COLLEGE of CHARLESTON

SCHOOL OF SCIENCES AND MATHEMATICS

30th Annual Poster Session Abstracts
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1. The Confinement Effect on a Superparamagnetic Nanocolloid

Gabrielle Seymore, Ashley Rice, Ana Oprisan, and Sorinel Oprisan, Department of Physics and Astronomy

Superparamagnetic nanocolloids could be implemented in the medical field in the near future due to their biocompatibility, magnetic qualities, cost efficient manufacturing process, and external manipulation possibilities in vivo.

Multiple experiments were conducted using a shadowgraphy method of imaging to record the diffusion process of the magnetic nanocolloid with a concentration gradient, oriented against the gravitational field, using a superluminescent diode. Experiments inducing horizontal and vertical magnetic fields with a Helmholtz coil were also recorded. Multiple cell geometries allowed the confinement effect on non-equilibrium concentration fluctuations to be explored. Cylindrical glass cells of degassed water were injected with magnetic nanocolloidal suspension and recorded with a CCD camera. We used a dynamic structure factor algorithm for image processing to compute structure factor, find power law exponents, and determine correlation time of fluctuations. Our results show that the correlation time is affected by the confinement effect due to cells of different geometries.

2. A comparison of Alzheimer's ß-amyloid protein plaque labeling using methoxy-04 and 82E1 antibody

Marcel Soliven, Department of Biology, Program of Neuroscience, and Department of Neuroscience, Medical University of South Carolina

ß-amyloid protein plaques are the hallmark of Alzheimer's disease, the world's current leading cause of dementia. However, exactly how plaques disrupt brain function remains unclear. To study the role of different types of plaques in Alzheimer's we used dual-labeling

immunohistochemistry in transgenic mouse brain to clarify the types of plaques labeled by Methoxy-04 and 82E1. Our preliminary results show that Methoxy-04 labeling is biased to only the larger, more compact plaques in the parenchyma, whereas 82E1 labels smaller plaques, some of which are concentrated around the brain vasculature. This is especially relevant for the emerging cerebrovascular theories of ß-amyloid pathology, which may involve smaller plaques around brain vessels that disrupt blood flow. The results from this study will support future co-labeling projects that will look for patterns of plaque distribution along brain structures like cerebrovasculature and provide a means of testing how plaque distribution is affected by pharmacotherapies and/or comorbidities.

3. Analysis of Surfactants and their Influence on Foam Synthesis

Penny Huebsch and Neal Tonks, Department of Chemistry and Biochemistry

The purpose of this research was to determine an efficient way to synthesize foams using bio-based materials. By combining polyols, agrol, multranol, pentane, water, acetone, and different surfactants, with isocyanates, different types of foams were created. In order to understand how “good foams” are made, different analyses were conducted on surfactants like comparison between their silicone and proton NMR’s, their surface tension and interfacial tension with other solvents, and what the foams looked like under an electron microscope to determine cell density. By finding patterns between this data, it is likely that a more efficient surfactant can be produced. This research is still ongoing, and so far has determined more successful foams come from “traditional surfactants,” which are polyethylene glycol based. Since PEG is petroleum based, this research would like to find a way to create a similar surfactant that is more bio-based so fossil fuel usage can continue to be reduced.

4. Investigating the Impact Of Episodic Stellar Activity On Planet Formation and Evolution

Best of Astrophysics

Elyana Crowder[1], Joe Carson[1], Ana Uribe[1], Maximiliano Moyano[2], and Giovanni Pinzon[3]
(1) Department of Physics and Astronomy, College of Charleston
(2) Instituto de Astronomía, Universidad Católica del Norte
(3) Observatorio Astronómico, Universidad Nacional de Colombia

By investigating young star systems known to exhibit variable brightness, we sought to better characterize episodic stellar activity observable on timescales of days to weeks and its role in the formation and evolution of orbiting planets. To achieve this, we wrote software to conduct an automated search of the ESO and NOAO archives for optical imaging data with a time cadence optimal for our analysis. Using this imaging data and catalogued photometric values, we then analyzed the episodic photometric variability of three young target systems: TW Hya, AT Mic, and AU Mic. Here we present the results of our archive search, data analysis, and possible implications for each star system.

5. Competitive Sorption and Transport of Pharmaceuticals in Natural Soils

Jeniffer Soto Perez, Ashley Turner, and Vijay Vulava, Department of Geology and Environmental Geosciences

Recently, pharmaceutical pollutants have become of increasing concern to the health of our environment and water resources. Erectile dysfunction medications such as Sildenafil (SDF), Vardenafil (VDF), and antihistamines like Cetirizine (CET) and Diphenhydramine (DPH) are amongst the most used pharmaceuticals in the U.S. The goal of this project is to examine the individual sorption and transport behavior of each compound as well as the competitive behavior between SDF and VDF, and CET and DPH in natural organic matter- (OM) and clay-rich soils. A series of batch sorption isotherm and column transport experiments were conducted. Compounds were analyzed using high performance liquid chromatography (HPLC). All

compounds displayed greater sorption in clay-rich soils than OM-rich soils. Competitive experiments showed a reduction in sorption of each compound in both soil types. These results have strong implications for future environmental management of pharmaceutical chemical effluents and disposal.

6. Prospective Deep Sea Coral Habitats on Musicians Seamounts, Pacific Ocean

Darina DeBenedictis and Leslie Sautter, Department of Geology and Environmental Geosciences

Deep sea corals thrive in areas of high slope, hard substrate, and exist at depths ranging 400 to at least 2100 m. In August 2017, NOAA's Deep-Sea Symphony expedition mapped Musicians Seamounts and collected video footage of the diversity of corals found there. Multibeam sonar and backscatter intensity data were collected aboard NOAA Ship *Okeanos Explorer*, and were then post-processed in CARIS HIPS & SIPS 10.4. Bathymetry, backscatter mosaics, and profiles were used to find sites of high slope and high backscatter intensity, in order to identify potential coral habitat locations. ROV dives to these sites should be conducted in order to prove the success of these methods in definitively pinpointing deep sea coral habitat.

7. Comparison of Exportin Expression in *Lytechinus variegatus* and *Stronglyocentrotus purpuratus*

Maddie Davis, Ramsha Shams, and Christine Byrum, Department of Biology

Exportins are karyopherins that facilitate the diffusion of macromolecules such as RNA or proteins out of the nucleus and into the cytoplasm. They bind to their cargo and Ran-GTP via recognition of a nuclear export sequence (NES) and then exit via a nuclear pore complex (NPC) to the cytoplasm where they release their cargo. It has been hypothesized that the differential expression of these karyopherins plays a role in the differentiation of cells during embryogenesis by influencing the availability of transcription factors. As a beginning to this effort, our lab is investigating the evolutionary relationships among these molecules and the periods during which they are expressed in two different echinoids through transcriptomic analysis.

8. Degradation of Sertraline and Aspirin in Space

Virginia James and Wendy C. Cory, Department of Chemistry and Biochemisty

In determining what medications to send to the International Space Station (ISS), NASA must consider how the different conditions on the ISS might affect the rate of drug degradation and the identities and amounts of the products of this degradation. In this study, sertraline (Zoloft®) tablets and aspirin that were stored aboard the ISS were investigated for potency and degradation products. Results were compared to those of sertraline and aspirin tablets procured from the Johnson Space Center (JSC) pharmacy. Potency and purity of all tablets were analyzed using HPLC methods from the United States Pharmacopoeia (USP); an LC-MS method was developed for sertraline to identify and quantify degradation products. An additional HPLC method was developed for the detection of degradations in aspirin. Both instruments yielded acceptable results for all sertraline and aspirin sample sets stored on Earth and the ISS. Some degradants were found, but were in low concentration.

