on the same file at the same time. Creating works digitally allows artists to collaborate in real time while miles away from each other. No longer will scene designers and directors leave a phone conversation with two separate interpretations of the discussion. Meetings can now take place in real time while viewing actual sketches and research provided by the designer. Works can be seen, commented on, and revised immediately. As this technology and these methods gain speed in the industry a designer's proximity to a particular theatre company will become less of a deciding factor. Students who are familiar with these types of technologies and are able to communicate well from afar, will be more employable in a wider range of venues, regardless of where they reside.

2. **Student: Dorothy Alice Blake** — **Major:** Psychology
   Mentor: Cindi May — **Department:** Psychology
   Title: *Prospective memory and emotional auditory cues: An applied study*

Prospective memory (PM) is the memory to execute a task in the future, such as remembering to pick up a prescription or send a birthday card. Prospective memory has been studied extensively in laboratory investigations, most of which indicate that older adults experience more PM failures than younger adults. Successful PM is important to older adults as it underlies independent living and allows seniors to remain financially stable (e.g., paying bills), healthy (e.g., taking medicine), active (e.g., lunch dates), and safe (e.g., turning off the iron). Recent work from our lab and from others demonstrates that emotional cues can boost PM, but to date no studies have used emotional auditory cues, or tested their effectiveness in an applied setting. Participants in our study will respond to an auditory cue four different times each day for three weeks. The nature of the cue (positive, negative, neutral) will vary across weeks. To administer the cues, we will load the digitized sounds from the International Affective Digitized Sounds database on an android device, and program them to sound at different times of the day using the MedRemind+ app. This app allows for precise recording of the accuracy and time of PM responses, with data that are tamper proof. In this way, we can measure the success of executing a PM task when it must be executed in the midst of a busy day, and we can assess whether different kinds of auditory cues yield higher PM success rates.

3. **Student: Brenna Kaitlyn Casey** **Major:** Biology
Mentor: Jennifer Wilhelm **Department:** Psychology

Title: *Does exercise alter sensory neuron regeneration after peripheral nerve injury?*

Each year, peripheral nerve injury impacts the lives of more than 200,000 individuals (Nobel et. al., 1998; Taylor et al., 2008). Although the peripheral nervous system possesses the ability to recover after trauma, functional recovery remains evasive and typically results in a loss of utility within the affected region. Previous studies have identified exercise in the form of treadmill training as an effective therapy in promoting motor neuron axon regeneration and improved functional recovery (Gordon & English, 2015). Presently, it is unknown whether exercise affects the regeneration of sensory neurons. It is theorized that in order to regain full function after injury, the regeneration of both the sensory and motor neurons is required. This project seeks to investigate the effects of exercise on sensory neuron regeneration following traumatic peripheral nerve injury. In order to determine the involvement of these cells, a branch of the sciatic nerve will be severed and repaired. After a brief recovery, the mice will participate in exercise in the form of treadmill training for two weeks. The regenerated sensory neurons will be labeled and counted to determine whether exercise influences the regeneration of the sensory system. The results of this project could have massive implications on the treatment of individuals suffering from peripheral nerve injuries.

4. **Student: Zachary Diamond** **Major:** Biology
Mentor: Calvin Blackwell **Department:** Economics

Title: *Combatting Joy of Destruction via Prosocial Behavior*

Oxytocin, the molecule that Paul Zak claims is the molecular basis to morality, is a mammalian hormone associated with love and parental care. Recent studies have shown that acts of interpersonal touch such as hugging may result in the neural release of oxytocin. Hugging is a ubiquitous act of prosocial behavior, expressing affection and companionship between those in the act. This study seeks to combat innate antisocial behavior via hugging and its subsequent release of oxytocin. Economics experiments using the mini-game Joy of Destruction, have shown that participants will choose to eliminate a portion of another subject's monetary reward despite there being no obvious motivation for such spiteful act. We hypothesize that, after hugging, participants will choose to eliminate less of other participants' compensation. Psychological assessment tests will be use to gain further information into how and why humans make spiteful decisions. This research will help expand the small, but growing literature in neuroeconomics by looking at how oxytocin may moderate non-incentivized antisocial behavior. The results of this work may have broad implications for economics, sociology and even the study of crime.

5. **Student: Katherine Duchinski** **Major:** Biology / Data Science
Mentor: Paul Anderson **Department:** Computer Science

Title: *Bioinformatics Development and Digital Transcriptomics for FLI1 in Human Breast Cancer Cells*

Breast cancer is the second most common cancer-related death among women in the United States. In 2015, the American Cancer Society estimates that 231,840 women will be diagnosed with and 40,290 will die from breast cancer. One of the most promising and rapidly developing areas of breast cancer research is genomics. The discipline of genomics applies DNA sequencing and computational methods to analyze the structure and function of genomes. Recording the genetic differences between normal and cancerous cells will facilitate the development of new diagnostic, prognostic, and therapeutic tools. Recent developments in experimental methods for genomics, referred to as next-generation sequencing (NGS), have increased the reliance on computational methods and algorithms for successful scientific discovery. The goal of this project is to develop further the computational tools necessary to study breast cancer. The specific resources, computer code, and software that will be developed require the acquisition of new primary experimental data through our ongoing collaboration with the Medical University of South Carolina. This data is not available in any public repository, and therefore, the generation of this data is in itself a novel resource that will be made available to the scientific community.

6. **Student: Hannah Edwards** **Major:** Classics and History
Mentor: Andrew Alwine **Department:** Classics
Title: *College of Charleston Classics Museum*

Many are aware that Randolph Hall has an impressive 200-year history, but do they know that this building holds museum-quality replicas of artifacts from a much more ancient past? Unfortunately, the collection on the 3rd floor is relatively unknown since they are in disorganized cases, with no identification, and no archaeological context. It is my intent to curate these treasures to benefit the entire Charleston community with a finished product.

This multi-phase research project seeks to publicize the College of Charleston Classics Museum and build a Classics Museum database. The Classics Museum will be home to over 100 artifact replicas that are identified, organized, and prepared for students, faculty, and general public use. This intensive process will require publishing software, photo selection, professional printing, lamination, and new track and shelf lighting. I will then begin work on publishing the database. This public resource will offer additional information on the cultural context of these artifacts and will be searchable through tags and links. This website will also provide recommendations for further reading on these artifacts and the cultures they represent.

