COLLEGE of CHARLESTON

UNDERGRADUATE RESEARCH AND CREATIVE ACTIVITIES

2014 - 2015 Award Recipients

The office of Undergraduate Research and Creative Activities is pleased to announce the Grant Award Recipients for 2014–2015 academic year. Please join us in congratulating these students and their mentors.

Academic Year Research Grant (AYRA)

1. **Student: Sahand Askarian** — **Major:** Biochemistry
   Mentor: Gamil Guirgis — **Department:** Chemistry and Biochemistry
   Title: *Novel Isocyanation of Chloromethyl Silane*

As part of my long-standing research program in chemistry, we prepare, characterize, and predict the characteristic and spectroscopic properties of small organic compounds. This project was started as a result of a novel isocyanation mechanism that is not yet explained by the means of organic and inorganic chemistry. We correlate the theoretical *ab initio* predictions of molecules to the observed experimental values. This fundamental area of research may lead to interesting applications and certainly will lead to publications in a refereed journal. The refinement of fundamental knowledge is a very appropriate activity in which to involve undergraduate students in research in a meaningful and productive manner.

2. **Student: Colin Cotter** — **Major:** Chemistry
   Mentor: Gamil Guirgis — **Department:** Chemistry and Biochemistry
   Title: *Believe it or not, not all six membered ring compounds are not in chair conformation: preparation, characterization, and spectra of cyclo- 1,3,5-trisiloxane*

Organo-silane compounds, molecules with both carbon and silicon, have a variety of uses ranging from making water proof clothing to assisting in making other chemical compounds. This projects aims to study organa-silane compounds in a ring formation by synthesizing 1,3,5-trioxatrisilanane. This compound has been predicted to have an extremely unusual shape where the C-Si ring in the compound is planar. Normal rings in chemistry almost always form a complex shape called chair where they atoms are spread out away from each other on different planes as opposed to be aligned on one. We aim to synthesize 1,3,5-trioxatrisilanane and study its structure through Raman and infrared spectroscopy for this project.

3. **Student: Allen S. Hill** — **Major:** Physics
   Mentor: Alem Teklu — **Department:** Physics and Astronomy
   Title: *Thin Film Characterization through Resonant Ultrasound Spectroscopy*

Resonant Ultrasound Spectroscopy (RUS) is an experimental technique by which fundamental material properties can be obtained through acoustic probing. Many of the limitations of the RUS technique deal with the size, shape, and composition of the sample specimens. The samples used in the current RUS research at the College of Charleston are commonly a few millimeters in diameter. This particular experiment necessitates the characterization of a material that is on the order of a few hundred nanometers in thickness. The two overarching goals of this experiment include the adaption of current techniques so as to allow for the characterization of these materials. The second goal is to utilize this technique in order to characterize the mechanical properties for a thin film of Zinc Oxide. The vital

component of this process is the construction of a new RUS sample cell – an apparatus wherein small micrometer sized samples can be mounted and examined. The apparatus utilizes two transducers, one of which drives the sample through the application of acoustic waves while the other measures the sample's response. These transducers are to be created with polyvinylidene fluoride (PVDF) strips that are 9 micrometers thick. This piezoelectric film reduces noise and provides for more accurate measurements. The cell as a whole can be adapted to utilize the Dynamic Resonance Systems (DRS) Modulus 1, which is used for all other RUS work presently done at the college.

4. **Student: Marino Mugayar-Baldocchi** **Major:** Psychology
Mentor: Daniel Greenberg **Department:** Psychology
Anthony Bishara

Title: *Anchoring Autobiographical Memories*

Autobiographical memories are memories for the events of everyday life. They help provide the foundation of our identity and serve as a record of what we have done and where (or who) we have been. Most people report that they can remember back to the age of three or so, but memories from ages three to five tend to be vague and fragmented. How reliable are these memories, and how vulnerable are they to distortion and change? In a previous study, we sought to determine whether participants' earliest memories were susceptible to a subtle manipulation known as the *anchoring effect*. This effect occurs when the presentation of a number affects participants' estimates of a subsequent uncertain quantity. In this case, we found that participants who received a low anchor (the number 1) reported earlier memories than those given a high anchor (the number 6). We now hope to replicate the effect and extend it by examining a broader range of childhood memories. In this way, we hope to understand how reliable and pervasive the effect really is, and whether it varies with the age of the memory. We hypothesize that anchoring will affect a range of childhood memories, not just their earlier memories, but that the effect will be stronger.

5. **Student: Hannah Wilson** **Major:** Biology
Mentor: Joe Carson **Department:** Physics and Astronomy

Title: *An Innovative System for 3D Clinical Photography*

We recently developed a low-cost, user-friendly technique to take a single snapshot image using the commercially available Lytro camera and convert this image into a full 3D rendering that can be effective for the diagnostic monitoring of cancer lesions, such a Kaposi's sarcoma – the leading cancer among men in Mozambique. By utilizing a relatively low cost (~$300) consumer camera as the technology backbone, the technique translates to an estimated cost of around 75 cents per diagnosis. This is an extreme benefit for areas of the world that cannot afford most 3D imaging technology that is available today. In contrast, for example, the commonly used Magnetic Resonance Imaging (MRI) has a typical cost of >$2,000 per diagnosis, as well as requiring expert personnel to operate it and substantial infrastructure to support it. Our technology provides a way for minimally trained personnel to operate it, and the complicated data processing work can take place at a location away from the resource limited setting, allowing relevant results to be succinctly summarized and restored to clinicians in the field. To prove the effectiveness of the technique, we and collaborators successfully carried out a pilot program at Maputo Central Hospital, the largest public hospital in Mozambique, and showed that effective, single-snapshot, 3D images of Kaposi's sarcoma lesions could be obtained bedside by minimally trained personnel. The results are published in the Journal of Translational Medicine (Baghdadchi et al. 2014).

Major Academic Year Support (MAYS)

1. **Student: Melina Acosta** **Major:** Psychology
Mentor: Jennifer Wilhelm **Department:** Psychology
Title: *Does estrogen mediate axon regeneration after peripheral nerve injury in males?*

Thousands of peripheral nerve injuries occur each year. Although nerves in the peripheral nervous system have the capacity to regenerate, recovery of function is often poor and incomplete leaving patients with long-term deficits. Previous studies have shown that exercise in the form of treadmill training causes an enhancement in axon regeneration following peripheral nerve damage that could improve functional recovery. Interestingly, this exercise induced increase in regeneration occurs in a sex dependent manner with males and females requiring different forms of treadmill exercise to achieve maximal regeneration. The mechanisms mediating this sex difference are relatively unknown. Previous studies have shown that androgens, such as testosterone, can enhance the regeneration of nerve following a nerve injury. However testosterone can be converted into estrogen; therefore, the enhancement by testosterone treatment may be due to an increase in estrogen. The present study will examine the effects of estrogen on axon regeneration in unexercised and treadmill exercised male mice. The common fibular branch of the sciatic nerve will be cut and repaired. Estrogen-filled or blank capsules will be implanted subcutaneously in male mice at the time of nerve transection. Three days post repair mice will be treadmill exercised for two weeks. Two weeks after the initial cut and repair, neurons whose axons will have regenerated past the original cut sites will be labeled with a retrograde dye. The number of labeled neurons will be counted to examine the effects of estrogen on axon regeneration. We hypothesize that estrogen treatment will enhance axon regeneration after peripheral nerve transection similar to the enhancement found in treadmill exercised mice. The results of these experiments will provide insight into whether exercise induced increase in axon regeneration is estrogen dependent.

2. **Student: Alana Acuff** **Major:** Anthropology
Mentors: James Newhard **Department:** Classics
Title: *The Global Electronic Repository of Aegean Scripts (GERAS): post-processing 3D structured light scanning imagery*

The Global Electronic Repository of Aegean Scripts (GERAS) as an international, multi-year, interdisciplinary effort to record the extant remains of writing from the Late Bronze Age Aegean. Formed in 2012, it elected as its initial project to bring the Linear B archives from the Palace of Nestor at Pylos to full publication and access via traditional print and online media.

Documentation of the archives includes tablet transcriptions, archaeological illustration, Reflectance Transformation Imagery (RTI), 3D imaging, X-Ray Fluorescence (XRF) data, and archaeological context of tablet fragments via geographic information systems (GIS). In the summers of 2013 and 2014, GERAS collected raw image data of approximately 75% of the nearly 1,200 tablets and sealings from the archive necessary to complete the project.

The College of Charleston serves as the informatics hub of the project, responsible for the development and maintenance of the GERAS database, user interface, image files (RTI and 3D), and geospatial component. In the 2014 academic year, students and faculty will be engaged in developing a prototype online interface, which will include refining the database structure, processing raw 3D imagery captured in 2013 and 2014 into final products, developing the online presence of GERAS, and refining the geospatial search capabilities. RTI image processing, tablet transcriptions, and illustrations will be concurrently undertaken by project members at the Universities of Texas and Toronto.