9. Larval and juvenile fishes and their ecological associations with algal beds dominated by the invasive red alga *Gracilaria vermiculophylla*

Madison Martin, Melanie Herrera and Antony S. Harold, Department of Biology

Our goal was to determine if the degree of coverage by the invasive benthic alga *Gracilaria vermiculophylla* is related to growth or inhabitation of developing fishes. Fish specimens (larval, post-larval, and later juveniles) were collected by M. Herrera in summer 2017 in either sparse or dense algal beds in Charleston Harbor. We hypothesized that dense algal beds would be preferred by smaller fishes as cover from predation. Specimen were measured and we compared body size for species with adequate sample sizes. Standard length was also plotted against time (days) to elucidate the growth trajectory of species. We found that (1) body size of most species (Silver Perch, Atlantic Pipefish, Atlantic Silverside, and Bay Anchovy) is not statistically associated with algal density, (2) the predatory species, Florida Pompano, has greater body size in sparse habitats, and (3) body size greatly increases in late summer.

10. Creating a New Vision for Long Branch Creek: Improving and Expanding Recreational Opportunities

Megan Arnett[1], Ashley Turner[1,2], Timothy Callahan[1,2], and Joshua Robinson[3]
(1)Graduate Program in Environmental Studies
(2)Geology and Environmental Geosciences
(3)Robinson Design Engineers

Long Branch Creek, located in the West Ashley area of the Charleston, SC metropolitan region between the Stono and Ashley Rivers, is a highly modified and degraded waterway due to

historical land use change and more recent suburban development of the surrounding area. In an effort to address this neglected creek system, a new vision for restoring and improving the creek will provide ecological services, specifically aesthetic form and recreational opportunities. To enhance and expand recreational opportunities for Long Branch Creek, the site's current conditions were assessed and suggested improvements were made. These include the construction of boardwalks and docks, the addition of walking trails, increased public access, pet waste management strategies, preservation of historic sites and conservation areas, and implementation of community outreach and engagement activities.

11. Hippocampus lesions and their effect on time perception

Best of Physics

Tristan Aft[1], Sorinel A Oprisan[1], Mona Buhusi[2], Catalin V. Buhusi[2]
(1) Department of Physics and Astronomy
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Many species form bees to humans are capable of perceiving and accurately reproducing temporal durations from seconds to tens of hours. Interval time perception is experimentally tested using peak interval (PI) procedure. The subjects are required to reproduce a previously memorized duration and the responses have a wide Gauss-like distribution with the peak at the memorized time. We know from the experimental work on hippocampus lesions that dorsal hippocampus (DH) area shift the time perception towards shorter durations, whereas lesions of the ventral hippocampus (VH) shift the time perception towards longer durations. We successfully developed a computational model that mimics temporal perception and reproduced the experimentally observed temporal shifts.

12. Investigating Critical Fluids in a Magnetic Field Suspension

Christian Hawkins and Ana Oprisan, Department of Physics and Astronomy

The critical point is the point at which a fluids liquid and gas phases become indistinguishable, defined by the critical pressure p_c, or the critical temperature T_c. The compressibility of a fluid rapidly increases as it fluid approaches the critical temperature, causing the fluid to stratify in a

gravitational field. It is therefore necessary to study near critical fluids in a reduced gravity environment. The optical properties of fluids also undergo rapid changes near the critical point resulting in light attenuation, or turbidity increase, and can be used to probe the universality of critical behavior. Turbidity measurements in critical oxygen and hydrogen suspended in a magnetic field where performed to investigate such behavior in terms of temperature relative to the critical point. We analyzed intensity map data to determine the light transmission and turbidity measurements of 450nm, 500nm, and 650nm light projected through cells containing near critical oxygen.

13. Geomorphological Analysis and Characterization of Labadie Bank in the Celtic Sea

Luke Hollahan and Leslie Sauter, Department of Geology and Environmental Geosciences

By 2020, The Marine Institute of Ireland and the Geological Survey of Ireland plan to map Ireland's continental shelf using high resolution multibeam. A recent survey was conducted aboard the R/V *Celtic Explorer* (July 22-August 6, 2017). The study area was located off Ireland's southeastern coast. Sonar data was post-processed to generate bathymetric and backscatter intensity surfaces. Much of the study area is comprised of a large sand bar called Labadie Bank, where depths fluctuate between 63m (bank crest) to approximately 135m (surrounding basin). Labadie Bank has an elliptical shape along with several geomorphological features, including four different types of large scours clumped in study sites in different locations on Labadie Bank. The study's purpose is to interpret Labadie Bank's geomorphological features and to create a classification system for the different scour types.

14. A multimodal approach to characterizing urban stormwater runoff in Charleston, SC

Ashleigh N Kirker and Vijay M Vulava, Department of Geology and Environmental Geoscience

Nonpoint source pollution is the main source of surface water impairment in the coastal US and in Charleston, SC, where the effects of rapid urbanization are compounded by the problems of coastal flooding. The goal of this project is to create a method that helps identify stormwater pollutant hotspots within highly urbanized watersheds. Enterococci appear to vary seasonally, with lower concentrations of the bacteria corresponding to the colder months of the year. It was revealed that heavy metals, Ni, Pb, Cd, and Cr are related to one another, but not significantly related to land use. Despite concern about high levels of nutrients as an environmental hazard, nutrient loads in stormwater runoff do not exceed recommended concentrations. However, fecal contamination has been shown to be of primary importance to recreational water safety and to DO levels in surface water, and so further monitoring of enterococci bacteria in runoff is recommended.

15. Application of Operations Research Methods in MMA Predictions

Daniel Rich, Bailey Williamson, Henry Reith, and Amy Langville, Department of Mathematics

A statistical analysis platform was designed to predict the outcomes of Mixed Martial Arts bouts. Our goal is to predict fight outcomes with at least 70% percent accuracy using methods of ranking algorithms, machine learning, and simulation techniques. Data containing the records of over 160,000 fights was scraped from *Sherdog.com* and *UFC.com*. From this data, modifications to the Elo and Glicko rating systems are being developed to rank MMA fighters. Various clustering schemes were used to categorize fighters and predict fight outcomes based on features such as height, reach, strikes, takedown percentages, etc. Additionally, a random forest classifier method was used to determine which features best predict fight outcomes. Statistical simulation techniques were developed to simulate fight outcomes and provide predictive measures for MMA fights.

16. Spectroscopic Study of Large Amplitude Motions

Alyssa Johnson and Richard Lavrich, Department of Chemistry and Biochemistry

We present the study of 9-hydroxy-5-phenalenone, the third in a series of molecules exhibiting coupled large amplitude motions. 9-hydroxy-5-phenalenone is a fused ring system which contains a five-membered hydrogen-bonded cyclic structure and a low barrier methyl top. The coupled large amplitude motion occurs when the tautomerization induced by an intramolecular hydrogen transfer triggers a 60^{o} "corrective" internal rotation of the methyl group. The presence of these coupled motions introduces splittings in the molecule's rotational spectra. Analysis of these spectroscopic splittings provides information on the height of the barriers restricting each large amplitude motion and the time frame in which they occur. 9-hydroxy-5-phenalenone is not commercially available and details of its synthesis in preparation for a spectroscopic study will be discussed.