The establishment of the Classics Museum and database will be accessible and beneficial to the public, but will also have a great impact on students and faculty in the interdisciplinary fields of Archaeology, Anthropology, Art History, History, and Classics. The museum and database will be rewarding tools for future generations of academic scholars and will prepare me for my future career as a museum curator.

7. **Student: Laura Galloway** **Major:** Biology
Mentor: Agnes Ayme-Southgate **Department:** Biology
Title: *Isoforms of Sallimus and the efficiency of flight in the honeybee*

Within a honeybee colony, the worker bees have specific tasks "assigned" to them based on the need of the colony. In a typical healthy hive most worker bees are initially performing in-hive tasks ad are known as nurses, which barely ever leave the hive and therefore are not active fliers. Typically after 2-3 weeks, some of the nurse bees "graduate" to tasks outside of the hive and become forager bees. Forager bees can fly long distances carrying comparatively heavy loads (nectar, pollen, etc.) and are therefore extremely good fliers. So how do you prepare for such a transition in life? This process is in a way similar to somehow starting a fitness program. Major changes occur to enable the worker bee to transition to this completely different job. Decrease in weight, increase metabolic and immune activity, depressed ovary activity are a few of the known reprogramming events. There are also some evidence for modifications of the muscle proteins to generate increased flight ability. Starting to understand this process at the molecular level is the goal of this proposal. We will look in particular at a very large protein implicated in the elastic properties of the muscle, which is known as Sallimus (Sls). We will use a quantitative protocol (qRT-PCR) to determine the change in Sls mRNA expression and splice variants between nurses and foragers across different ages from 5 to 25 days after adult eclosion.

8. **Student: Haven Lane** **Major:** Geology
Mentor: Barbara Beckingham **Department:** Geology
Title: *Sorption of a common antimicrobial and a metabolite to microplastic textiles*

Although visible litter in marine environments has been recognized as a serious environmental problem for decades, the impact of micro-litter, specifically microplastics, has only recently been acknowledged. Microplastics can be defined as those pieces <5 mm in size, and can be sourced from synthetic clothing, personal care products such as toothpaste or facial cleansers, or by the breakdown of larger plastic debris. The molecular organization of plastics allows for the sorption of chemicals from their surrounding environment. Therefore, there could be a hazard associated with microplastics that accumulate contaminants as they travel through wastewater plants and are then deposited into the ocean, serving as a

potential source for the exposure of toxic chemicals to organisms that inadvertently ingest them in the water column. This research will focus on triclosan, an antimicrobial agent common in personal care products, and its metabolite, methyl-triclosan. The outcome will be measures of their partitioning constants to a number of synthetic plastic textile fibers common to wastewater. The partitioning constant quantifies the attraction and capacity for pollutants interacting with the materials. This information will ultimately help to establish the role of microplastics as a vector for contaminant transfer in the food web.

9. **Student: Morgan Larimer** **Major:** Biology
Mentor: Craig Plante **Department:** Biology

Title: *Fungal and bacterial composition of sea turtle nest sand at Ostional*

The olive ridley sea turtle is listed by the IUCN as a vulnerable species. This species is characterized by a nesting behavioral polymorphism, with some females nesting solitarily and others nesting *en masse*. Hatching success is markedly lower at mass nesting beaches than at solitary nesting beaches, presumably due to the high microbial activity that results from decomposing eggs crushed by overlapped nesting. Higher microbial activity at these sites increases temperature and decreases oxygen availability, potentially interfering with embryonic development. To discount the competing hypothesis that specific bacterial or fungal pathogens instead cause the high embryo mortality, this study aims to compare microbial species composition and diversity in nesting areas of disparate embryo survivorship. Using previously collected nest samples from Ostional, Costa Rica, modern molecular biology techniques for microbial community analysis will be employed to identify bacterial/fungal species and compare the microbial communities from areas of high, intermediate, and low hatching success. Based on preliminary results, we tenuously predict that community structure among these nesting areas will be indistinguishable, thereby supporting the view that generalized high microbial metabolism causes low hatching success rather than specific pathogens. However, previously used methodologies were crude and much controversy remains about the cause of poor hatching success, hence the need for this study. This work could potentially have important conservation implications for sea turtle species worldwide, with the potential to influence management practices and increase reproductive yields.

10. **Student: Emily Morris** **Major:** Athletic Training
Mentor: Michelle McLeod **Department:** Health and Human Performance

Title: *Neuromuscular Characteristics of College-Aged Dancers Compared to Non-Dancers*

Dance performance requires repetitive jumping and leaping motions followed by a stable landing, not unlike other non-dance sports. However, dancers tend to have fewer injuries where non-dancers frequently suffer an injury during similar motions. It is believed that this difference may be due to skills that dancers learn and perfect from an early age involving anticipated movements. Learning pre-planned choreography may promote central nervous system adaptations influential to the control of movement that are different than non-dancers. While dancers tend to have fewer injuries compared to non-dancers, it is estimated that nearly 90% of dancers experience an injury at some point during his or her career, largely occurring as ankle sprains. Furthermore, traditional treatments of injuries suffered by dancers may be ineffective due to different neuromuscular profiles compared to non-dancers. Therefore, dancers may still be at an increased risk for increased long-term physical disability.

Our goal is to improve our understanding of the role of nerves and muscles of the leg that are important for stability of the ankle and the knee. We will also investigate measures of strength, range of motion, and balance. We aim to determine if these measures in dancers differs between limbs and compared to non-dancers. This information is important as it may reveal implications of how musculoskeletal health of a dance population is approached, as different intervention strategies may be required. Additionally, this opportunity will further prepare Miss Morris for additional research and employment opportunities as she develops in both her personal and professional career.