This proposal specifically applies to the 3D post-processing component of the project, which will be undertaken by Acuff in collaboration with Newhard and Baxley.

3. **Student: Jami Baxley** **Major:** Classics
Mentor: James Newhard **Department:** Classics

Title: *The Global Electronic Repository of Aegean Sripts (GERAS): post-processing 3D structured light scanning imagery and final season assessment*

The Global Electronic Repository of Aegean Scripts (GERAS) is an international, multi-year, interdisciplinary effort to record the extant remains of writing from the Late Bronze Age Aegean. Formed in 2012, it elected as its initial project to bring the Linear B archives from the Palace of Nestor at Pylos to full publication and access via traditional print and online media.

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This proposal specifically applies to the 3D imagery post-processing component of the project, which will be undertaken by Baxley along with Newhard and Alana Acuff.

4. **Student: Aubrey Butcher** **Major:** Marine Biology
Mentor: Craig Plante **Department:** Biology

Title: *Effects of Beach Renourishment on Benthic Microalgal Communities*

Beaches are valuable resources providing recreational activities and storm protection, and sustaining diverse biological populations. One method of preserving beaches against the effects of erosion and sea-level rise is beach renourishment. Folly Beach completed a renourishment project from January-June 2014 and Tybee Island will begin their own project in November, 2014. Both projects involve transporting (via pipeline) sediment from offshore borrow sites onto the beach face in hopes of reversing erosional losses; however, other components of the ecosystem are affected as well.

This study aims to monitor renourishment effects on benthic microalgae (BMA), a group of photosynthetic microbes found in coastal sediments. BMA, as primary producers, represent the basis of nearshore food webs. They also release extracellular polymeric secretions (EPS), which bind together sediment particles thereby inhibiting erosion and sediment transport. Despite these vital roles, few studies have examined the effects of renourishment on these microbes. By studying BMA biomass, composition, and EPS, this project will reveal the effects of specific renourishment practices (e.g., use of coarse borrow sediments) on benthic microalgae. Our research this past summer demonstrated that beach renourishment does significantly reduce BMA abundance immediately after the event. We also know that BMA recovery time is longer than 4 months, which is surprising given their motility and short generation times. More research is needed to understand the differences in BMA species composition between renourished and control beaches. Findings could lead to changes in renourishment protocols that favor BMA communities, thereby indirectly enhancing stabilization of newly added beach sands.

5. **Student: Haley Cabaniss** **Major:** Geology
Mentor: John Chadwick **Department:** Geology

Title: *Prediction of Catastrophic Eruptions of Colima Volcano, Mexico, via Analyses of Long-term Trends in Lava Chemistry*

Volcan de Colima in western Mexico is one of the most active volcanoes in the world, erupting dozens of times in the past century. It is therefore an excellent laboratory for

understanding temporal patterns of eruption activity and investigating how eruption magnitudes may relate to the varying chemistry of its erupted lavas and gases over time. Identifying a relationship between lava chemistry and eruption activity may allow for improved predictions of the particularly powerful and deadly eruptions that occur at Colima about once every century. This study will focus on the relationship between the chemical compositions of volatiles (gases such as water vapor and sulfur dioxide) released before, during, and after volcanic eruptions and those same volatiles trapped in tiny inclusions within the erupted lava itself. Since volatiles in volcanic systems are the most important drivers of eruptions, understanding their behavior during the period leading up to and during eruptions may allow for an improved method of predicting them. Working with a professional colleague in Mexico, student Haley Cabaniss collected lava samples at Colima during the summer of 2014 from several eruptions with known dates back to the 1960s. In this study, Haley and her College of Charleston mentor Dr. John Chadwick will analyze the chemistry of Colima lavas and the volatile gases trapped in them in an effort to identify temporal patterns in volatile behavior that signal impending larger eruptions. The project will provide the student with a wealth of field, laboratory, data analysis, and presentation experience.

6. **Student: Kellen Lawson** **Major:** Astrophysics
Mentor: Joe Carson **Department:** Physics and Astronomy
Title: *Searching for Extrasolar Planets with the Subaru SEEDS Survey*

The **S**trategic **E**xploration of **E**xoplanets and **D**isks with **S**ubaru (SEEDS) survey is a five year international astronomical survey with 120 nights of observations using the Subaru telescope atop Mauna Kea in Hawaii (Tamura et al. 2009). The intent of this survey is to directly image exoplanets and disks (the reservoirs of material around young stars from which these planets form) around stars and to better understand how they form and are related.

More specifically, our research comprises a group within SEEDS that focuses on extrasolar planets around high mass stars. The importance of these stars lies in the fact that they often produce higher mass planets. Such planets retain more heat and are therefore more visible in infrared wavelengths in which we observe (Baraffe et al. 2003). Additionally, we will prioritize targeting the youngest stars in this category, for similar reasons to those above; namely, these systems will have more residual heat, again making planets more visible in the infrared.

Alternative indirect detection strategies discover planets by observing their effects on the star, such as a slight drop in stellar brightness due to a transiting planet. Besides revealing the fact that the planet exists and offering basic limits on planet mass and orbit, these approaches are limited in the knowledge they provide. With the light from direct imaging, we can produce information on the planet's temperature, composition, and atmospheric chemistry. While technically difficult, this method allows us unique insights into characterizing planets and the parameters that affect their formations.

7. **Student: Lawson Lloyd** **Major:** Biochemistry
Mentor: David Boucher **Department:** Chemistry and Biochemistry
Title: *Atomic Force Microscopy Study of Polymer Films Processed from Mixtures of Organic Solvents*

Functional materials that incorporate semiconducting polymers, which are now being used in solar cells and other optoelectronic devices, are processed by forming a thin film of a polymer solution onto an appropriate substrate, e.g., glass, quartz, etc. The random nature of the molecular packing of a polymer during this process is detrimental to the properties of functional composites, and has proved to be one of the main barriers to achieving high performance devices using polymer materials. In order to make these materials more efficient we need to control how the polymers organize themselves when the films are made. Our research group is trying to achieve control by using mixtures of organic solvents, wherein the disparate properties of the solvents in the mixtures, e.g., evaporation rates and viscosity, help the polymer assembly in different ways. Using over 100 different solvent mixtures, we have already shown that we can achieve control of polymer organization in the liquid phase, but now we need to see what happens when we actually make films from these mixtures. To accomplish this task we will

use atomic force microscopy (AFM) to study the films that we make. AFM is a highly sensitive imaging technique that allows us to see the structure of polymer films on a molecular, or even an atomic, level. The high resolution possible with AFM will allow us to observe different film structures with a great level of detail that can then be tested as possible candidates for solar cells materials.

8. **Student: Kaitlyn Manley** **Major:** Applied Mathematics
Mentor: Amy Langville **Department:** Mathematics
Title: *Calculus Workbook Series*

This continuing project aims to complete a series of calculus workbooks/journals for publication, aimed towards secondary and post-secondary students. We will be attempting to overcome challenges faced by educators in our field: Why are so many students turned off by math? How can we make it appealing and relatable? What are some successful strategies in engaging students with calculus? These books approach calculus from a new angle, providing a balanced development of concept- *and* calculation-based understanding. Inspired by Keri Smith's *Wreck This Journal* series, we invoke creativity as the primary vehicle for instruction by appealing to kinesthetic learners and those who consider themselves as "non-math-minded." Through student involvement and innovative designs, including physical activities, games, and graphic novellas, we intend to engage the students who are most commonly disconnected from this surprisingly lively and relatable subject. Highly illustrative, with a focus on visual cues and tactile involvement, these books can appeal to all students, regardless of prior mathematical interest. In order to accomplish this, we first intend to research design and educational strategies, existing and comparable texts, and other sources for creative inspiration. We will then test the books in at least two classes of business calculus and use the students' feedback to improve upon their design. Finally, we will promote the series through academic connections made through conferences and other disseminations of our work. As two aspiring educators, we will get a hands-on experience of publishing an educational text by the completion of this project.

9. **Student: Sean Mueller** **Major:** Studio Art (Sculpture)
Mentor: Jarod Charzewski **Department:** Studio Art (Sculpture)
Title: *Exploration of the Unifying Factors behind Community, Industry, and Growth through Sculpture Collaboration in the Landscaped Environment for Art*

Sean Mueller and Jarod Charzewski will construct a series of three to five pieces with the intention of placing them on public display and entering into various sculpture competitions and exhibitions. Sean and Jarod will explore what elements unify communities and industry, particularly during periods of growth. They will then express these elements in a series of sculptures for public display in the landscaped built environment, specifically the sculpture park. The sculptures will be completed by working together: developing designs, procuring materials, and creating the piece. The project accomplishes both Sean and Jarod's goals of academic and career advancement, as well as having the opportunity of working collaboratively. Sean and Jarod predict the pieces will be installed in public exhibitions and receive high commendation in competitions.