17. Aggregation of Poly(3-hexylthiophene) at Solvent-Solvent Interfaces

Marni Sapolsky and David S. Boucher, Department of Chemistry and Biochemistry

The aggregation behavior of P3HT is investigated at the interface of orthogonal solvents for P3HT. The changeable characteristics of P3HT aggregate dispersions, e.g., extent of aggregation and intrachain order, are studied by varying (1) the interfacial area, (2) the poor solvent used to induce aggregation and (3) the relative composition of the good solvent, chloroform (CF), and poor solvents. The results are compared to those observed using rapid injection of the solvent. Atomic force microscopy (AFM) is used to analyze the morphology of films processed from

dispersions with disparate characteristics, but having the same solvent composition, e.g., 60:40 CF:DCM. Based on the disparity of the kinetics and miscibility gap values, the prevalence of specific structural motifs in the films is effectively rationalized in terms of the structural attributes of the aggregates in the liquid phase rather than the evaporation rate (boiling point) differences of the solvents in the mixture.

18. Long term impact of acute stress on anxiety and reinstated heroin seeking in male and female rats

Jordan S. Carter[1], Angela M. Kearns[2], Rachel A. Weber[2], and Carmela M Reichel[2]
(1) Department of Biology, CofC
(2) Department of Neuroscience, MUSC

It has been suggested that withdrawal symptoms following substance use disorders (SUD) and post-traumatic stress disorder (PTSD) reciprocally exacerbate one another. Previous studies show that rats potentiate substance-seeking behavior when exposed to scents associated with restraint stress, a model used to mimic PTSD in rodents. We examined the effects of restraint stress on heroin seeking and anxiety in rats during withdrawal. Throughout self-administration, active lever presses and intake did not differ between stress groups, but females had higher intake than males. After a period of abstinence, rats underwent a defensive burying test. Defensive burying trials showed that stressed rats had a shorter latency to bury and spent more time burying a paired odor-contaminated dish than unstressed rats. For reinstatement testing, either the stress-paired odor or a novel odor was placed into the operant chamber and lever responding was recorded. Future studies will further characterize the interaction between stress and withdrawal.

19. Phase resetting generalization and phase-locked mode prediction in biologically-relevant neural networks

Austin Dave and Sorinel A. Oprisan, Department of Physics and Astronomy

The brain processes the external stimuli and adapts to changes in the environment by constantly changing (resetting) the firing pattern of its neurons. Stimuli intensity and duration are encoded in the relative change of the firing period of specific neurons. Since the neurons form large neural networks, the information processing takes place at multiple levels with a large number of feedback loop. As a result, these hierarchically-organized layers of neurons can produce repeatable firing patterns called phase-locked modes. Such attractors of the neural activity can be predicted based on the response of the individual neurons to external stimuli. We successfully generalized mathematically and then checked numerically that knowledge of how one isolated neuron responds to a stimulus can help predicting the response of a larger network to complex stimuli.

20. ATPase Afg1 Helps Maintain Protein Homeostasis in the Mitochondrial Matrix

Mason L. Huebsch[1], Edward M. Germany[2], Nataliya Zahayko[2], Oleh Khalimonchuk[2], and Jennifer L. Fox[1]

(1) Department of Chemistry and Biochemistry

(2) Department of Biochemistry and Nebraska Redox Biology Center, University of Nebraska-Lincoln

Mitochondrial functions are critical for cellular physiology. Several conserved mechanisms are in place to maintain the functional integrity of mitochondria; however, many of the molecular details and components involved in these activities remain obscure. Here we identify a novel role for the evolutionarily conserved mitochondrial AAA ATPase Afg1 in mediating mitochondrial protein homeostasis during aging. We found that *Saccharomyces cerevisiae* cells lacking functional Afg1 are hypersensitive to oxidative insults, unable to tolerate protein misfolding in the matrix compartment, and exhibit progressive mitochondrial failure as they age. Our results indicate that Afg1 plays an important role in mitochondrial quality control.

21. Port of Charleston Entrance Channel Dynamics

William Woody Thomas and Scott Harris, Department of Geology and Environmental Geosciences

Water flow and subsequent changes in bedforms were examined around the mouth of the Charleston Harbor, SC, throughout a series of tidal levels to determine how changes in velocity affect bedforms in the entrance channel, and how the changing bedforms may have long-term affects in onshore/offshore dynamics. Changes in harbor entrance bedforms were analyzed using a sidescan sonar, and current velocities were measured using Acoustic Doppler Current Profiler (ADCP). Measurements made over a complete tidal period were interpreted to further understand sediment deposition and composition throughout varying current velocities. Datasets from the current profiler, sidescan sonar, and grainsize analyses were related to one another to further understand their relationships.

23. Life History Dynamics and Gonad Histology of the Hardhead Catfish, *Ariopsis felis*

Kimberly G. Darville, Kimberly S. Schmutz, and William A. Roumillat, Department of Biology and The South Carolina Department of Natural Resources

The goal of this study was to determine the life history dynamics of the hardhead catfish, *Ariopsis felis,* through gonad histology and aging analyses. Gonadal tissue and lapillar otoliths

were obtained from catfish specimens provided by the South Carolina Department of Natural Resources and analyzed using standard SCDNR techniques. Lengths and ages at 50% maturity were found using RStudio. An ANOVA was used to calculate significant differences among size and age dynamics. Size and age at first maturity was determined to be 3.02 years at a standard length of 180.4 mm. A positive relationship between age and size was determined for both males and females. Results indicated that *Ariopsis felis* possibly partakes in group synchronous oocyte development.

24. A Computational Examination of Spartiene

Michael Harris and Clyde Metz, Department of Chemistry and Biochemistry

We evaluated the relative energies of 27 spartiene conformations using an ab initio density functional computational method. The method used for this work was wB97X-D and the basis set was 6-311+G(d,p). The focus of this work was to determine if the dispersion correction employed in the wB97X-D method would produce significantly different results compared to non-dispersion correcting methods used in earlier research. Additionally, the 6-311+G(d,p) basis set used includes d and p polarization terms that were not generally used in the prior spartiene research. Significant differences between the predicted energies were observed using this combination of dispersion-correcting method and basis set compared to the nondispersion-correcting methods using the simpler basis sets. Specifically, our choice of method and basis set predicted greater relative favorability for several conformers that were considered to be quite unstable based on steric hindrance considerations alone.

25. Tissue Engineering Strategies in Bone; rhBMP2- Too Much of a Good Thing

SarahRose Hall, R. Nicole Howie, Emily Durham, Zachary Grey, Nicholas Larson, and James Cray, Department of Biology, College of Charleston, and Department of Oral Health Sciences, MUSC

The clinical reality is that often there is not adequate native tissue to use the gold standard autologous graft intervention for bone injury. Tissue engineering strategies can aid with this problem. Specifically, INFUSE comprised of an osteoconductive matrix and osteoinductive peptide (rhBMP2) has been employed. However concerns over inflammatory side effects have arisen. Thus, alternative scaffolding is needed. Here we tested the coordinated use of INFUSE with the addition of pGlcNAc, which is innately anti-inflammatory, employing titrated doses of rhBMP2 in a murine calvarial defect. µCT and histological results suggested defects treated with a subclinical dose of rhBMP2 produced the best bone regenerate compared to defects treated with higher doses of rhBMP2. Further, the higher doses of rhBMP2 resulted in significant ectopic bone which is contra-indicated in healing. Our data suggest alternative scaffolding may not be necessary as using a lower dose of the peptide results in optimal healing.