11. **Student: Shannon Morrison** **Major:** Sociology
Mentor: Idee Winfield **Department:** Sociology
Title: *Exploring and Navigating LGBT Identity in Fandom*

To date, very little qualitative research has been completed and published on how exactly those who identify as LGBT use the internet to explore and define their own identities. My research aims to fill this gap by studying how LGBT members of fan communities explore, navigate, and define their personal identities through their experience in the community and work in the realm of speculative fiction ("fan-fiction"). I will accomplish this through interviewing a number of LGBT-identified members of this community and asking about how their interaction with their community in addition to their personal work affected them in their personal coming-out process. I will then analyze these interviews to identify common themes in the experiences of LGBT members of fandom communities. With this research, I hope to investigate the unique experience of defining one's sexuality in the internet age from the viewpoint of a member of a queer-positive, accepting community, so that I may identify possible characteristics of such a community that makes it an ideal place for individuals to safely explore their sexual identities.

12. **Student: Matthew Mossberg** **Major:** Anthropology
Mentor: Zhiying Qian **Department:** Asian Studies
Title: *Verb bias and plausibility in second language sentence comprehension*

Learning a foreign language after puberty is significantly slower than learning a native language. Some researchers argue that one reason responsible for such difficulty is that second language learners understand sentences fundamentally differently from native speakers, such that while native speakers can make rapid use of syntactic information (e.g., number, tense, gender agreement) to predict the upcoming structure (e.g., after reading a verb like eat, native speakers can predict that the upcoming word is likely to be a noun, such as cake), second language learner are not capable of doing so. To compensate for that, second language learners rely heavily on plausibility information (e.g., eat a cake is plausible, and eat a desk is implausible) to understand sentences as they unfold in real time. However, this hypothesis has not gone unchallenged. To deal with the inconsistent findings in the field of second language sentence processing, this proposed project compares the relative timing of using syntactic vs. plausibility cues by second language learners. In four experiments, native and second language learners of English, and native and second language learners of Mandarin will read sentences containing temporary ambiguity (e.g., The club members understood the bylaws..., in which the bylaws can be the object of understood or the subject of the following sentence, as in The club members understood the bylaws would be applied to everyone.) Syntactic and plausibility cues are manipulated. The result of this project will lead to better pedagogical approaches in the foreign language classroom.

13. **Student: William Raines** **Major:** Philosophy
Mentor: Thomas Nadelhoffer **Department:** Philosophy
Title: *Moral and Political Psychology of Fairy Tales*

Fairy Tales are extremely prevalent across a multitude of cultures, yet despite this fact, very little empirical research has been conducted when it comes to what impact these tales may have on their primary audience, young children. Many parents regard these tales as moral teaching tools, but the messages of the tales are often more obscure than other traditional "morality tales" like Aesop's fables. In fact, some fairy tales seem to advocate for stances that a modern audience may appear barbaric and distasteful. "Snow White," "Rapunzel," "Cinderella," and "The Dancing Jew" are all tales included in the popular Grimm Brothers' collection, but while the first three are modern staples, the latter is a markedly anti-Semitic story of hate. Even more common tales like "Little Red Riding Hood," include gruesome violence in the form of evisceration by an axe man. These tales might influence young developing minds and sense of morality, yet little research has been done in the area. Additionally, what little research has been done is beset with shortcomings and limitations. My primary goal is to shed light on the moral and political psychology of fairy tales white correcting for the problems with the extant literature.

By surveying individuals about their exposure to fairy tales as children and young adults, their political ideology, and their moral reasoning, this project hopes to explore the correlations (or lack thereof) between the three subjects. Looking at these findings through various academic lenses (moral and developmental psychology, political philosophy, ect.) will advance our understanding in the surprisingly underexplored relationship between fairy tales and moral and political psychology.

14. **Student: Erin Risner** **Major:** Biology
Mentor: Agnes Ayme-Southgate **Department:** Biology
Title: *Alternative splicing and the role of Muscleblind in Apis mellifera*

Initially one of the major surprises coming out of genome projects was the very similar number of genes irrespective to the perceived species complexity (20,000 genes for both human and a small worm). One process that can help understand this discrepancy is the availability of RNA alternative splicing to generate multiple related proteins from a single gene. As a consequence the number and variety of potential proteins can increase up to ten times or more. Understanding the process of alternative splicing has therefore become an important questions in molecular cell biology, evolution and development. We will use the insect system to start addressing how alternative splicing drives remodeling of the flight muscle system to different physiologies and environmental demands. Erin project will focus on the expression of one splicing factor, muscleblind and one of its known RNA target, troponinT in *Apis mellifera* using the transition from in-hive nurse tasks to forager tasks as the physiological trigger for remodeling.

15. **Student: Leslie Sawyer** **Major:** Psychology
Mentor: Chad M. Galuska **Department:** Psychology
Title: *Do Negative Incentive Shifts in Food Reward Produce Excessive Fluid Intake in Rats?*

Negative incentive shifts involving transitions from favorable-to-unfavorable situations can disrupt behavior profoundly and may have relevance to the types of environmental stressors that engender alcohol seeking in humans. An existing animal model of negative incentive shifts involves arranging schedules of positive reinforcement differing in the signaled amount of food pellets delivered contingent upon rats completing a lever-press response requirement. We recently demonstrated that the transition from a just-received large food reinforcer to an upcoming signaled small food reinforcer disrupted lever press responding and caused non-thirsty rats to begin drinking water from a bottle available in the testing environment. In the proposed research, we will explore a number of parametric manipulations of both food reward parameters (e.g., manipulations in response requirement and session duration) and fluid type (plain water or sweetened water) to produce greater levels of drinking. If successful, these parameters will constitute a behavioral baseline from which to study rats' oral ethanol consumption produced by negative incentive shifts in food reward. This would model real-world conditions more effectively than existing animal models of ethanol self-administration.

16. **Student: Alexandria Schwartz** **Major:** Chemistry
Mentor: Michael Giuliano **Department:** Chemistry and Biochemistry
Title: *Sequence, Structure, and Function in Small Opioid Peptides*

Many medicines are small molecules that mimic the effects of naturally occurring substances. Because of the *structural differences* between drugs and the molecules that they emulate, synthetic molecules frequently display *functional differences*; they interact within the human body in ways that are often undesired relative to their designed purpose. In the brain, these chemical interactions are particularly fragile and their disruption can lead to devastating side effects such as depression and addiction. In order to understand how to avoid such consequences, the structure of naturally occurring molecules that are important for healthy brain function must first be understood.