10. **Student: Joye Nettles** **Major:** Computer Science
Mentor: James Bowring **Department:** Computer Science
Title: *CHRONI – An Android Application for geochronologists to access archived sample analyses from the NSF-funded GeoChron.org data repository*

NSF requires data management plans as part of funding proposals and geochronologists, among other scientists, are archiving their data and results to the public cloud archives managed by the NSF-funded Integrated Earth Data Applications, or IEDA. GeoChron is a database for geochronology housed within IEDA. The software application U-Pb_Redux[1,2,3] developed by Dr. Bowring at the College of Charleston provides seamless connectivity to GeoChron for geochronologists to automatically upload and retrieve their data and results. CHRONI is a lightweight mobile application for Android devices that provides easy access to these archived data and results. With

CHRONI, geochronologists can view archived data and analyses downloaded from the GeoChron database, or any other location, in a customizable format. CHRONI uses special documents called Report Settings that can be customized in U-Pb_Redux, stored in the cloud, and then accessed and used in CHRONI to create the customized data display on a mobile device. In addition to providing geologists effortless mobile access to archived data and analyses, CHRONI allows users to manage their GeoChron credentials, quickly download private and public files, and view specialized graphics associated with particular files. Future versions of CHRONI will be developed to support iDS-compatible (iPhone, iPod, and iPad) devices. CHRONI is an open source project hosted at https://github.com/CIRDLES/CHRONI.

11. **Student: Alexis Payne** **Major:** Physics
Mentor: Alem Teklu **Department:** Physics and Astronomy
Mike Larson

Title: *Resolving Airborne Particulate Concentration Inhomogeneities with a Schlieren Optical Technique*

Turbulence is a phenomenon that is present in many aspects of everyday life; even the act of walking through a room generates complicated turbulent eddies in the wake of the walker. Atmospheric particulates suspended in air are moved about by the complicated fluid motions associated with turbulence, though the general behavior of particulates is unknown. The purpose of this project is to explore the influence turbulence has on particulates is unknown. The purpose of this project is to explore the influence turbulence has on particulate clustering via use of the Schlieren Photographic technique. This light scattering technique can be used to investigate particle concentration fluctuations, which, in our experiment, would be driven by turbulence. The light that hits the airborne particles is scattered, and the scattering effect gives rise to an image that allows inference of the particle locations. Ultimately, statistical properties of the spatial clustering of individual particles will be linked to properties associated with the turbulence to attempt to quantify the effects of turbulence on particle clustering.

12. **Student: Tyler Perini** **Major:** Mathematics
Mentor: Amy Langville **Department:** Mathematics

Title: *Wreck This Calculus Workbook Series*

This continuing project aims to complete a series of calculus workbooks/journals for publication, aimed towards secondary and post-secondary students. We will be attempting to overcome challenges faced by educators in our field: Why are so many students turned off by math? How can we make it appealing and relatable? What are some successful strategies in engaging students with calculus? These books approach calculus from a new angle, providing a balanced development of concept- *and* calculation-based understanding. Inspired by Keri Smith's *Wreck This Journal* series, we invoke creativity as the primary vehicle for instruction by appealing to kinesthetic learners and those who consider themselves as "non-math-minded." Through student involvement and innovative designs, including physical activities, games, and graphic novellas, we intend to engage the students who are most commonly disconnected from this surprisingly lively and relatable subject. Highly illustrative, with a focus on visual cues and tactile involvement, these books can appeal to all students, regardless of prior mathematical interest. In order to accomplish this, we first intend to research design and educational strategies, existing and comparable texts, and other sources for creative inspiration. We will then test the books in at least two classes of business calculus and use the students' feedback to improve upon their design. Finally, we will promote the series through academic connections made through conferences and other disseminations of our work. As two aspiring educators, we will get a hands-on experience of publishing an educational text by the completion of this project.

13. **Student: Mariel Thottam** **Major:** Psychology
Mentor: Daniel Greenberg **Department:** Psychology
Title: *Stress, Coping, and Autobiographical Memory*

Everyone reacts to stress and trauma a bit differently. Some people are "cool under fire" no matter how difficult life becomes; for others, a seemingly moderate trauma can lead to substantial emotional distress, including post-traumatic stress disorder (PTSD). Research on PTSD has historically focused on pharmacological or psychological therapies for people who have been traumatized; however, recent studies have tried to identify risk factors that make one individual more susceptible to trauma than another. Neurological research, for instance, has identified differences in a brain region called the hippocampus, which is important for learning and memory: People with smaller hippocampi are more likely to fall victim to PTSD. Although these results are interesting and important, brain scans are cumbersome, expensive, and somewhat removed from the psychological symptoms that trauma can bring about. What if you could predict someone's vulnerability to stress and trauma with a simple paper-and-pencil test instead?

In our study, we will focus on tests of autobiographical memory (memories for events of everyday life). Previous research has shown that overgeneral autobiographical memories – memories that are vague and short on details – often go hand-in-hand with emotional distress or psychiatric illness. We propose that this relationship exists because people with overgeneral memories are more vulnerable to stress. More specifically, people might develop a tendency to remember in an overgeneral fashion as a way of avoiding further exposure to stressful memories. If this is true, then we can use these tests to predict who will have a poor reaction to subsequent major stressors.

14. **Student: Kelsey Marie Vollmer** **Major:** Biology
Mentor: Sorinel Oprisan **Department:** Physics and Astronomy
Title: *Investigation of stimulus shape contribution to phase resetting curve*

Neurons are excitable cells that are silent most of the time and only briefly produce a burst of electrical activity called action potentials (APs) in response to inputs received from other neurons. Some neurons are intrinsic burster capable of producing a periodic sustained electrical activity. Such spiking neurons are frequently encountered as part of autonomous neural networks responsible for rhythmic activities, such as flying, swimming, walking, chewing, etc., called central pattern generators (CPG). The main mechanism used by neurons to respond and adapt to environmental stimuli is through changing their firing frequency proportional to inputs received. The relationship between the external stimulus timing and the change in the firing rate of the neuron is called a phase resetting curve (PRC). In addition to its application to investigating the mechanisms that allow the same neural network to generate multiple patterns of activities, e.g., the gait network can produce walk, trot, gallop, etc., the PRC can predict the synchronous firing of a large network that occurs during epileptic seizures. Our work this summer will focus on investigating numerically the relationship between the shape of the external perturbation and the PRC. For this purpose, a model neuron will be used to map the effect of external perturbations, such as the amplitude, duration, rate of change of inputs from other neurons, and the PRC.

15. **Student: Benjamin Wilson** **Major:** Computer Science
Mentor: Joe Carson **Department:** Physics and Astronomy
Title: *Extrasolar Planets and Disk Imaging using the Hubble Space Telescope*

The Hubble DICE survey is an observational program approved by NASA. The team consists of nineteen multinational experts in the field of astrophysics. Led by Dr. Glenn Schneider (Univ Arizona), there is an ongoing effort to study eleven carefully chosen stars with known circumstellar disks. The disks surrounding these young stars are interesting because they are believed to be the birthplaces of planets. By discovering evidence of planet formation in these disks, either by imaging disk gaps caused by forming planets or by directly imaging the planets themselves, one can gain invaluable insights to guide planet formation theories and ultimately help better understand the origins of our own solar system.

We use the STIS camera equipped on the Hubble Space Telescope to observe our target stars,

utilizing high resolution imaging techniques to probe precise and detailed structures of the circumstellar disk. Aided by the precision of the STIS camera, combined with the sensitivity of the Hubble Telescope, we collect data from these target stars at multiple telescope roll rotations. These observations allow us to, for the first time, explore sub- structures and, in particular, asymmetries that indicate the presence of recently formed planets.

In particular, I have been working under the guidance of Dr. Joe Carson to develop a Variable-Pixel Linear Reconstruction, or "Drizzling", procedure. This allows us to take advantage of the multiple roll angles in order to sub-pixelate the final image and increase the effective imaging resolution. We have successfully proven that this procedure, among others, aids the clarity of the disk and will be applied to our additional targets.

Research Presentation Grants (RPG)

1. **Student: Olivia Adams** **Major:** Anthropology
Mentors: Maureen Hays **Departments:** Anthropology
Kimberly Pyszka
Title: *Landscape Archaeology and GIS: Understanding Cultural Adaptations and Tenant Farming in the Low Country, Hollywood, SC*
Conference: South Eastern Archaeological Conference

Dixie Plantation (Hollywood, SC) has a long history of occupation, though little is known about the period post-Civil War, a time of social and economic change. For this research, the focus is on the transition of tenant farming through the mid-20th century. The ephemeral nature of tenant sites and the social significance of the transition mark this as a critical period for investigation. A preliminary picture of tenant farming will be presented through the analysis of existing architecture, historic documentation, and material culture. Using GIS to geospatially reference structure, site, and resource location allows for exploration on how alterations in landscape usage communicate changes in social relationships.