26. Lunar Analysis and Sampling for Exploration and Research: Lander Team - NASA Proposal

Hailey Connell, Logan Richard, Forest James, Lauren Seltsam, Miranda Roesing, John Chadwick, and John Hakkila, Department of Geology and Department of Physics and Astronomy

The South Pole Aitken Basin (SPA) is one of the most geologically significant locations on the moon - surpassing all other basins in age, size, and depth. Lander and orbiter missions to this location are being planned through the College's NASA Mission Design Course, in conjunction with a team of engineering students at the University of Alabama in Huntsville. The primary objectives of the lander team are to learn about lunar mineralogy, magnetism, seismology and age - in order to further understand mantle composition, the ancient core dynamo, crustal thickness and core size, and the occurrence of a Late Heavy Bombardment (LHB), respectively. The SPA basin is the single best place to evaluate all aforementioned objectives. Collected data would help fill gaps in models of lunar geologic processes, improve our understanding of early solar system formation and aid in the design of future NASA expeditions.

27. Characterization of Five Geological Zones within the Northern Mariana Trench Subduction Region

Sophie Alpert and Leslie Sautter, Department of Geological and Environmental Sciences

Between 2003 and 2016 scientists from the NOAA Office of Ocean Exploration and Research, the University of New Hampshire's Center for Coastal and Ocean Mapping, and the University of Washington collected multibeam sonar data approximately 2,330 km off Taiwan along the Northern Mariana Trench. Sonar data were post-processed with CARIS HIPS 10.4 software to create 2D and 3D bathymetric surfaces, and the area's geomorphology was examined focusing on differences between five zones identified which are characteristic for subduction regions: remnant arc; back-arc basin; volcanic arc; fore-arc; and trench. Typical features found within these zones were observed, including back-arc basin rifting, seamounts along the volcanic arc, and mud mounds within the fore-arc. Overall, this portion of the Mariana Trench was determined to include the classic geologic zones associated with subduction regions, however an unusual rifting area was identified, oriented perpendicular to the trench within the volcanic arc zone.

28. Analysis of Structural Geomorphology in Ballycotton Bay Bedrock on the South Irish Coast

Hayley Drennon and Leslie Sautter, Dept. of Geology and Environmental Geosciences

During April-May 2013, the Geologic Survey of Ireland, as a part of the INFOMAR project, conducted bathymetric surveys aboard the R/V *Celtic Voyager* on the southern coast of Ireland, northeast of Cork. Located on the Cloyne Syncline, Ballycotton Bay was surveyed using a Kongsberg EM3002 multibeam echosounder. Data collected were post processed using CARIS HIPS & SIPS 10.4 to create surfaces depicting bathymetry and backscatter intensity. The purpose of this study is to directly correlate the structural geomorphology of Ballycotton Bay to the known regional terrestrial bedrock outcrops in order to potentially identify the seabed rock formations. Observations of the seabed geomorphology were made using the bathymetric surface, revealing variances in structural geology in different regions of the bay. Potential transitions between the Cloyne Syncline and its adjacent Ballycotton Anticline were detected and correlated with terrestrial geology maps.

29. The Performance of a Thin-film Thermoelectric Characterization Apparatus

Sam Bleser and Gregory Smith, Department of Physics and Astronomy

We designed, fabricated, calibrated, and automated a system to characterize thin-film thermoelectric samples at room temperature. We modified the apparatus with the addition of a four-point probe in order to measure the electrical conductivity. The four-point probes were calibrated using thin-film samples of CNT20/PVDF80 and samples of aluminum. We fabricated polymer nanocomposite sampels with a blend of Bi_2Se_3 nanoplatelets and Au nanorods in PVDF. Pristine samples of PVDF: Bi_2Se_3 exhibited poor electrical conductivity that we attribute to discontinuities in the conduction pathways between ends of the sample. We blended small weight fractions (0.01% - 1.00 %) of gold nanorods into the samples to facilitate better conductivity between neighboring Bi_2Se_3 domains. We used an atomic force microscope and a scanning electron microscope to image and analyze the morphology of the thin-film samples.

30. Predicting Cognitive Ability at Age 2 using White Matter Brain Connectivity

M. Adamson, M. Schaich, and B.C. Munsell, Department of Computer Science
J. Girault, M. Styner, and J. Gilmore, Department of Psychiatry, University of North Carolina

It is thought that the foundational wiring of the human brain is in place by term birth, and that the white matter (WM) connectome supports developing functional connectivity. It is unknown, however, how the WM connectome at birth supports emergent cognition. In this study, we

employed a deep learning approach to classify full-term infants into groups based on cognitive assessments at age 2, and used results from this model to directly predict their individual cognitive scores via cross-validation. We were able to accurately predict a child's 2-year cognitive group and individual score in both full and pre-term infants. Regions in the frontal lobe and the right insula were important for predicting future cognition, along with connections between language, sensory, and motor regions. Results indicate fetal WM development is foundational for future cognition, and the neonatal WM connectome may be a highly accurate neuroimaging biomarker of later cognitive development.

31. Substrate Classification of Puerto Rico's Northern Continental Slope Submarine Canyons

Caroline Bradley and Leslie Sautter, Dept. of Geology and Environmental Geosciences

NOAA scientists conducted a study aboard the NOAA Ship *Okeanos Explorer* from March to May in 2015 to survey the northern continental margin of Puerto Rico using multibeam sonar. The study area included 180 km of the continental slope, which included many submarine canyons of different morphologies. These canyons exhibit 2000 m of vertical relief over a distance of 50 km, illustrating the slope's steep gradient. Bathymetry, slope, and backscatter surfaces were generated using CARIS HIPS and SIPS 10.2. Geomorphic features and substrate variations were recorded and classified from exposed rock to unconsolidated sediments. These data and mapped surfaces were used to identify possible deep-sea coral habitat locations as well as potential demersal fish habitats.

32. Common Systems of Distinct Representatives in Uniform Partitions

Dinesh Sarvates and William Cowden, Department of Mathematics

We prove that, given any two partitions of a set of size *kn*, denoted {Ti : 1 ≤ i ≤ n} and {Si : 1 ≤ i ≤ n}, of *k* elements each, there exists *k* disjoint common systems of distinct representatives of size *n* that form a partition of the set of size *kn*. We used this result to obtain a solution of a problem given in Mathematics Magazine, issue 90, 2017.

33. Tropical Cyclone Climatology of Savannah, Georgia from 1851 to 2016

Aaron Neuhauser and Bernhard Lindner, Department of Physics

Data for the years 1851 to 2016 from the National Hurricane Center were analyzed to compile a list of hurricanes and tropical storms whose centers passed within 75 nautical miles of Savannah, Georgia. Results of the analysis were compared to data from a previous study that

focused on the tropical cyclone variability and climatology of Charleston, South Carolina. Seasonality, intensity, translational velocity, and approach angle were recorded for each system at its closest approach to Savannah. The return period for major hurricanes is 55 years, while the return periods for tropical storms and hurricanes are about 2.3 years and 4.7 years, respectfully. As predicted, the majority of tropical storms approached Savannah from the west and southwest (220° to 250°) while most hurricanes approached from the south (180° to 210°). This indicates that Savannah's tropical cyclone impact is influenced heavily by activity in the Gulf of Mexico.