One such family of molecules is called the *neuropeptides*, which act as chemical 'signals' in the brain. This study will focus on one group of neuropeptides that behaves similarly to opium-derived drugs, leading to their name – the opioids. Using organic chemistry, we will synthesize several opioids and determine their

structure using state-of-the-art instrumentation and computational software here at the College of Charleston and nearby MUSC. We will compare our opioid structures with published models of the molecular shapes believed to give the opioids their functions. Our analyses and new structural data, we hope, will provide the scientific community with new insight into 1) how the opioids interact with many brain sites simultaneously, 2) how simple changes to the building blocks that compose these molecules can change their structure and function and 3) how to better design mimics of these molecules to reduce the negative side effects of today's brain-targeting medicines.

17. **Student: Juliana Wallace** **Major:** Psychology
Mentor: Cindi May **Department:** Psychology

Title: *Prospective memory and emotional auditory cues: A laboratory investigation*

Prospective memory (PM) involves remembering to complete a task in the future (e.g., taking medication, feeding the dog). Errors in PM can be embarrassing or costly (e.g., forgetting to pay a bill), or even deadly (e.g., accidentally taking medication twice). Laboratory research suggests that PM errors can be reduced when reminders are emotional rather than neutral. While these data hold promise for improving PM in applied settings, they are limited by the fact that previous studies used visual PM reminders (e.g., pictures of a puppy or a stapler), but in everyday settings people rely heavily on auditory cues (e.g., alarm clocks, cell phone reminders) to prompt memory. Little is known about the effect of different kinds of auditory cues on PM. Our study will examine younger and older adults' PM with auditory reminders that are neutral, positive, and negative. Participants will be given the primary task of listening to sounds played on a computer (e.g., raindrops, guitar, sneezing), and rating the pleasantness of those sounds. Sounds will be drawn from the International Affective Digitized Sounds database, and have been normed for valence and arousal. In addition to the rating task, participants will complete a PM task in which they monitor for specific a target sound (e.g., laughter), and will press a specific key when that target occurs. This paradigm is analogous to listening to a podcast while monitoring for an audio phone alarm. We anticipate better PM when target sounds are emotional (e.g., laughter, vomit) relative to neutral (e.g., doorbell).

Research Presentation Grants (RPG)

1. **Student: Abigail Asper** **Major:** Psychology
Mentors: Sarah Robertson **Departments:** Psychology
Grace Hubel

Title: *Expressive Writing and Mental Health of College Freshmen*

Conference: Association for Behavioral and Cognitive Therapies 49th Annual Convention

Higher levels of depression and anxiety are associated with the transition to college, during which students must adapt to an unfamiliar environment while managing new personal and academic responsibilities. We hypothesized that expressive writing (uncensored personal narrative) would help students make sense of their stress. We recruited students in their first year at the College of Charleston to examine the effect of expressive writing on mental health of college freshmen. For twenty minutes each day on three consecutive days, participants wrote either objectively about a topic of their choice or about their deepest thoughts and feelings upon coming to college. At each visit and at 1-month and 6-month follow- ups, participants completed self-assessments of their depression and anxiety levels. Preliminary data shows a significant decrease in anxiety for the participants who completed expressive writing, and we expect to observe a significant decrease in depression as our sample grows.

2. **Student: Aubrey Butcher** **Major:** Biology
Mentor: Craig Plante **Department:** Biology
Title: *Effects of Beach Renourishment on Benthic Microalgal Communities at Folly Beach, SC*
Conference: National Conference on Undergraduate Research

One method of preserving beaches against erosion and sea level rise is beach renourishment. We monitored the effects of renourishment at Folly Beach on benthic microalgae (BMA), photosynthetic microbes found in coastal sediments. BMA represent the base of nearshore food-webs and release exopolymeric secretions (EPS), which bind sediment particles, thereby inhibiting sediment transport. Though BMA play these vital roles, few studies have examined renourishment effects on these microbes. We assessed BMA biomass, composition, diversity, in addition to EPS and sediment erodibility through time to characterize disturbance and recovery. Results reveal significantly reduced BMA abundance immediately after renourishment and that recovery time of BMA was >119d, surprising given their motility and short generation times. Ongoing high-throughput DNA sequencing is providing understanding of differences in BMA community structure between renourished and control beaches. This work could lead to changes in renourishment protocols favoring BMA communities, thereby enhancing stabilization of added beach sands.

3. **Student: Patricia Cooney** **Major:** Biology
Mentor: Chris Korey **Department:** Biology
Title: *Presenting at the Society for Integrative and Comparative Biology Annual Meeting, 2016*
Conference: Society for Integrative and Comparative Biology, Annual Meeting 2016

The snapping shrimp (Alpheus spp.) exhibit extreme claw lateralization, presenting a large snapper and a small pincer, which are used for different behaviors. Like most crustaceans, the snapping shrimp is able to autotomize limbs when threatened, and through subsequent molts, regenerate the lost limb. Autotomizing a limb is therefore costly not only in terms of loss of function, but also in terms of limb re-growth; failing to autotomize a limb, however, could be deadly. Here we examine variation in latency to autotomize, or the time it takes to drop a claw, the snapper claw in Alpheus angulosus. We measured latency to autotomy of mature snapper claws in a large cohort of shrimp (nf=36, nm=36). After initial snapper autotomy, we also measured latency to autotomize the regenerating claw based on molt stage. We found autotomy to be based on threat type (how the shrimp is disturbed) rather than duration among all shrimp, as a distinct pattern in our data. We also found significantly longer latency to autotomize in males, suggesting a greater cost of snapping claw loss for males compared to females. Surprisingly, amount of investment in claw regrowth (as measured by molt stage) did not affect latency to autotomize. Regarding postautotomy claw transformation, we have found that restoring snapping behavior only requires one molt, despite reduced claw size. Our analysis of changes in sensory hairs shows that the new setae types appear by molt two of transformation, suggesting that sensory setae follow behind snapping functionality and may be less important for shrimp fitness. Through these perspectives, we will present the evolutionary tradeoffs of autotomy and plasticity in the snapping shrimp.