2. **Student: Omorose Aighewi** **Major:** Biochemistry
Mentors: Wendy Cory **Departments:** Chemistry and Biochemistry
Title: *The Photodegradation of Ranitidine in the Aquatic Environment*
Conference: 2015 International Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Because of the wide use of pharmaceuticals, there is now increasing concern about their possible presence in public water systems and the surrounding aquatic environment. When exposed to UV light, the active compounds in some medications have been observed degrade into compounds that may pose a threat to aquatic life. In this research, the photodegradation of ranitidine (the active drug in Zantac®, an acid reflux medication) was investigated under simulated environmental conditions. The rate of solar photodegradation was determined for ranitidine in aqueous solution and in solutions containing humic acid, an important form of dissolved natural organic matter found in the aquatic environment, following photoexposure of these solutions in a solar simulator. Future work before the conference will include identifying the products of photodegradation using a chemical analysis technique called liquid chromatography-mass spectrometry (LC-MS).

3. **Student: Zak Bartholomew** **Major:** Anthropology
Mentor: James Newhard **Department:** Classics
Norman Levine
Title: *The Development of a Legacy GIS for the Contextualization of the Linear B Deposits from the Palace of Nestor at Pylos*
Conference: Archaeological Institute of America Annual Meeting

The Palace of Nestor has been an important site for scholars since it was first excavated. One of the noteworthy classes of artifacts is the administrative evidence in the form of Linear B tablets and sealings. Concurrent with the formal, traditional publication of this assemblage is the development of a visual and spatial informatics system. One of the sub-tasks includes the creation of a GIS to spatially locate the fragments within the palace. While the location of the objects have been emphasized in previous studies, geospatial applications have advanced such that the spatial location of the tablets can be linked to other information and presented in a format that facilitates querying and exploration by the user. This project will give users the ability to query by tablet and series data. Results are displayed within a site map that shows the location of each queried fragment.

4. **Student: Elizabeth H. Blankenship** **Major:** Biochemistry
Mentor: Jennifer L. Fox **Department:** Chemistry and Biochemistry
Wendy Cory

Title: *Metabolite Profiling of Saccharomyces cerevisiae by Liquid Chromatography-Mass Spectrometry*
Conference: Southeastern Regional Meeting of the American Chemical Society

Metabolomics is a field capable of improving medical diagnoses, drug therapies, and our current understanding of cell biology. Metabolites are small molecules that act as signatures of biochemical activity at the cellular level, detected primarily through liquid chromatography-mass spectrometry (LC-MS), a technique that allows for identification of the chemical compounds in a sample. To investigate metabolic differences experienced by cells in response to varying cellular conditions, we developed methodology for metabolite extraction of baker's yeast and analysis by LC-MS. Our results will be presented at this conference, including the reproducibility of this method for analysis of independent biological samples.

5. **Student: F. Garrett Boudinot** **Major:** Geology
Mentor: Vijay M. Vulava **Department:** Geology

Title: *Sorption and Transport of Sildenafil in Natural Soils*
Conference: Annual Meeting of the Geological Society of America

Pharmaceutical Chemicals mainly enter our ecosystems from discharges of treated wastewater, and have direct effects on their ecological health. Sildenafil (Viagra) is one such chemical, whose effect on natural ecosystems is heretofore unknown. Given that sildenafil consumption (and concurrently disposal) is on the rise, it is essential that its behavior in the natural environment be understood. Thus, the goal of this study was to quantify how sildenafil travels and functions in differing natural soils. Experiments were performed using pristine organic-rich and clay-rich soils collected in a managed forest near Charleston, SC. Data from the experiments indicate strong chemical bonding of sildenafil to all soils, with clay-rich soils showing even higher bonding. Soil bonding acts as a filter in groundwater, effectively removing those bound chemicals from the water system. These results show that very little sildenafil will remain in the groundwater upon discharge into natural soils.

6. **Student: Haley Cabaniss** **Major:** Geology
Mentor: John Chadwick **Department:** Geology

Title: *Prediction of Catastropic Eruptions of Colima Volcano, Mexico, via Analyses of Long-term Trends in Lava Chemistry*
Conference: Geological Society of America's Annual Conference

As the most active volcano in Mexico, Volcan de Colima is an excellent laboratory for understanding patterns of eruption activity and how the chemistry of its lavas and gases varies over time. Understanding how the chemical signatures of these volcanic products evolve may allow for improved predictions of the particularly powerful and deadly eruptions that occur at Colima about once every century. Working with a professional colleague in Mexico, student Haley Cabaniss collected lava samples in Colima during the summer of 2014 from several eruptions dating back to the 1960s. In this study, Haley and her College of Charleston mentor Dr. John Chadwick are analyzing the chemistry of Colima lavas and volatile gases trapped in tiny inclusions within these samples to understand how their variability relates to the pattern of eruptions over time to identify patterns in volatile behavior that signal the start of eruptions.

7. **Student: Christine Logan Chambers** **Major:** Psychology
Mentor: Lisa Thomson Ross **Department:** Psychology

Title: *The Role of Sex Education for Reducing Risky Behaviors*
Conference: Society of Southeastern Social Psychologists

Early sexual behaviors (ESBs) and risky sexual behaviors (RSBs) put young adults in danger of

unwanted outcomes (STD/STI, pregnancy, sexual aggression). The current study focused on the prevention of ESBs/RSBs through sex education. Secondary data was used to test the hypothesis that students reporting higher quality sex education would have lower reports of ESBs/RSBs. College women (N=260, 73% Caucasian, M = 19 years) completed a survey on the quality of sex education (family and school) and ESBs/RSBs. Sex education quality was more valuable from mothers than fathers. Participants who reported the sex education from their mothers as more valuable were more likely to report their first sex was with a partner they had known longer and closer to their age. Participants reporting more valuable father sex education also reported fewer sexual hookups. Surprisingly, school sex education was unrelated to ESBs/RSBs. Family-based sex education can be valuable for reducing ESBs/RSBs.

8. **Student: F. James Claire** **Major:** Chemistry
Mentor: Richard Himes **Department:** Chemistry and Biochemistry
Title: *Synthesis of novel dual-active antimitotic chemotherapies*
Conference: South Eastern Meeting of the American Chemical Society

The goal of this project was to design and synthesize a novel chemotherapeutic compound. One way to make chemotherapies more effective is to design the drugs such that they will bind to multiple sites within cells to disrupt several cell processes. Our compound was designed based on the chemically- active structures of two molecules that are known to inhibit cell division in different ways. Combretastatin A-4 (CA4), the first of these molecules, attacks microtubulin within a cell to prevent cell division. The second molecule is a Roche drug that suppresses tumors by attacking a specific site abundantly found in tumor cells of many types of cancer. The combination of these two compounds' structures will allow our novel chemotherapy to bind to both of these sites therefore having greater cytotoxicity to cancer cells.

9. **Student: Lundy Davis** **Major:** Biology
Mentor: Brooke Van Horn **Department:** Chemistry and Biochemistry
Title: *Iodinated Hydroxylamines for X-ray Opaque Polyester Materials*
Conference: Southeastern Regional Meeting of the American Chemical Society

X-ray imaging is a common technique used in medical science in which contrast agents injected in the body are illuminated to detect and diagnose disease states. Our lab aims to guide X-ray imaging science away from the current limitations associated with small molecule contrast agents and toward polymer systems. The polymeric systems we are building have the benefit of being tunable in size and the potential to target tissues, diagnose/image and treat disease through personalized medicine. In summer 2014, we fulfilled our goal of successfully synthesizing a triiodo small molecule and conjugating it to varying polymer chains. We will continue to improve the synthesis and purification of the triiodo small molecule and conjugate it to polymer chains for higher iodine concentration, as well as evaluate our products using Nuclear Magnetic Resonance (NMR) and Gel Permeation Chromatography (GPC) at CofC and by X-ray analysis with collaborators at Clemson University.

10. **Student: Lauren Deasy** **Major:** Psychology
Mentor: Daniel Greenberg **Department:** Psychology
Title: *Sociability, Personality, and Autobiographical Memory*
Conference: Annual Meeting of the Southeastern Psychological Association

Our memories provide us with a record of where we have gone, what we have done, and who we have been. On a social level, they connect us to a point in history (as with memories of 9/11), and they help us establish relationships with others. Most people recall memories that are detailed, rich, and vivid; however, other people report memories that are overly general, and they cannot provide specific details, even when pressed. People who tend to retrieve overgeneral memories are vulnerable to depression and other mental illnesses as well as several forms of cognitive decline.