34. Analysis of Potential Deep Sea Coral Habitats on the Mid-Pacific Seamounts

Angelina Ponella and Leslie R. Sautter, Department of Geology and Environmental Geosciences

Multibeam sonar surveys were conducted by NOAA near Wake Island in the Pacific Ocean between March and September 2016. Bathymetric data were obtained using a Kongsberg EM302 aboard the NOAA Ship *Okeanos Explorer* and were post-processed in CARIS HIPS and SIPS 10.4. The data revealed various seamount types that each included different sections of high intensity backscatter along highly sloped areas. These regions often provide hard substrate favorable for deep sea coral attachment. The purpose of this study is to locate the potential coral habitats by focusing on sites that contained high intensity backscatter and steep slopes. Determining this information would be beneficial for ROV dives to quickly locate and observe possible coral habitats. All eleven of the studied seamounts displayed properties for potential coral habitats, however one seamount had significantly more sites to explore. Additional research should be conducted to support these findings.

35. Analysis of Enzymes Homologous to the Sulfohydrolase SdsA1

Caroline R. Gilmer, John Randolf S. Reveral, Abigail E. Reeves, Grace L. Waddell, Nicholas G. Taylor, Marcello Forconi, Jennifer L. Fox, Department of Chemistry and Biochemistry

The eukaryotic enzyme Bds1 in *Saccharomyces cerevisiae* is a metallo-β-lactamase-related enzyme that serves an unknown biological role. Previously, Bds1 was reported to be an alkyl and aryl sulfatase. However, we demonstrate that Bds1 acts on primary alkyl sulfates but not the aryl sulfates p-nitrophenyl sulfate and p-nitrocatechol sulfate. In contrast to SdsA1 and another bacterial homolog with selectivity for secondary alkyl sulfates named Pisa1, Bds1 does not show any substantial activity towards secondary alkyl sulfates. Neither Bds1 nor SdsA1 have any significant activity towards a branched primary alkyl sulfate, primary and secondary steroid sulfates, or phosphate diesters. Therefore, the enzymes homologous to SdsA1 that have been identified and characterized thus far vary in their selectivity towards primary and secondary alkyl sulfates but do not exhibit aryl sulfatase activity.

36. Cyber Security - Is your password keeping you safe?

Adam Lavelle, Jody Mullinax, Arlen Barr, Olivia Chowdhury, Michael Bishof, and Lancie Affonso, Department of Computer Science

The premise of the simulated capture the flag lab is to demonstrate how easy it is to infiltrate devices or networks that are not protected by strong passwords. Using GENI to exploit four different virtual machines that have four different levels of password strengths, we can demonstrate how easy it is to gain access to devices that are poorly protected. How does CTF exercises relate to the real world? You can simply replace the word “flag” with file, image, budget, or document and anyone can see the importance of having a secure network. Throughout the lab, various tactics are deployed, observed, logged, and then studied for further use. In essence, CTF labs hone and sharpen skills of security experts while also providing valuable education to those who watch. CTF competitions can breed new and innovative hacking tactics and maneuvers, which are introduced to existing security systems to probe for weaknesses.

37. Estimating Advertising Value of Primary Sponsorship of a NASCAR Racing Team

Emma Collins, John Allen, Austin Mishoe, and Amy Langville, Department of Mathematics

We aim to estimate the advertising value of providing primary sponsorship for a NASCAR Cup Series team. Advertising value is quantified using the standard metric of dollars per thousand ‘impressions’, where impressions are calculated from total views of the sponsor’s logo during a televised race. Viewership was estimated using Google Trends data to geographically distribute the total viewers by month and by race. Advertising value estimates have been based upon the geographic distribution of viewers in relation to the sponsor’s store locations across the U.S. Using provided airtime data on duration of sponsor logo visibility, we have estimated lower and upper bounds on the advertising value at a state level by month and by individual race for the 2016 and 2017 seasons. We propose that these techniques could be applied to advertising value estimations for other television related sponsorships.

38. Critical fluctuations and phase separation in SF6 under a shallow temperature quench

Mael Chateau, Christian Hawkins, Carole Lecoutre, Yves Garrabos, Daniel Beysens, and Ana Oprisan, Department of Physics and Astronomy

Phase transition in fluids has important applications in food industry for volatile oils extraction or in nuclear plants for heat transfer. We used direct imaging to record snapshots of phase

separation that takes place in Sulphur hexafluoride under microgravity conditions on the International Space Station. The system was already at equilibrium slightly below the critical temperature and further cooled down by a 0.2mK temperature quench that produced a phase separation. Both full view and microscopic views of the direct observation cell were analyzed to determine the evolution of the radii distributions. It was also found that the fraction of small radii droplets generally decline over time whereas the fraction of large radii droplets increase, which suggested a binary coalescence mechanism during phase separation. In addition, we found that the mean radii of liquid droplets exhibits at 1/3 evolution, in agreement with growth driven by Brownian coalescence.

39. Optogenetic experiments reveal some aspects of brain dynamics

Jessica Helms[1], Xandre Clementsmith[2], Sorinel A. Oprisan[1], Antonieta Lavin[3]
(1) Department of Physics and Astronomy
(2) Department of Computer Science
(3) Neuroscience Department, Medical University of South Carolina

Neurons communicate through large excursions of membrane potential called action potentials (APs). Neurons form large neural networks and recording the electrical activity of individual cells is challenging. We used a novel technique - optogenetic - that combined genetic manipulation of neural membrane such that some channels through it become light sensitive. Optogentic allowed us target specific neural cells in the prefrontal cortex (PFC) which is involved in decision making, social behavior, and complex cognitive functions. We record the average electrical activity called local filed potentials (LFPs) obtained in vivo from mice. We studied the modulatory effect of dopamine on PFC activity. Dopamine is a chemical released by neurons to send and modulate the signals to other neurons. Among the most studied dopamine pathways is the one involved in reward-motivated behavior. We successfully reconstructed the high-dimensional neural activity from LFPs and compared it against the control cases.

40. GENI Network Traffic & Denial of Service (DoS) Simulation

Amanda Guinyard, Destiny Hunt, Caleb Mayfield, Claudio Miro, and Lancie Affonso, Department of Computer Science

The purpose of our project is to simulate a Denial of Service (DoS) attack and demonstrate how simple and effective they can be. DoS attacks are any type of attack where legitimate users are deprived from accessing online services. In a DoS attack, the attacker typically sends an excessive amount of messages asking the server or network to authenticate requests that have invalid return addresses. DoS attacks can affect anyone from the common person to entire

governments. The real-world consequences of DoS attacks can be detrimental and by exposing students to the potential consequences, we can better prepare ourselves for the future. By using the virtual GENI network, we were able to simulate DoS attacks and respond to them without compromising actual websites.