4. **Student: Noah Denman** **Major:** Biology
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: *SdsA1: A bioinformatic and kinetic study*
Conference: Southeastern/Southwestern Regional Meeting of the American Chemical Society

SdsA1 is an enzyme discovered in the pathogenic bacterium *Pseudomonas aeruginosa* that has been proposed to be responsible for the destruction of sodium dodecyl sulfate (SDS), a common ingredient of detergents used to prevent bacterial growth, lending to the proposal that *Pseudomonas* might have evolved SdsA1 under selective pressure. Surprisingly, we found that there are at least 2,000 enzymes with high identity with SdsA1. These enzymes are found in several organisms, including eukaryotes. These organisms are not affected by SDS. Bioinformatics analyses suggest that these enzymes, albeit very

similar, can be divided into at least three separate clusters. We have selected three representative enzymes from different clusters to study their reactivity towards SDS and other potential substrates. The aim of this project is to determine whether these enzymes act on different substrates or if they are part of a single cluster that possesses broad substrate specificity.

5. **Student: Jonathan Derryberry** **Major:** Biochemistry
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: *Cysteine modification via nucleophilic aromatic substitution*
Conference: Southeastern/Southwestern Regional Meeting of the American Chemical Society

The environment on the inside of a protein is often different than the aqueous solution in which the protein is dissolved. Further, the properties of the inside of a protein can significantly vary depending on the nature of the amino acids present. A particular probe is the nitrile group, which is not present in natural protein and has a stretching frequency significantly different than any other functional group. The frequency of this stretching is affected by local properties such as the amount of water and the number of hydrogen bonds, and can be used as a reporter for these properties. We are developing a facile and inexpensive method to allow introduction of nitrile probes into proteins using a very common reaction called nucleophilic aromatic substitution. In addition to a nitrile group, our method introduces two fluorine atoms, which can also be used as local reporters using nuclear magnetic resonance (NMR).

6. **Student: Lauren Fanning** **Major:** Biology
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: *Kemp eliminase activity of ketosteroid isomerase*
Conference: Southeastern/Southwestern Regional Meeting of the American Chemical Society

Computational design of enzymes is an emerging field of research that can provide significant advances in environmental and medicinal chemistry. The most successful story in design is that of the Kemp eliminase, which catalyzes a model reaction that does not represent the biologically- relevant reaction of any known natural enzymes. We wanted to test how well the computational design performed, relative to random chance. We selected an enzyme called ketosteroid isomerase (KSI), which catalyzes proton transfer of significantly different substrates, and tested it for kemp eliminase activity. We found that KSI catalyzes the Kemp elimination of several substrates better than the computationally-designed Kemp eliminases, suggesting that this reaction represents a fairly easy reaction to catalyze, and that computational design should focus on more challenging reactions.

7. **Student: Nathaniel Fletcher** **Major:** Chemistry
Mentor: Katherine Mullaugh **Department:** Chemistry and Biochemistry
Title: *Sulfidation of Silver Nanoparticles*
Conference: Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Silver nanoparticles are currently one of the most common types of nanoparticle found in consumer goods due to their antimicrobial properties and they have been used in items like cleaning products and clothing. The widespread use of silver nanoparticles has raised concerns about the environmental implications of their use, as they are potentially toxic to many aquatic organisms. To anticipate their environmental impact, we need to assess the chemical changes they undergo in wastewater treatment plants (WWTPs). We have performed a series of experiments that monitored the chemical changes of silver nanoparticles in the presence of sulfide, a reactive component of WWTPs. The products of silver nanoparticle sulfidation reactions have been characterized by acid-volatile sulfide measurements and UV/vis spectrophotometry. Our results indicate a possible reversal of the sulfidation process over a few days, suggesting sulfidized silver nanoparticles could continue to act as a source of dissolved silver in natural waters.

8. **Student: Lucas Freeman** **Major:** Biochemistry
Mentor: Richard Himes **Department:** Chemistry and Biochemistry
Title: *Titanium-Mediated Reduction of Imine Substrates*
Conference: Southeastern Regional Meeting of the American Chemical Society

The molecules of life are exquisitely complex, which requires biologically active compounds – drugs for example – to have a very specific structure to create their intended effect. That effect can be sensitive to even miniscule changes in the molecule: switching a single atom's arrangement can lead to an inactive or hazardous drug. Synthesizing drugs and other useful organic molecules thus requires very specific control over the reactions in their synthesis. Yet, the simpler the process to make a drug, and the simpler and more readily available the starting materials, the more cheaply and more easily the drug may be made for the public. The synthetic chemist continually looks to more easily build complex molecules: using less energy, less expensive materials and simpler methods. Building complex molecules from simple reactants requires control over how those reactants arrange their bonds and atoms when they combine. The use of a metal compound – called a catalyst – may provide that control. The goal of this proposed project is to develop the chemistry of titanium (abundant, cheap, non-toxic) catalysts for using simple, readily available materials to synthesize molecules with control over their complexity. These specific molecular building blocks can then be expanded into desirable, biologically active molecules.

9. **Student: Colby Gabel** **Major:** Public Health
Mentor: Andrea DeMaria **Department:** Public Health
Title: *It's Your Place: Development and evaluation of an evidence-based bystander intervention campaign*
Conference: American Public Health Association Annual Meeting and Exposition

One in five women is sexually assaulted while in college. Bystander intervention offers a promising approach to change social norms and prevent sexual assault. This study presents formative research, implementation, and evaluation of a multi-media campaign to increase awareness of sexual assault and promote active bystander intervention. Rigorous audience research included eight focus groups with college women and men (n = 69) to assess knowledge, attitudes, and behaviors related to sexual assault and bystander intervention. Findings revealed the target audience's perceived barriers, potential benefits, competing behaviors, and influence of important others on bystander intervention. These findings were used to segment target audiences and develop campaign strategies, communication channels, and messages, including "It's your place to prevent sexual assault: You're not ruining a good time." The evaluation concluded the campaign was in fact successful and prompted students to consider intervening, take steps to intervening, and discuss bystander intervention with family and friends.