In this study, we examined the relationship between personality, social support, and memory in older adults. We found that strong support of family members led to stronger and more positive autobiographical memories; the support of friends had no significant effect. We now plan to present

these findings at the Southeastern Psychological Association's annual meeting.

11. **Student: Taylor Domenick** **Major:** Biochemistry
Mentor: Wendy Cory **Department:** Chemistry and Biochemistry
Title: *Photodegradation of Fluoxetine in the Aquatic Environment*
Conference: 2015 International Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

The effect of the release of pharmaceuticals into the environment is gaining attention due to their potentially deleterious effects on aquatic organisms. Selective serotonin reuptake inhibitor fluoxetine (Prozac®) has been reported to persist (remain) in the aquatic environment. Photoexposure has been documented to degrade pharmaceuticals and result in the formation of new compounds (products) with diverse activities. In this work, aqueous solutions of fluoxetine were exposed to simulated sunlight with and without humic acid (HA), a form of natural dissolved organic matter found in the environment, to mimic natural water conditions. After light exposure, the samples were chemically analyzed and the rate of fluoxetine photodegradation was determined. Data indicated that the half-life of fluoxetine in water was 46 hours, meaning it took almost two full days for half of the sample to degrade. Humic acid was observed to speed up the degradation reaction.

12. **Student: Tess Dooley** **Major:** Marine Biology
Mentor: Robert Podolsky **Department:** Biology
Title: *Fertilization in single- and multiple-male spawnings under elevated CO_2: implications for reproductive success in response to ocean acidification*
Conference: Society for Integrative and Comparative Biology Annual Meeting

Ocean acidification (OA), where CO_2 is absorbed by the ocean, is of major ecological concern because it interferes with pH-sensitive biological processes. Our recent research suggested that predicted near-future levels of OA will negatively impact fertilization in the sea urchin, *Arbacia punctulata*. However, recent literature reviews have noted that OA more weakly affects fertilization in studies that mixed gametes from multiple mating pairs. To test the hypothesis that group spawning reduces the negative effects of OA, we measured fertilization success under current and 2.5x-current CO2 conditions using single- and multiple-male crosses. We did not find a significant effect of CO_2 on fertilization and the multiple-male crosses did not show greater resistance to the effects of CO_2. However, the multiple-male crosses showed significantly lower fertilization than the average fertilization of the single-male crosses, indicating an interaction among sperm that could reduce fertilization success for females that spawn in larger aggregations.

13. **Student: Aliya Dumas** **Major:** Biochemistry
Mentor: Wendy Cory **Department:** Chemistry & Biochemistry
Title: *Photodegradation of Diphenhydramine*
Conference: 2015 International Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Pharmaceuticals enter the sewage system as the result of human excretions or improper disposal of unused medications. Often, these compounds are not wholly removed during the wastewater treatment process. Once in the aquatic environment, they are then exposed to sunlight which facilitates photochemical degradation. In this work, the photodegradation of diphenhydramine (Benadryl®, a common antihistamine) in aqueous solution was investigated. Solutions were exposed to light in a solar simulator, then chemically analyzed in order to measure the amount of diphenhydramine left in solution as well as any new compounds (products) that might have formed as a result of the photochemical reactions. The effect of humic acid, a form natural organic matter found dissolved in natural water samples, was investigated. The resulting data was used to determine the rate of the photodegradation reactions, and the products of these reactions were also measured and identified.

14. **Student: Hannah Evans** **Major:** English
Mentor: Simon Lewis **Department:** English/International Studies
Title: *Chimamanda Ngozi Adichie against the single story: intersections of virtual space, transnationalism, and feminism*
Conference: British Commonwealth and Postcolonial Studies Conference

This project explores Nigerian author Chimamanda Ngozi Adichie's layered narrative in her novel *Americanah*. Adichie writes virtual space in a transnational context, through her protagonist's blogs, to scrutinize racism in the U.S. and give intersectional perspectives on feminism and nationality. She inhabits multiple spaces, both literary and actual, rejecting a "single story" of Nigerian literature. A close reading of Adichie's fiction and that of relevant African and African-American contemporaries forms my foundation. I situate this reading within the context of Adichie's presence in popular culture, including TED talks, online articles, and a blog based on her protagonist's blog in *Americanah*. I examine how Adichie inserts herself into and pushes against Nigerian literary tradition. Virtual space in *Americanah* gives insight into how Adichie's transnational status enables her bold comments on American racism and cross-cultural feminism. Virtual space connects the narrative functions in *Americanah* to Adichie's participation in popular and literary discourse.

15. **Student: Chloe Fletcher** **Major:** Data Science
Mentor: Jason Howell **Department:** Mathematics
Title: *Dynamic Modeling of Targeted and Non-targeted Advertising Strategies*
Conference: Institute for Operations Research and the Management Sciences 2014 Annual Meeting

With the growing collection of data regarding the depth of detailed knowledge of consumer habits and trends, firms are gaining the capability to discern customers of other firms from the market of uncommitted consumers. Firms with this capability will be able to implement advertising campaigns where the advertising effort towards customers of competing firms differs from that towards uncommitted customers. We develop two mathematical models for the dynamic behavior of sales due to competitive advertising in a setting with a small number of competing firms. One model (non-targeted) assumes the advertising effort is the same for both categories of customers, and the other model (targeted) gives firms the capability to allocate advertising effort across the two categories differently. The models are mathematically analyzed and we formulate and answer several strategic questions that a firm may face when implementing a targeted policy.

16. **Student: Malka Fox-Epstein** **Major:** Public Health
Mentor: Beth Sundstrom **Department:** Communication/Public Health
Andrea DeMaria Health and Human Performance
Title: *Investigating correlates of daily and nondaily contraception use among college-aged women*
Conference: 142nd American Public Health Association Annual Meeting and Exposition

One third of unintended pregnancies in S.C. are among women in their twenties. The majority of these women use "the pill" as their primary method of birth control, which has a higher failure rate than nondaily contraception. This study investigated correlates of daily and nondaily contraception use. 663 participants aged 18-24 years completed self-administered web based surveys. Contraception methods were categorized as daily (oral contraceptive pill) and nondaily (IUD, implant, injection, patch, vaginal ring). Results showed nondaily users were more likely to have a history of vaginal (p=.02) and anal (p=.01) intercourse, giving (p=.02) and receiving (p=.02) oral sex, and greater frequency of solo masturbation (p<.01) during the past four weeks than daily users. Those classified as overweight or obese were significantly more likely to primarily use nondaily contraceptive methods (*OR* 3.82; 95% *CI* [1.61, 8.77]; p<0.01). Findings suggest opportunities to increase uptake of nondaily methods among college-aged women.

17. **Student: Megan Freifelder** **Major:** Elementary Education and Dance
Mentor: Gretchen McLaine **Department:** Theatre and Dance
Title: *To "e" or not to "e"? Using technology for enhanced collaborative learning and self-reflection*
Conference: National Dance Education Organization Conference 2014

Our research project, "To e or not to e," is a study on how technology, specifically the use of e-portfolios, can expand the way artists engage in collaborations, receive and apply feedback, and how they can be effectively used to assess dance education practices and outcomes. E-portfolios are a key tool to artists' engagement in meaningful assessments and reflective practice. Our research demonstrates the need for dance educators to incorporate e-portfolios and other technology into their teaching, and that prospective employers in this market prefer seeing the applicant's work in one place and in a creative, up-to-date, format. The resulting presentation will provide attendees easy-to-use, practical applications for implementing various technologies in their classrooms, and the value of such.

18. **Student: Madeleine Gordon** **Major:** Chemistry
Mentor: David Boucher **Department:** Chemistry and Biochemistry
Title: *Mixed-solvent Directed Assembly of Poly(3-hexylthiophene) Films*
Conference: Southeastern Regional Meeting of the American Chemical Society

Organic photovoltaic (OPV) materials are a growing field in the area of solar cell research. Poly(3-hexylthiophene) (P3HT) is a common photovoltaic polymer used in the construction of OPVs and the structure of solid P3HT thin films plays a central role in device efficiency. Our research explores the structural order and assembly of P3HT thin films through fine adjustments made in the composition of solvent mixtures used to process these solar cell materials. We have used different optical and atomic force microscopy imaging techniques to observe the structure of the film surfaces, which is critical to the efficiency of P3HT-based solar cells. Our research has shown that small changes in the composition of binary organic solvent mixtures and P3HT film processing procedure lead to drastic changes in the P3HT film structure. Our observations will help improve our understanding of what structures are optimal for the performance of P3HT-based solar cells.

19. **Student: Avigeet Gupta** **Major:** Biochemistry
Mentor: Timothy Barker **Department:** Chemistry
Title: *Synthesis of Unnatural Amino Acids*
Conference: Southeastern Regional Meeting of the American Chemical Society

Amino acids are the basic building block of all living things. There are twenty naturally occurring amino acids in nature. We examined methods to make unnatural amino acids in the chemistry laboratory that have previously never been made. These unnatural amino acids will then be connected into a string of natural amino acids. We focused our efforts on the synthesis of the unnatural amino acids.