41. The Ecotoxicty of Sertraline (Zoloft®) and its Transformation Product

Morgan Seidel, Allison Welch, and Wendy Cory, Departments of Biology, and Biochemistry and Chemistry

Many organisms that live in freshwater ecosystems are subjected to pharmaceuticals polluting the water. UV phototransformation catalyzes reactions that can convert pharmaceuticals into other related molecules. Sertraline is a selective serotonin reuptake inhibitor (SSRI) that is typically prescribed as an antidepressant. Southern toad tadpoles were monitored in different concentrations of sertraline and its phototransformation product to determine the relative toxicity of these compounds. Sertraline (25ppm) was exposed to UV light for 8 hr in a solar simulator, then tadpoles were subjected to a range of concentrations of untransformed sertraline, 8 hr photoexposed sertraline, and norsertraline (sertraline's major phototransformation product). The phototransformation of the sertraline solution did not substantially reduce its toxicity. These results suggest sertraline, which is excreted on a daily basis does not immediately become less due to phototransformation. Very little research has been done on ecotoxicity of pharmaceutical transformation products making this an important area for continued research.

42. Cyberpaths: Cybersecurity Education for the Liberal Arts

Morgan Euliano, Sophia Frankel, Eddie Goffn, Julia Kaplain, Ryan Snyder, Gerben Timmerman, and Lancie Affonso, Department of Computer Science

The purpose of this project is to introduce students to basic cybersecurity principles in Liberal Arts Colleges. A way to achieve this is through GENI, a virtual network to practice communication between clients and servers in a safe and ethical way. In the first part of this project, we will break down how and what you will need to do in a GENI project. Next, we will discuss how the program works by demonstrating a step by step lab. Lastly, we will explain the real world implications of a GENI project and what skills can be gained.

43. Tropical Cyclone Climatology of Wilmington, NC from 1851-2017

Ryan T. Evsich and Bernhard L. Lindner, Department of Physics and Astronomy

An analysis of National Hurricane Center data for the years 1851-2017 produces a chronological list of tropical storms and hurricanes that passed within 75 nautical miles of Wilmington, NC. The final product includes date, intensity, approach angle, and translational velocity, while providing an insight of the return rate of Wilmington being struck by tropical storms and hurricanes. This is analyzed by studying past tropical tracks to see if a storm passed within the given miles. If even just 1 of the data points approached Wilmington within 75 nautical miles, it will be considered a strike. If a TS and H was classified as both a TS and H while within 75 nautical miles of Wilmington, it will be considered a strike as a hurricane. The results will be distributed to government emergency officials, medical facilities, etc. to plan for hurricane seasons and provide helpful insight to the public.

44. Intrusion Detection System (IDs)

Austin Crawford, Will McAbee, Sydney Jackson, Zachary Esherick, Justin Arends, Adam Dzierzko, and Lancie Affonso, Department of Computer Science

This project introduces students to different Intrusion Detection Systems (IDSs). We implemented a denial-of-service attack (DoS) where the perpetrator seeks to make a machine or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a host connected to the Internet. Then we use multiple computer networking tools to analyze and generate the computer network traffic in the attack. Snort is the IDS that we used. Snort monitors network traffic for predefined suspicious activity or patterns, and alerts system administrators when potential hostile traffic is detected. Snort is a small, flexible, and highly capable system that is in use around the world on both large and small networks. For the GENI lab, we created our own rule for Snort, our own alert, and then tested it.

45. Separating Tide and ET Signals in a Tidal Creek: Independent Component Analysis of Huger Creek

Emma Collins[1,2], Timothy Callahan[1], and Martin Jones[2]
(1) Department of Geology
(2) Department of Mathematics

We aim to model the hydrological processes of Huger Creek, a tidal forested freshwater wetland system in the Cooper River basin, by separating the water level pattern into individual behavior components. We have used Independent Component Analysis (ICA) on a collection of

thirteen stream gauge and piezometer data sources during a period in October with no precipitation. The ICA has extracted three independent signals contributing to the behavior of Huger Creek. We propose that these signals correspond to the tidal wave from downstream originating in Charleston harbor; an evapotranspiration signal reflecting evaporation and transpiration by vegetation in the forest; and a 'noise' signal which combines less prominent processes in the water system. We will show example results of the deconvolution of these processes. Results suggest that ICA is a promising technique for extracting periodic signals from hydrological data.

46. Doing Good with Data: Promoting the Bike MS Program

Xandre Clementsmith, Lancie Affonso, Department of Computer Science

The goal of this project to provide students with an opportunity to demonstrate their data analytics and visualization skills through data philanthropy, doing good with data, to help e National Multiple Sclerosis Society (NMSS). Multiple Sclerosis(MS) is an unpredictable, often disabling disease of the central nervous system that disrupts the flow of information within the brain, and between the brain and body. The focus of this project will be on the Bike MS program, which is the #5 fundraising event in the US raising $68 million last year with 82 rides in the US and the UK. This project will examine, analyze, and visualize the NMSS data and business questions and present findings and actionable recommendations.

47. Restoration of Long Branch Creek: A Focus on Recreation and Aesthetics

Christopher Brown[1], Jordan Davis[2], Timothy Callahan[2], and Joshua Robinson[3]

(1) Graduate Program Environmental Studies
(2) Geology and Environmental Geosciences
(3) Robinson Design Engineers

Long Branch Creek has undergone extensive hydrological modifications over time that have altered its original tidal creek nature. Creek restoration that focuses on restoring natural hydrological function and increasing habitat should also focus on creating increased recreational use of the creek by the community. This project proposes creating a recreational area near the headwaters of the creek by Bon Secours Hospital that will work in concert with green infrastructure to produce a more aesthetically pleasing environment. There is a focus of creating easier access to and movement throughout the creek, both on-water and adjacent to the water through walking paths that connect previously isolated areas. These paths are created with the intention of promoting community and individual health, with a desired use as an educational tool. Property values adjacent to the creek will be assessed to determine the potential increase in value with the development of the proposed park.

48. Unit processes at wastewater treatment plants in South Carolina and implications for the removal of microplastics

Logan Johnson[1], Kenda Conley[1], Allan Clum[2], Jestine Deepe[2], and Barbara Beckingham[1]
(1)Department of Geology and Environmental Geosciences
(2)Mount Pleasant Waterworks, Mt. Pleasant, SC

The objective of this study was to document the current infrastructure of wastewater treatment plants (WWTPs) in South Carolina and apply it to assess the removal capacity of an emerging contaminant of concern, microplastics, based on literature data for the unit processes that most effectively capture microplastics. We have collected and analyzed information from 66 of 169 WWTPs identified in SC, resulting in a preliminary response rate of 39.0%. WWTPs surveyed treated 2.6 ± 5.4 MGD on average (median 0.8 MGD; range 0.02-22 MGD). WWTPs reported using primary, secondary, and tertiary treatment levels at rates of 87%, 95% and 40%, respectively. Results suggest that a small percentage of WWTPs in SC (<20%) are equipped for optimal removal of MPs during treatment. This report may be used to inform researchers and stakeholders in the wastewater industry of current treatment processes in South Carolina, and ultimately guide development in the future.