10. **Student: Mamiko Higa** **Major:** Public Health
Mentor: Merissa Ferrara **Department:** Communication
Title: *Fulfilling the Promise of Telehealth: A Case Study of South Carolina*
Conference: Society for Public Health Education (SOPHE) 67th Annual Meeting

Telehealth provides an opportunity to increase health care access in rural populations. This study investigated the key components of developing a sustainable telehealth program. Researchers conducted a case study of telehealth in South Carolina through a combination of interviewing and document analysis. Documents, archival legal records and public artifacts were analyzed and 11 in-depth interviews were conducted with telehealth experts. Evidence showed that relationship-based collaboration and legal understanding were critical in developing a telehealth intervention. Efforts to increase and ensure reimbursement, provider buy-in, and patient trust were major components in sustaining telehealth interventions. Findings provide evidence for the use of technology to reach underserved populations and increase access to care in rural communities. This case study highlighted the interplay of current legal policies in addition to establishing trust with telehealth providers and patients to ensure a viable intervention.

11. **Student: Jessica Hinson** **Major:** Biology
Mentor: Allison Welch **Department:** Biology
Title: *Effects of two antidepressants and their photodegradants on tadpoles*
Conference: Society for Integrative and Comparative Biology Annual Meeting

Fluoxetine (Prozac®) and sertraline (Zoloft®) are two commonly used antidepressants which have been found in natural waterways due to incomplete removal during water treatment. When exposed to sunlight, these pharmaceuticals degrade into related compounds, which may be more toxic. We used southern toad tadpoles to compare toxicity of fluoxetine, sertraline, and their degradants. Fluoxetine was found to be less toxic than sertraline. A sertraline solution was exposed to UV light for different lengths of time to allow different degrees of degradation. As the duration of UV exposure increased, the toxicity the solution decreased, likely because the degradant was present only in small quantities relative to the original concentration of sertraline. The results suggest that sertraline and fluoxetine can be toxic to freshwater organisms at high concentrations. While sertraline decreases in toxicity once introduced into the environment, continuous release could keep concentrations high enough to pose a risk to amphibians.

12. **Student: Lucien Jay** **Major:** Biochemistry
Mentor: Timothy Barker **Department:** Chemistry and Biochemistry
Title: *Pd catalyzed synthesis of ureas*
Conference: Southeastern Regional Meeting of the American Chemical Society

Many pharmaceutical drugs contain at least one nitrogen atom. Developing new methods of incorporating nitrogen into molecules is useful to medicinal chemists. We are prenting a method to incorporate a nitrogen atom into molecules that can be further modified into compounds with different properties in a subsequent reaction. One current pharmaceutical candidate centered around a functional group that we can make using our method is Tozedenant, a promising Parkinson's disease treatment in phase 3 trials. The novel synthetic method involves a single step process involving less dangerous intermediates to generate the same kinds of products.

13. **Student: Grace Moxley** **Major:** Biology
Mentor: Andrea DeMaria **Department:** Health and Human Performance
Title: *Castor oil as a natural alternative to labor induction: A retrospective descriptive study*
Conference: Women's Health 2016: The 24th Annual Congress

Fifty percent of US women report receiving the medical agent Pitocin to induce or augment labor, which often leads to negative side effects for the mother and baby. Castor oil is a common alternative to pharmacological induction techniques. Though it is bolstered by much anecdotal evidence, few studies have examined the safety and efficacy of castor oil. The purpose of this study is to better understand castor oil as a nonmedical agent of labor stimulation. Through utilizing a retrospective clinical chart review, researchers examined the birth outcomes of women who used castor oil for labor stimulation and gave birth at a local birth center. Our study demonstrated castor oil use as a natural alternative to stimulate labor, as nearly 90% of women who received castor oil were able to give birth vaginally.

14. **Student: Katelyn O'Dell** **Major:** Physics
Mentor: Michael Larsen **Department:** Physics and Astronomy
Title: *A Study of Realistic Sampling-Variability on Precipitation Measurements*
Conference: American Geophysical Union Fall Meeting

Previous publications in the literature have utilized simulated models to reveal that rain's irregular structure causes inaccurate measurements of bulk quantities (i.e. rain rate) due to variability between data samples. To explore the effects with more realism, models were developed using statistics

derived from real rain data recorded at College of Charleston's Dixie Plantation. The data-derived statistics were used to simulate rain drop-by-drop, assigning a number of drops for each sample and sizes for each individual drop. Models were created for three types of events: a heavy rain event, a light rain event, and an intermediate event. The models were sampled at intervals of several different durations associated with a certain average numbers of raindrops per sample. Results resemble previous studies qualitatively, but quantitative differences imply the impact of sample variability is much greater than previously thought and can differ for different types of rain events.

15. **Student: Olivia Pearce** **Major:** Chemistry
Mentor: Katherine Mullaugh **Department:** Chemistry and Biochemistry
Title: *Voltammetric Detection of Trace Silver Ions Using Carbon Paste Electrodes*
Conference: Southeastern Regional Meeting of the American Chemical Society

Silver nanoparticles are increasingly present in consumer goods due to their antimicrobial characteristics. Concerns arise, however, regarding their fate once they reach natural waters and ultimately release silver ions, which are toxic to many aquatic organisms. Current methods are unable to quantify silver ions in the presence of silver nanoparticles at low, environmentally relevant concentrations. To address this, we have optimized a method capable of measuring very low silver ion concentrations without interference from silver nanoparticles. We have applied this method to a study investigating the pH-dependence of the release of silver ions from silver nanoparticles and have demonstrated silver ion release is favored in acidic conditions. In the future, we plan to use this method to investigate how other solution conditions affect the release of ions from the nanoparticles, which will lead to a better understanding of the potential environmental implications of the widespread use of silver nanoparticles.

16. **Student: Dillon Presto** **Major:** Chemistry
Mentor: David Boucher **Department:** Chemistry and Biochemistry
Title: *Characterization of P3HT/6 Composites Synthesized via in-situ GRIM Methods*
Conference: Southeastern/Southwestern Regional Meeting of the American Chemical Society

State-of-the-art organic solar-cell devices generally incorporate interpenetrating networks of an electron donating polymer, e.g., poly(3- hexylthiophene) (P3HT), and a strong electron acceptor like inorganic nanocrystals, fullerenes, and carbon nanotubes. Optimizing the nanoscale morphology is critical to attain efficient solar cells, and a major objective in the field is the development of innovative methods to achieve idealized morphologies that improve the performance of these photoactive composites. In previous studies P3HT-Graphene (P3HT/G) composites were made using ultrasonic dispersion techniques. This research seeks to enhance the donor-acceptor (D-A) interactions at the D-A interface via a novel synthetic procedure of generating P3HT/G composites by growing P3HT chains in the presence of graphene. By providing a graphene nanoscaffold for P3HT to grow upon we seek to improve the morphology and inter-chain organization of P3HT/G composites. Our spectroscopic and imaging data on these composites suggest enhanced ground-state interactions and polymer-chain ordering.