20. **Student: Nicholas J. Harris** **Major:** Biology
Mentor: Jennifer L. Fox **Department:** Chemistry and Biochemistry
Title: *Mutational Analysis of Heme A Synthase*
Conference: Southeastern Regional Meeting of the American Chemical Society

Proteins act as the agents that orchestrate an intricate series of chemical reactions in our bodies' cells, through which all of the components of the cell are created, broken down, and transformed into useful molecules. There are thousands of unique proteins within a cell, each with its own specific role. The goal of this project is to understand how the cell synthesizes the large protein complex cytochrome oxidase, which has a crucial role in the cell's ability to generate energy. Improper function of cytochrome oxidase can lead to a broad range of negative impacts on human health. To determine the mechanism for the complicated assembly process of cytochrome oxidase, we focused on one of the steps that is not yet understood (specifically, cofactor synthesis and installation into the maturing complex). We investigated this step by altering the enzyme responsible for performing it and analyzing

the effects of those modifications.

21. **Student: Alyssa Johnson** **Major:** Geology
Mentor: John Chadwick **Department:** Geology
Title: *Analyzing the Eruptive Phases of the Blue Dragon Lava Flow through Hyperspectral and Multispectral Remote Sensing and Geochemical Analysis*
Conference: Geological Society of America 2014

The Blue Dragon flow resulted from a volcanic eruption approximately 2,000 years ago at Craters of the Moon National Monument in Idaho, and is one of the largest single lava flows in the contiguous United States. Field work conducted by Dr. John Chadwick and student Alyssa Johnson in the summer of 2014 revealed that the flow resulted from multiple eruption phases. Geochemical analysis on the collected lava samples is performed using X-Ray Fluorescence (XRF) for major and trace elements at external laboratories after preparation in Dr. John Chadwick's high temperature geochemisty lab. Chemical analysis of the lava samples reveals that the magma supplying these eruptions evolved over time in a shallow magma chamber. Remote sensing satellite images are also being used to determine the boundaries and volume of the eruptive phases.

22. **Student: Savannah Jones** **Major:** Biochemistry
Mentor: Timothy Barker **Department:** Chemistry
Title: *Lewis Acid-Catalyzed Minisci Reactions*
Conference: Southeastern Regional Meeting of the American Chemical Society

Heterocycles are molecules with a ring of carbon atoms that also contain nitrogen, oxygen or sulfur. Heterocycles are an important class of molecules to study because they are often found in drug candidates and medicines. The ability to easily modify a heterocycle is useful to medicinal chemists because they are then able to create many drug candidates with slightly different structures and physical properties. We developed a method to modify heterocycles to provide medicinal chemists an efficient way of preparing many different drug candidates from a single heterocycle starting material.

23. **Student: Lisa Kasprzok** **Major:** Chemistry
Mentor: Wendy Cory **Department:** Chemistry and Biochemistry
Title: *Solar Photodegradation of Sertraline in the Aquatic Environment*
Conference: 2015 International Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Pharmaceuticals are being released into our aquatic environment by wastewater treatment plants and are increasingly being detected along with the products that they turn into after chemical reactions in the environment. These new compounds can be more toxic than the pharmaceutical itself. We investigated what happens when solutions of sertraline (Zoloft®), a commonly prescribed anti-depressant, are exposed to sunlight. Some solutions contained humic acid, a form of natural organic matter that is found in the aquatic environment. Samples were photoexposed in a solar simulator and analyzed at certain time points. As expected, the concentration of sertraline was observed to decrease due to photodegradation. Sertraline was observed to photodegrade quickly, within the course of a day; added humic acid made it photodegrade even faster. Future work, to be included in the presentation, will include evidence of new compounds that formed using a chemical analysis technique called liquid chromatography-mass spectrometry (LC-MS).

24. **Student: Kellen Lawson** **Major:** Astrophysics
Mentor: Joe Carson **Department:** Physics and Astronomy
Title: *Searching for Extrasolar Planets with the Subaru SEEDS Survey*
Conference: American Astronomical Society 225th Meeting

This research comprises the major part of the High-Mass Star study within SEEDS, a direct

imaging exoplanet survey. Observations for the survey are carried out using the 8-meter Subaru Telescope's HICIAO camera in near-infrared wavelengths. We utilize sophisticated software to remove much of the star's light in the images in order to resolve the relatively much fainter planetary light. Once confirmed, additional observations may allow for a wealth of information to be uncovered regarding the planet – including planet temperature, composition, and atmospheric chemistry. These measurements aid in filling a significant gap in the census of exoplanet data, and will help to reach a more complete understanding of the nature of these astronomical bodies. In January, the survey's progress to date will be reported – including the nature of the novel methods used in processing our data, improved software sensitivities, and the prior discovery of the Super-Jupiter planet Kappa Andromedae.

25. **Student: Robert Lemasters** **Major:** Physics
Mentor: Mike Larsen **Department:** Physics and Astronomy
Title: *Investigating the Dependence of Fractal Dimension on Raindrop Size for Drop Arrival Times as Measured by a Two-Dimensional Video Disdrometer*
Conference: American Geophysical Fall Meeting

The statistical structure of rainfall is an important, yet not well characterized subject in the field of atmospheric microphysics. For most purposes, raindrops are assumed to arrive in a completely random fashion. However, when rainfall is looked at closer, one will find that this is not quite the case and that rain has an inherent "clumpyness" to it. This project is mainly focused on characterizing this observed deviation from perfect randomness and how this evolves throughout a given storm. There exist a variety of methods that can used to better identify these deviations, but for this project we attempt to calculate what's called the "Monofractal Dimension" of a storm because of its easy implementation and relatedness back to physical phenomena. With data provided by a novel rain-measuring instrument array located at Dixie Plantation in Hollywood, SC, we have developed a better understanding of the behavior of rain.

26. **Student: Danielle Massé** **Major:** Applied Mathematics
Mentors: Jason Howell **Department:** Mathematics
Title: *Newtonian and Non-Newtonian Fluid Dynamics in Abdominal Aortic Aneurysms*
Conference: Society of Industrial and Applied Mathematics Conference on Computational Science and Engineering

Prevalence of abdominal aortic aneurysms in the general population is estimated to be at least 2%, and rupture of these aneurysms often directly leads to mortality. Biomedical research has indicated that dynamic characteristics of the blood flow inside arteries with aneurysms are risk factors for both the enlargement and rupture of the associated aneurysm. In Summer 2014 this project analyzed these blood flow characteristics inside arteries with aneurysms from a mathematical and computational standpoint. In the model, an idealized shape of an aneurysm was constructed and subsequently adjusted to account for characteristics found in actual aneurysms. Data from the simulations indicated that the force along the arterial walls of an asymmetric aneurysm presents a larger gradient than symmetric aneurysms, which could lead to further growth and possibly rupture of the modeled aneurysm. Ongoing research will extend these simulations to more realistic geometries and fluid parameters.

27. **Student: Grace Moxley** **Major:** Biology
Mentors: Andrea DeMaria **Department:** Health and Human Performance
Beth Sundstrom Public Health/Communication
Title: *Predicting women's responses to contraceptive campaign messages: An application of the theory of planned behavior*
Conference: Society for Public Health Education 66th Annual Meeting

Despite widespread use of the oral contraceptive pill (OCP), half of all pregnancies in the US remain unplanned. Nondaily (e.g., vaginal ring, patch) contraceptive options offer an alternative approach that has proven more effective than the OCP in preventing pregnancy. Despite high rates of unintended

pregnancy, reported lack of satisfaction with traditional methods, and the success of nondaily options in studies and clinical trials, women in the US continue to rely on the OCP as their primary birth control method.

Long-acting reversible contraceptives (LARC) (e.g., intrauterine device, implant, injection), a category of nondaily contraception, eliminate the possibility of user error and offer higher rates of effectiveness. The recent Affordable Care Act requires that all FDA-approved contraceptives, including LARC methods, must be covered by health insurance. Research suggests with the barrier of price removed, LARC methods become a more realistic option for all women.

This research project offered an interdisciplinary approach to investigate psychological, clinical, and behavioral factors impacting contraceptive choice. Research findings will extend public health and communication concepts, methods, and theory to offer practical recommendations for campaign development.