49. A New Vision for Habitat. A Master Plan for Improving Ecology along Long Branch Creek, Charleston, SC

Lindsey Beard[1],James Burke[2], Timothy Callahan[2], and Joshua Robinson[3]
(1)Graduate Program in Environmental Studies
(2)Geology and Environmental Geosciences
(3)Robinson Design Engineers

Long Branch Creek is an urban tidal creek located in Charleston, SC between the Stono River and Ashley River. A site assessment and literature review were performed to determine habitat conditions along a reach of Long Branch creek near the Carolina Bay neighborhood. Results show habitat at the site is dominated by pine trees, salt marsh vegetation, birds, fish, shrimp, and crab. Despite extensive habitat currently at the site, results show declining conditions, likely due to increased stormwater runoff volumes. A master plan was created to address ecological concerns along the section of the creek near Carolina Bay neighborhood. The plan includes creating small wetlands and vegetative swales along the creek to address pollution concerns and increase habitat through new vegetation. New species would be attracted to Long Branch Creek as reduced pollution and increased habitats provide enhanced ecology and ecological goods and services for the area.

50. Preparation, characterization, FT-microwave spectra and conformational stability of 1, 1-difluoro-1-silacyclopent-2-ene and its Chloro, Fluoro derivatives

Trisani Mukhopadhyay, Daniel Hickman, and Gamil Guirgis, Department of Chemistry and Biochemistry

The compounds 1,1-dichloro- and 1,1difluoro-1-silacyclopent-2-ene have been prepared and characterized by their ^{1}H, ^{13}C, ^{19}F NMR spectra. The FT-microwave spectrum of 1,1-difluoro-1-silacyclopent-2-ene (C-$C_4H_6SiF_2$) has been recorded and 140 transitions for isotopologues have been assigned for the planar conformation. The ground state rotational constants (MHz) were determined with vales for the normal species: A=3599, B=1762, C=1674. Adjusting the r_0 parameters are reported with distances (Å) C_α-Si=1.859 (2), and Si-C_β =1.1854(3), and Si-F =1.583 (3) and angle (°) :< CSiC = 104.3 (3), SiCC = 103.6 (3). The conformational stabilities have been predicted from *ab initio* calculations utilizing various basis sets. Vibrational assignments are in progress.

51. A Novel 3D Imaging Technique for Cancer Diagnoses

Blake Mino, Joseph Carson, David Melnick, Elyana Crowder, Department of Physics and Astronomy, and the Pensievision research team

Developed to be a low-cost, easy-to-use tool for medical personnel to use in areas of the world without proper medical equipment or care, this device is useful for diagnosing cervical pre-cancer. This device can be used for other purposes as well, such as throat or anal cancer diagnosis. The device and its accompanying software are capable of creating 3D images from a single perspective by taking multiple photos at varying focal powers. The device consists of a pen camera, a liquid lens, and an LED light ring all encased in a slim enclosure. The liquid lens is capable of rapidly changing focus allowing for photos to be taken in quick succession. Using re-purposed astronomy image processing techniques, the photos are combined and a 3D model is created by determining which areas of the image are in focus at which focal power.

52. Analysis of Zetaproteobacterial RubisCO genes of the Mariana Arc and Backarc

Heather Fullerton and Nisarg Patel, Department of Biology

In recent years, increasing technologies have revealed that microbes play a significant role in all environments and biological nutrient cycles. Iron is one of the most abundant elements in the world, and as such represents a vast energy source for many microbes through the oxidization of iron. The recently discovered bacterial class, Zetaproteobacteria, were found to be abundant

at marine sites high in iron such as hydrothermal vents. Microbial mat samples were collected from various sites in the Mariana arc and back-arc and processed. This included DNA extraction, MiSeq 2X300bp sequencing, sequence QC, and assembly. The assembled contigs were then annotated with IMG. The RubisCO amino acid sequences were further analyzed with BLAST and SwissProt databases to determine enzyme isoforms. Results found the majority of Rubisco genes were type II and most similar to the Gammaproteobacteria *Hydrogenovibrio marinus*.

53. Piece-Wise Study of Human Galanin

Cecilia M. Hendy, Katelyn N. Kraichely, Sarah E. Clinkscales, and Michael W. Giuliano, Department of Chemistry and Biochemistry

Our research is aimed at studying the structures of different fragments of human galanin, a 30 residue long neuropeptide, and clarifying parts of its structure that still remain vague. The N-terminus is highly hydrophobic as compared to the C-terminus. One hypothesis we have is that the C-terminus plays the role of a naturally occurring solubility tag and it is our goal to determine if it has any inherent structure. Investigations of galanin have consisted of an N-terminal fragment, hGal(1-12)+KK, and a C-terminal fragment, hGal(17-30), using 2D ^{1}H-^{1}H NMR experiments. A structure of hgal(1-12)+KK has been generated from assigned 2D ^{1}H-^{1}H NMR data. Our data for hGal(1-12)+KK suggests that Gly(1) induces a weak helix in the region between residues 3-9 compared to a previously studied fragment in our laboratory, hGal(2-12)+KK. The structure of the C-terminus is currently being investigated using 2D ^{1}H-^{1}H NMR.

54. Geomorphologic Analysis of Bedrock in Youghal Bay, County Cork, Ireland

Gabriel Higgs and Leslie R. Sautter, Dept. of Geology and Environmental Geosciences

In association with the INFOMAR Project, a multibeam sonar survey was conducted aboard the R/V *Celtic Voyager* from April to May of 2013. Data were collected at both near-shore and offshore areas of Youghal Bay, 55 km east of Cork, and multidimensional maps of the area's bathymetry were produced using CARIS HIPS & SIPS 10.4. The purpose of this study was to examine the bathymetry to identify and characterize lithologic formations in Youghal Bay, and to correlate those lithologies with local terrestrial outcrops. The terrestrial geology in Youghal is part of the South Munster Basin, which is made up of a series of tilted and folded beds alternating in composition between red sandstone, fine grained mudstone, and limestone. The identification of these rock features is crucial for better understanding of the geologic relationship between terrestrial and marine environments.

55. Effects of Estrogen on Sensory Neuron Participation in Axon Regeneration Following Peripheral Nerve Injury

Katherine Eppley[1,3],Brenna Faust-Casey[1,3], Josh Goodman[1,3], Amanda Gosine[1], Alison Bruce[2], and Jennifer Wilhelm[1,3]

(1)Department of Biology
(2)Department of Psychology
(3)Program in Neuroscience

Regeneration of sensory and motor neurons is critical for full functional recovery following peripheral nerve injury. Estrogen significantly enhances regeneration of motoneurons; however, the effects have not been studied in sensory neurons. This study examined the role of estradiol treatment in sensory neuron regeneration. Common fibular nerves of male and female mice were cut and immediately repaired. Mice were treated with estradiol at the time of nerve injury. Two weeks later, a retrograde tracer dye was applied 1.5mm distal to the original repair site to label neurons whose axons had regenerated at least that distance. Regeneration was quantified by counting the number of neurons containing fluorescent tracer. Estradiol treatment significantly increased the number of labelled neurons, indicating an increase in sensory neuron participation in axon regeneration. These findings demonstrate that estrogen treatment could be used to enhance recovery of patients by encouraging regeneration in both motor and sensory neurons.

56. Structural Characterization of N-terminal Galanin Fragments

Katelyn Kraichely, Cecelia Hendy, and Michael Giuliano, Department of Chemistry and Biochemistry

Galanin is a mammalian neuropeptide that regulates many physiological processes. The N-terminal half is of specific importance for receptor binding, and N-terminal fragments of varying lengths have been shown to have different affinities for galanin's three receptors. As there is interest in galanin as a neuroprotective and anticonvulsant agent targeted to specific receptors, accurate structures of pharmacologically active fragments are crucial for future drug design. In this study, 2D 1H-1H Nuclear Magnetic Resonance Spectroscopy was used to derive distances between protons in an N-terminal galanin fragment, hGal(1-12)KK. From this, the structure of the fragment was calculated and compared to that of two previously studied peptides, hGal(1-17)K and hGal(2-12)KK. The helical character of hGal(1-12)KK supported our hypothesis that the N-terminal glycine is important for α-helix formation in this region. In addition, some N-terminal residues are in conserved positions between all three fragments, supporting literature hypotheses about the core pharmacophore of galanin.