17. **Student: Lea Richter** **Major:** Geology
Mentor: Vijay Vulava **Department:** Geology
Title: *Geochemical Fate and Transport of vardenafil and sildenafil*
Conference: American Geophysical Union Fall Meeting

Vardenafil and sildenafil, main ingredients in Levitra and Viagra respectively, are two emerging contaminants of concern that are contaminating natural water sources such as rivers and streams. The unique and complex chemistry of these contaminants allows them to be bound with some mineral components present in natural soils. Our experiments with these compounds show that clay minerals, and to a smaller extent organic matter, present in soils strongly bind these with these compounds. These compounds also degrade contact with light, resulting in very complex environmental behavior. Our

studies focused on determining relative sorption rates to different components in soils and how easily these compounds are transported in model groundwater systems. Preliminary data suggests that the amine functional groups present in the structure of these compounds is key to their behavior in the environment.

18. **Student: Amber Ruby** **Major:** Biology
Mentor: Allison Welch **Department:** Biology
Title: *Salinity effect on different life stages of squirrel treefrog (Hyla squirella)*
Conference: Society for Integrative and Comparative Biology Annual Meeting

Elevated salinity in freshwater habitats is an increasing environmental problem, as rising sea levels, storm surges, deicing salts, and other forms of habitat modification introduce salt into these habitats. Habitat salinization may pose a risk for amphibians, which typically require freshwater for fertilization and development of embryos and tadpoles. We investigated the effects of elevated salinity across three life stages in a local tree frog species. While increased salinity had negative effects on fertilization, embryonic development and tadpole development, we found that embryos were the most sensitive stage. Although all three of the life stages were able to proceed in a weakly brackish solution (4 parts per thousand salinity), tadpole growth was reduced even at this salinity. Our results suggest that populations of squirrel tree frogs may be adversely affected by modest increases in salinity; consequently, habitat salinization could present a threat to this species.

19. **Student: Enis Sanchez** **Major:** Chemistry
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: *Kemp eliminase activity of ketosteroid isomerase*
Conference: Southeastern/Southwestern Regional Meeting of the America Chemical Society

We studied the ability of a natural enzyme called ketosteroid isomerase (KSI) to catalyze a reaction called Kemp elimination. The Kemp elimination is a reaction not present in any metabolic pathway, and thus is not the native reaction of any known enzyme. For this reason, it was chosen as a model reaction for the computational design of enzymes. Surprisingly, we found that KSI catalyzes the Kemp elimination with rates similar to those of the computationally- designed enzymes. In conjunction with literature data, our results suggest that the Kemp elimination is an easy reaction to catalyze, and that it should not be used a benchmark for the success of the design process.

20. **Student: Benjamin Stephens** **Major:** Chemistry
Mentor: Neal Tonks **Department:** Chemistry and Biochemistry
Title: *Utilization of Biologically Derived Polyester Polyols in Surfactants for Polyurethane Foams*
Conference: Southeastern Regional Meeting of the American Chemical Society

The primary focus of this research is to improve foam formation in the production of polyurethane foams, using bio-based materials. Industrially, poly-ethylene glycol based surfactants are derived from petroleum oil. In contrast to these petroleum-based surfactants, our surfactants are based on renewable fatty acid sources, thus, being more environmentally favored. Surfactants reduce the surface tension between isocyanates and poly-ether or poly-ester based polyols, which allows for more uniform mixing during polyurethane formation. We have started synthesizing polyurethane foams, comparing foams made with bio-based surfactants to foams made with traditional surfactants. Image analysis based on scanning electron microscopy will allow for comparisons of average foam cell size distributions between the polyurethane foam samples. Upon further interpretation of the results, we hope to conclude that polyurethane foams synthesized using bio-based surfactants are comparable to polyurethane foams manufactured using petroleum-based surfactants used in industry.

21. **Student: Nicholas Taylor** **Major:** Biochemistry
Mentor: Jennifer Fox **Department:** Chemistry and Biochemistry
Title: *Mechanism of Heme a Synthase*
Conference: Southeastern Regional Meeting of the American Chemical Society

Enzymes are unique proteins that catalyze specific chemical reactions within many different organisms. Enzymes often work together to derive energy from food and to build the structures that are essential for cell survival. One crucial example of how enzymes work together is the assembly of the mitochondrial electron transport chain, which is essential for life.

Our project focuses on one enzyme that is necessary for the correct assembly of the electron transport chain. However, the structure and mechanism of action of this enzyme remain unknown. The goal of our project is to understand how the structure of this enzyme is important for its function and how it interacts with other enzymes to assemble the final component of the electron transport chain. Dysfunction of this enzyme and improper assembly of the electron transport chain result in human disease. Therefore, understanding this enzyme could aid in the creation of new therapeutics.

22. **Student: Travis Varner** **Major:** Biochemistry
Mentor: Richard Himes **Department:** Chemistry and Biochemistry
Title: *Synthesis, Substitution, and Attempted Metalation of a Rigid, Fused, Bis-indenyl "Batwing" Compound*
Conference: Southeastern Regional Meeting of the American Chemical Society

In the past few decades, interest and research in the production of new materials with novel properties have increased significantly. One type of material that chemists have gravitated towards is the polymer. The average person unknowingly encounters polymers several times on a daily basis—common examples include styrofoams and plastics. In the chemical formation of these polymer materials, another molecule called a catalyst is often needed. Catalysts are known for initiating and speeding up the formation of the desired product; however, their use can also be advantageous to control certain aspects in the chemical structure of the polymer. These small changes in the chemical composition (that result from using certain catalysts) ultimately engender large changes in the physical property of the polymer. For example, in the development of plastics, using a specific catalyst may cause a new, more rigid plastic to form that would not have been possible otherwise. Our research focuses on designing, making, and understanding these catalysts.