28. **Student: Marino Mugayar-Baldocchi** **Major:** Psychology
Mentors: Anthony Bishara **Department:** Psychology
Title: *Anchoring Effects on Earliest Autobiographical Memories*
Conference: Annual Meetings of the Psychonomic Society and Society for Judgment and Decision Making

The current project investigated the malleability of people's earliest memories. We were particularly interested in whether participants' reported age of their earliest memory could be influenced by a subtle cognitive technique called anchoring. Anchoring is the choice of an arbitrary number that influences a person's estimate. There were two conditions with an anchor present, one to pull the age estimate up and one to bring it down, and a control condition with no anchor. After reporting the age of their earliest memory, participants then had to rate certain aspects of that memory on 7 point scales. The results suggested that participants' estimates were pulled up by the anchor but were not brought down the other anchor. Moreover, the reported age of the memory was more malleable if the person recalled the event in a third person perspective as opposed to a first person perspective.

29. **Student: Joye Nettles** **Major:** Computer Science
Mentor: James Bowring **Department:** Computer Science
Title: *CHRONI – An Android Application for geochronologists to access archived sample analyses from the NSF-funded GeoChron.org data repository*
Conference: 2014 American Geophysical Union Fall Meeting

Today, geochronologists are archiving their data and results to public cloud archives managed by the NSF-funded GeoChron database. The software application U-Pb_Redux[1,2,3] developed by Dr. Bowring at the College of Charleston provides seamless connectivity to GeoChron for geochronologists to automatically upload and retrieve their data. CHRONI is a mobile application for Android devices that provides easy access to this information. With CHRONI, geochronologists can view archived data and analyses downloaded from the GeoChron database, or any other location, in a customizable format. CHRONI uses special documents called Report Settings to create the customized data display on a mobile device. In addition to providing geologists effortless mobile access to archived data and analyses, CHRONI allows users to manage their GeoChron credentials, quickly download private and public files, and view specialized graphics associated with particular files. Future versions of CHRONI will be developed to support iDS-compatible (iPhone, iPod, and iPad) devices.

30. **Student: Samantha E. Nicolau** **Major:** Biochemistry and Biology
Mentor: Brooke Van Horn **Department:** Chemistry & Biochemistry
Title: *Investigations into the Ring-Opening Polymerization of 1,4,8-trioxa[4.6]spiro-9-undecanone (TOSUO) using an Organocatalyst*
Conference: Southeastern Regional Meeting of the American Chemical Society

Current polymer science is evolving in its preparation of materials for an expanding variety of applications and to fill those needs, synthetic chemists must have precise control over the properties of those materials and therefore the means that we employ to make them. We are exploring organic catalysts for the synthesis of materials using analog molecules of epsilon-caprolactone. These polymers have significant value in biomedical applications where the health and safety of the material may require moving away from traditional heavy metal catalysts. We are preparing copolymers of epsilon-caprolactone and a ketal-containing analog as a means to introduce functional groups in the polymer in subsequent chemical reactions. Interestingly, we create polymers with one monomer inserting preferentially rather than randomly or statistically early in the polymerization process, giving gradient copolymers. This undergraduate presentation will highlight our preliminary results using NMR and GPC characterization of the polymerization process and final products.

31. **Student: Brenna C. Norton-Baker** **Major:** Biochemistry
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: *Introduction of FT-IR and ^{19}F NMR probes in proteins via S_NAr*
Conference: Southeastern Regional Meeting of the American Chemical Society

Many proteins need to fold in a globular structure to perform their functions. A folded protein can harbor microenvironments with significantly different characteristics. The development of specific probes to determine the properties of these microenvironments is an active area of research. We have used a simple chemical reaction to modify proteins and site-specifically introduce probes suitable for vibrational spectroscopy and nuclear magnetic resonance. This reaction uses cheap and relatively safe reagents, making it suitable for settings such as undergraduate institutions.

32. **Student: Derek Novo** **Major:** Physics
Mentor: Sorinel A. Oprisan **Department:** Physics and Astronomy
Title: *Fluctuations in network's parameters and their effects on the shape of interval timing output*
Conference: Annual Meeting of the Society for Neuroscience

In most species, decision making, rate calculation, and planning necessitate temporal estimations in the seconds-to-minutes range (interval timing). Briefly, a conditioning stimulus (light or sound) is presented to a subject for a to- be-learned duration and the subject's first response after the stimulus is terminated is reinforced with a reward. After this training, the conditioning stimulus is instead presented for threefold the duration of the learned time without reinforcement. During this procedure, the subjects respond less at the beginning, most around the learned time, and then gradually less as the trial ends, following a tailed Gauss-like distribution with a standard deviation proportional to the learned time. We used a computational network of oscillators that mimics the activity of some neurobiological structures known to be involved in interval timing. We found that small fluctuations of the network's parameters have specific signatures that help to reveal the source of noise perturbing the network.

33. **Student: Tyler Perini** **Major:** Mathematics (Applied)
Mentor: Amy Langville **Department:** Mathematics
Title: *The Humility Project: Text Analysis for Characteristic Linguistic Patterns*
Conference: Southeastern Chapter of the Institute for Operations Research and the Management Sciences

There has been a growing interest in using language data to identify, quantify, and differentiate individuals as either having or lacking certain traits, and in this research, our interest lies in humility. We

hope to empower the developing concept of humility's psychological construct by unveiling the hidden linguistic trends in self-reported answers from volunteers, treating sentences from responses as documents, while comparing to the individuals' respective humility scores. After initial data collection, we use a web tool to extract usage of terms, parts of speech, and semantic categories, which will initialize a sparse feature-by-document matrix, *A*, where we then introduce some term-weighting methods. By applying nonnegative matrix factorization (NMF), we decompose this matrix into two matrices that identifies some *k* number of trend vectors that best describe the data set: the *W* matrix specifies the weights of the terms' belonging to each topic, and the *H* matrix shows the topic distribution over the documents. By varying the values for *k*, and manipulating the weighting schemes used, we hope to find valuable topics that are uniquely characteristic for the 'humble' documents. From the topic-by-document *H* matrix, we may cluster the documents and evaluate the significance of the specified topic vectors; on the other hand, the term-by-topic *W* matrix allows us an easy resource for visualization, i.e. by creating word clouds of the characteristic words within the descriptive topics. With further improvements, the objective for this research is to create a tool that can predict the humility of an unknown query document.

34. **Student: Dillon Presto** **Major:** Chemistry
Mentor: David Boucher **Department:** Chemistry and Biochemistry
Brooke Van Horn
Title: *Progress Toward P3HT Block Copolymers from Modular "Click" Syntheses*
Conference: Southeastern Regional Meeting of the American Chemical Society

Organic photovoltaic materials show significant promise in creating more efficient solar cells. Unlike traditional silicon-based solar cells, organic-based materials are relatively lightweight, inexpensive, and their optical properties can be manipulated and optimized. Poly(3-hexylthiophene) (P3HT) is a benchmark polymer in organic photovoltaic devices. However, in many organic solvents P3HT, the electron donor, separates from the electron acceptor, such as quantum dots. Our research aims to solve this problem by adding small amounts of copolymers, which dramatically increase organic photovoltaic device performance, to P3HT blends. We seek to couple P3HT to polymers such as polystyrene that affinity for electron acceptors using a novel "click" chemistry methodology. This approach will give us greater control over the molecular architecture of the polymers. Once perfected, we will use this method to create a library of copolymers with varying chain lengths, which will serve as the basis for future research on polymer properties and device performance.

35. **Student: Caitlin Purvis** **Major:** Biology
Mentor: Wendy Cory **Department:** Chemistry and Biochemistry
Title: *The Photodegradation of Bupropion*
Conference: 2015 International Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy

Pharmaceuticals and over-the-counter medicines have been observed to have environmental effects due to human consumption and subsequent excretion of medications as well as the improper disposal of these products. Once introduced into an aquatic environment, drugs may further degrade into more toxic moieties which may harm humans and aquatic organisms. We investigated the effects of exposing solutions of bupropion (Wellbutrin®), an anti-depressant and smoking cessation aid, to simulated sunlight. Some solutions contained dissolved organic material, humic acid, which is naturally found in the aquatic environment. Samples were exposed to simulated sunlight for specific time periods so we could determine the concentration of bupropion after exposure. After photoexposure, bupropion in solution quickly degraded in less than a day, and the addition of humic acid aided in degradation. Future work will include identifying the photodegradation products and their toxicity using a chemical analysis technique called liquid chromatography-mass spectrometry (LC-MS).

36. **Student: Carson Reed** **Major:** Biochemistry
Mentor: Richard Himes **Department:** Chemistry and Biochemistry
Title: *Synthesis and Evaluation of a Novel, Bis-indenyl "Batwing" Ligand*
Conference: Southeastern Regional Meeting of the American Chemical Society

Often, it is necessary for synthetic chemists to utilize chemical additives called catalysts to speed up the rate of reactions and to increase reaction efficiency. Efficiency is key in various chemical industries, such as in the pharmaceutical industries and materials development (e.g., polymers). The advent of efficient chemical reactions in the pharmaceutical industry not only lowers the economic cost of synthesizing new drugs, and it also can open up novel synthetic routes to new drugs or other necessary compounds. My research involves the design and synthesis of a specific catalyst that can achieve this efficiency in the synthesis of new compounds with practical applications. Currently, I have successfully synthesized my catalyst precursor and will be investigating how this compound can be used to speed up the rates of certain reactions.

37. **Student: Luke Rein** **Major:** Biology
Mentor: Allison Welch **Department:** Biology
Title: *Toxicity of combinations of naproxen and its photodegradants*
Conference: Society for Integrative and Comparative Biology Annual Meeting

Pharmaceutical compounds have been observed in natural waterways, due largely to their incomplete removal from wastewater. In the environment, ultraviolet radiation can degrade these pharmaceuticals into other biologically active compounds. However, continual input of common pharmaceuticals results in pseudo-persistence, whereby enough new material is added that levels remain elevated in spite of their breakdown. We investigated the effects of UV photodegradation and pseudo-persistence on the toxicity of naproxen, a common anti-inflammatory. Southern toad tadpoles were exposed to naproxen, its two degradants, and combinations of these three compounds in proportions that correspond to laboratory observations of naproxen photodegradation. Naproxen's two degradants were significantly more toxic than naproxen itself, and combinations of naproxen and its photodegradants were particularly toxic. These data suggest that the ecological effects of pharmaceutical pollutants may be underestimated.

38. **Student: Enis Sanchez** **Major:** Chemistry
Mentor: Marcello Forconi **Department:** Chemistry and Biochemistry
Title: Using Bio-Based Materials to Synthesize a Novel Surfactant in the Production of 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.

39. **Student: Justin Skinner** **Major:** Biology
Mentor: Robert Podolsky **Department:** Biology
Title: *Sensory Neuron Plasticity During Claw Transformation in the Snapping Shrimp, Alpheus angulosus*
Conference: Society for Neuroscience 2013 Annual Conference

Alpheus species' claws are bilaterally asymmetrical: they possess a pincer and a snapper claw that differ both functionally and morphologically. Both claws play important roles in the behavioral interactions of the shrimp. When the snapper is removed, the pincer will morph over a period of four molts into a functioning snapper claw, which has the unique ability of producing a "snapping" sound when the shrimp rapidly closes the large claw. Transformation occurs through a step-like change in shape, nerve growth, and muscle tissue. Setae, hair-like structures on the claw, are the outward projections of sensory nerves; they provide a unique opportunity to use outward morphology as a window into the normally concealed nervous system. We will present our completed analysis of changes in setae patterns throughout claw transformations and what these changes may reflect in the nervous-system structures underneath the claws' surfaces.

40. **Student: Peter Spearman** **Major:** English
Mentor: Kathleen Beres Rogers **Department:** English
Title: *The Disabled Body: Superpowers in Lord Byron's The Deformed Transformed*
Conference: International Conference on Romaticism

Little has been written on Byron's last and unfinished play, *The Deformed Transformed.* Only article out there is "Unfixing Disbility in Lord Byron's *The Deformed Transformed*" by Sharon L. Snyder. In it she states that the disabled body resignifies its own cultural perception. However I believe that Arnold, the play's protagonist, gains heightened ability in his disability. In this play, Byron essentially creates super powers and provides a standard that has been followed since. Arnold of *The Deformed Transformed* inhabits an othered space, and his heroism is derived from that space. Arnold says that he received valor from disability. I want to explore the hyper-ability found in disability. This idea can be seen in the modern Byronic hero – the superhero. Much like a comic book, seeing something on the stage allows for audiences to really empathize with their heroes. We want our heroes to be tall, dark, and disabled.

41. **Student: Nicholas G. Taylor** **Major:** Physics
Mentor: Jennifer L. Fox **Department:** Physics and Astronomy
Title: *Nonlinear effects induced by stimuli on the phase resetting curve*
Conference: Society for Neuroscience 2013 Annual Conference

Rhythmic patterns of neural activity are ubiquitous phenomena in animals. Central pattern generators are autonomous networks of neurons that control biological rhythms such as the circadian rhythm, heartbeats, etc. The neurons change their firing patters due to the inputs from other neurons. Inputs arrive to the neurons with different amplitudes, durations, and shapes. As a result, each input induces a different neural response. In these computational experiments, we mimicked injected electrical stimulus of different amplitude, duration, and shapes into a neuron model. We found that the relationship between the stimulus strength and the response of the neuron was linear. However, the duration of the stimulus induced a non-linear response. This suggests that the change in firing rate is not strictly proportional to the area under the curve of the stimulus, as previously thought, but is also sensitive to other parameters such as how fast the stimulus reaches its maximum value.

42. **Student: Joshua Teves** **Major:** Chemistry
Mentor: Mike Larsen **Department:** Chemistry and Biochemistry
Title: *Synthesis of Stereospecific Bis-Indene Catalysts*
Conference: Southeastern Regional Meeting of the American Chemical Society

Everyone recognizes the vital role that medicine plays in our society today. However, not many

people are aware of the difficulties that organic chemists face when making pharmaceutical drugs. It is often difficult to control certain aspects of a molecule's structure, specifically its three-dimensional arrangement. This spatial arrangement of the drug's structure determines how it will react with the body. For instance, the anti-inflammatory drug known as Aleve could instead act as a liver toxin if its three-dimensional shape is slightly different. Our goal is to fabricate a new molecule, also known as a catalyst, which will aid in making the correctly shaped drug structures. Our newly designed catalyst has been based off a previous molecule that proved successful. Once we have finished producing our catalyst, we hope to soon test its effectiveness in making pharmaceutical drugs that require a specific three-dimensional arrangement.

43. **Student: Travis Varner** **Major:** Psychology
Mentor: Richard Himes **Department:** Psychology
Title: *Developmental Origins of the Moral Sense*
Conference: Cognitive Development Society

How do children first learn about, and begin to explore, the moral domain? We hypothesized that pretend play serves as an important context for moral learning by providing opportunities for moral evaluation and for moral exploration, as children take on/explore "moral themes.

We studied five children from 2.0 to 5.0-years-old. We coded separately for when they engaged in pretend play and when morally relevant parent/child dialogue occurred, mapping the extent to which these two overlapped. While there was a developmental decrease in the frequency of moral dialogue in general, there was no developmental change in the frequency of moral dialogue within the context of pretend play. Moral evaluation decreased and exploration increased over time. Children increasingly use pretend play as a medium through which to explore moral themes, doing so allows for an increased sensitivity to the feelings, dispositions, and behaviors of those (real/imaginary) with whom they interact.

44. **Student: William Vesely** **Major:** Biochemistry
Mentor: Vijay M. Vulava **Department:** Chemistry and Biochemistry
Title: *Synthesis of a Novel Dual-Action Cytosporone E/Triazole Antibiotic*
Conference: Southeastern Regional Meeting of the American Chemical Society

Antibiotic resistance is an issue that has recently taken precedence in the medical community and is rapidly becoming difficult to combat. As more antibiotics are introduced into our water supply, soil, and food, bacterial resistance to these antibiotics escalates, which reduces the effectiveness of current commercial antibiotics. The goal of this project is to create a series of new antibiotics, to which bacteria have not yet grown resistant. To do this we will be combining cytosporone E, a compound shown to have antibiotic properties, with key features of other antibiotic compounds. These new compounds will then be tested against different strains of bacteria to determine how effective they are compared to current antibiotics. The results from these tests will give us insight into how to change and design the next generation of antibiotic derivatives.

45. **Student: Grace Waddell** **Major:** Biochemistry
Mentor: Jennifer L. Fox **Department:** Chemistry and Biochemistry
Title: *Synthesis of a Novel Dual-Action Cytosporone E/Triazole Antibiotic*
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generation of antibiotic derivatives.

46. **Student: Benjamin Wilson** **Major:** Computer Science
Mentor: Joe Carson **Department:** Physics and Astronomy
Title: *Extrasolar Planets and Disk Imaging using the Hubble Space Telescope*
Conference: 225th American Astronomical Society Conference

The Hubble DICE survey is an observational program approved by NASA. The team consists of nineteen multinational experts in the field of astrophysics. Led by Dr. Glenn Schneider (Univ Arizona), there is an ongoing effort to study eleven carefully chosen stars with known circumstellar disks. The disks surrounding these young stars are interesting because they are believed to be the birthplaces of planets. By discovering evidence of planet formation in these disks, either by imaging disk gaps caused by forming planets or by directly imaging the planets themselves, one can gain invaluable insights to guide planet formation theories and ultimately help better understand the origins of our own solar system.

B. Wilson will be presenting his progress with Hubble DICE and the numerous contributions he has made in the last year. These contributions include revealing new disk substructures that have not previously been seen. Attending the conference will therefore be a unique opportunity to present unmatched progress, achieved at College of Charleston, for interpreting new results from NASA's flagship space telescope.