23. **Student: Will Vesely** **Major:** Geology
Mentor: Timothy Callahan **Department:** Geology
Title: *Dissolved Organic Carbon Fluxes in Forested and Urban Watersheds*
Conference: Geological Society Association Annual Meeting

The carbon cycle has been put into stress due to climate change and land-use changes from agriculture, urbanization, and watershed modification. This study focuses on the levels of dissolved organic carbon (DOC) in a forested watershed compared to an urbanized watershed. Sampling of water occurred during summer 2015 and will occur in fall 2015, these areas include Frances Marion National Forest freshwater, the Ashley River brackish and saltwater, and the Charleston Harbor saltwater. Filtered and acidified water samples were analyzed for DOC concentration using a Total Organic Carbon Analyzer. Fecal indicator bacteria populations in urbanized Charleston area were also compared with DOC concentrations and data showed positive correlation. Preliminary results indicate that forested watersheds have higher DOC concentrations than the urbanized watershed. The main contribution of the study is detailing the current DOC levels and environmental conditions of tidal systems and differences in urbanized portions in the Charleston, SC area.

24. **Student: Alexis Violette** **Major:** Chemistry
Mentor: Neal Tonks **Department:** Chemistry
Title: *Development, Synthesis, and Degradation Studies of Drug-Infused Biologically Compatible Polymers*
Conference: Southeastern Regional Meeting of the American Chemical Society

Polyurethanes are widely used polymer materials that have applications from paint coatings to soft/rigid foams. More recently, polyurethanes are being developed for drug delivery purposes. By incorporating a drug-delivery pre-polymer into the polyurethane matrix, we can produce a material that will slowly release a drug under physiological conditions. There are two significant unique aspects this project. Firstly, only biologically compatible materials will be used. Almost all current polymeric polyurethane materials are made using chemicals derived from petrochemicals. The major material in the final product by mass consists of a polyalcohol derived from a soy-based edible oil. Secondly, new drugs that have never been used for drug delivery purposes before using polymer delivery systems are being investigated. For this study, a series of successful drug delivery materials were made from the anti-inflammatory drug Ibuprofen, nalidixic acid, a simple antibiotic compound as well as two potent chemotherapeutic agents. Upon exposing these drug delivery materials to physiological media, significant drug release was observed in as little as 20 hours. A library of synthetic methodologies for the prodrugs was developed by Nathan Adamson over the last year and a half. The project will continue this year, specifically by exploring new synthetic approaches to these polymeric materials to yield products with varying applications including type of drugs being released, rate of drug release, and overall composition of the material. In addition, long-term degradation studies of these materials will be performed to confirm their safety in biological environments, and the results will be monitored by LC-MS.

25. **Student: Kelsey Vollmer** **Major:** Biology
Mentor: Chris Korey **Department:** Biology
Title: *Central Nervous System Neuroanatomy of the Snapping Shrimp*
Conference: Society for Neuroscience Conference

The plasticity, or changeability, of the adult nervous system provides a unique challenge to scientists studying vertebrate systems, as drastic changes are rare and often require permanently damaging the system for observation. For this reason, invertebrate systems possessing regenerative abilities provide a unique experimental system for exploring neural plasticity. The snapping shrimp, *Alpheus angulosus,* is a small crustacean with two asymmetric claws that serve distinct behavioral and sensory functions. If the large claw is lost, the organism switches handedness, transforming their small pincer claw into a large snapping claw while simultaneously developing a small claw on the other side. To better understand how the central nervous system adapts to this radical change in body composition, we have begun by characterizing the adult neural anatomy of *A. angulosus*. After developing protocols for sectioning and staining, we have begun to identify the major areas of the adult central nervous system. We will use this information to identify areas where new neurons (neurogenesis) are born in the adult. In particular, we are interested in regions of neurogenesis in the olfactory lobe and as well as neurogenesis in the thoracic ganglia that may support changes in the sensory nervous system in response to the change in the size of the new claw during transformation.

26. **Student: Grace Waddell** **Major:** Biochemistry
Mentors: Jennifer Fox **Departments:** Chemistry and Biochemistry
Marcello Forconi
Title: *SdsA1 Sulfohydrolase and Homologous Proteins*
Conference: Southeastern Regional Meeting of the American Chemical Society

Enzymes are biomolecules within organisms that catalyze chemical reactions essential to cells. This project aims to understand the biological roles associated with three homologous enzymes: SdsA1, Bds1, and CddY. SdsA1 is found in a bacterial pathogen and is capable of degrading the man-made detergent sodium dodecylsulfate (SDS). The evolutionarily related proteins Bds1 and CddY are found in baker's

yeast and a soil bacterium, respectively. Other homologous enzymes can be found in Tibetan antelopes and cucumbers. The diverse biological organisms that these enzymes originate from suggest the degradation of SDS is not the primary role of these proteins. Instead it is more likely that these enzymes serve an unknown biological role. This summer, we used molecular biology procedures to create bacterial cells capable of producing these proteins. Analyzing the types of reactions these enzymes are capable of performing will shed light on the true biological role of these widespread proteins.

27. **Student: Rachel Wireman** **Major:** Geology
Mentor: Vijay Vulava **Department:** Geology
Title: *Geochemical Fate and Transport of Diphenhydramine and Ceterizine*
Conference: American Geophysical Union Fall Meeting

This research focuses on how pharmaceuticals used to treat allergies behave once they have entered our soil. Pharmaceutical compounds generally enter our environment through treated wastewater and municipal sludge applications. With this research, I seek to determine which types of soils the molecules present in these medicines are most likely to bond with and how they travel through different types of soil. This is mostly determined by what types of minerals are present in each type of soil. For example, each of the pharmaceuticals I have been studying most strongly bind to soils that are very clay-rich compared with those that have more organic matter, implying that soil clay minerals may protect water resources from contamination. This research could lead to important mitigation efforts. For example, water treatment plants could incorporate clay mineral filters that will absorb those pharmaceuticals that are attracted to them before they can enter our environment.