57. Microplastics and Selective Feeding in Barnacles

 **Best of the Best**  **Best of Marine Biology**

Emily Clark and Phil Dustan, Department of Biology

Microplastics are widely dispersed and pervasive in marine environments. Barnacles are capitular planktivores, suggesting they could be actively consuming microplastic particles less than 5mm in diameter—paralleling the barnacle's diet. Two barnacle species (Chthamalus fragilis and Amphibalanus eburneus) were collected and examined for microplastic contamination. I examined the outer shell, mantle cavity, and body of 87 barnacles collected from three sampling sites—Brittlebank Park (Ashley River), Folly Beach (nearshore Atlantic Ocean), and the Harborwalk dock (Charleston Harbor)—for evidence of microplastic particles and their ingestion. I found that 77.1% of the barnacles had between 1 and 40 microplastic particles or microfibers present somewhere on the shell or mantle. No plastic particles were found in gut or body tissues, suggesting that even though they come in direct contact with microplastic, barnacles are able to exclude microplastic particles from their diet through as yet unknown selective feeding mechanisms.

58. Measuring topographic subsidence surrounding the Pavonis Mons volcano, Mars in the past 500 Million Years

Margaret Mauck, Blake Waring, and John Chadwick, Department of Geology and Environmental Geosciences

Pavonis Mons is one of the four enormous Tharsis volcanoes on Mars and is 375 km wide and 14 km tall. The massive volcano pushes down on the surrounding crust causing subsidence. In this study, the magnitude and timing of subsidence was measured by examining the orientations of lava flows. At the time of eruption, lava flows downhill. Subsidence of nearby Pavonis Mons reorients the topography and the flows no longer reflect the present-day downhill direction. The magnitude of change reflects the amount of volcano subsidence. We measured 21 lava flows near Pavonis Mons using CTX images from the Mars Reconnaissance

Orbiter in ENVI software. Their orientations were compared with topographic data from the Mars Global Surveyor. Divergence between flows and topography varies between -26.6 and 23.4 degrees. Crater size-frequency data from CraterTools software shows the topographic changes have occurred in the past 500 million years.

59. Long Branch Restoration: Improving Ecosystem Services of a Tidal Creek in a Changing City

Lloyd Hill[1], Michael Phillips[2], Eva Rence[2], Timothy Callahan[2], and Joshua Robinson[3]
(1)Graduate Program in Environmental Studies
(2)Geology and Environmental Geosciences
(3)Robinson Design Engineers

Berms and culverts restrict tidal exchange at Long Branch creek in Charleston, SC. This project proposes the removal of these hydrologic barriers to restore the natural tidal regime of Long Branch. With tidal flow restored, we anticipate the revitalization of Long Branch's ecosystem services such as stormwater control, water quality enhancement, increased biodiversity, and resilience to sea level rise. A 22-acre field currently cutoff disconnected from Long Branch by a large berm will serve as the focal point of this project. Restored hydrology will convert this field into an ecologically-rich matrix of high and low salt marsh, mudflats, and salt pannes. With the help of citizen science initiatives, habitat and biological data will be gathered before and after restoration to assess ecosystem changes and services. This project is one component of a proposed master plan for Long Branch that integrates stormwater management via green infrastructure and improved recreational access.

60. Long Branch Creek Stormwater Management Plan

Rebecca Fanning[1], Myrill Tracey[2], Taylor Cronin[2], Timothy Callahan[2], and Joshua Robinson[3]
(1)Graduate Program in Environmental Studies and Public Administration
(2)Geology and Environmental Geosciences
(3)Robinson Design Engineers

The restoration of Long Branch Creek in suburban Charleston, SC to its historical tidal regime raises concerns regarding stormwater management practices. Our proposal focuses on a 200-acre business zone including Roper St. Francis medical facilities at the headwaters of the creek. We estimate that runoff will increase by 79% if the current development pattern expands into the remaining acres of surrounding woods. In this project, we propose the following: restoration of a 22-acre wetland for increased floodwater storage, reduction of impervious surface area using green roofs and stacked parking, restructuring detention ponds to improve water quality, and litter removal structures at storm drains and at the creek

mouth. Combined, these efforts strive to improve environmental and public-access resilience around an urgent care facility, while enhancing the ecosystem services provided by Long Branch Creek and its associated environmental resources.

61. Quantification of the Adsorption of Various Organic Compounds to Silver Nanoparticle Surfaces

Bach Nguyen, Sondrica Goines, and Katherine M. Mullaugh, Department of Chemistry

Silver nanoparticles (Ag NPs) are commonly used in consumer products because of their anti-microbial properties, but their widespread use has raised environmental concerns. It is uncertain what processes control Ag NP fate in natural waters, but surface chemistry is likely important. The goal of this study is to determine the functionalities of organic material that play a role in altering Ag NP surfaces. To address this, various adsorbate compounds were combined with Ag NPs and, following separation, unadsorbed materials were quantified for a determination of the amount adsorbed by difference. Analysis was carried out with HPLC and voltammetry. Compounds with thiol group showed significant adsorption due to the affinity of sulfur for silver, but one non-thiol was also found to be attracted to the Ag NP surface. This ongoing research will continue to explore how variations in the structures of organic compounds influences the behavior Ag NPs in natural waters.

62. The effect of chemogenetic activation of prelimbic cortical neurons projecting to the nucleus accumbens core on relapse to cocaine-seeking

John McFaddin[1,2], Ben Siemsen[1], and Jakie McGinty[1]
(1) Department of Neuroscience, Medical University of South Carolina
(2) Neuroscience Program, College of Charleston

We hypothesized that preferentially activating the PreLimbic (PrL) cortex to Nucleus Accumbens (NAc) core glutamate neurons immediately after the final cocaine self-administration (SA) session would be sufficient to suppress relapse after abstinence. Rats received an intra-NAc core CAV2-Cre or a retrograde AAV (rgAAV) microinjection, which show preferential retrograde transport and express Cre recombinase in neurons projecting to the NAc core. Next they received an intra-PrL cortical Cre-dependent Gq-coupled Designer Receptors Exclusively Activated by Designer Drugs (DREADDs, AAV5-hSyn- DIO-hM3Dq). Controls received intra-PrL cortical Cre-dependent mCherry viral construct (AAV5-hSyn- DIO-mCherry). Immediately following the final cocaine SA sessions, all rats received an injection of Clozapine-n- Oxide, the otherwise inert ligand for hM3Dq. Results showed non-significant trends of CNO-mediated activation of PrL-NAc core neurons on post-abstinence context-induced relapse, cue-induced reinstatement, and cocaine prime-induced reinstatement after extinction. Additional analyses found discrete timepoints where hM3Dq-expressing rats showed suppressed cocaine seeking in all three relapse tests.

63. Simulating an acoustical experiment

Best of Mathematics

Grier M. Jones, Daniel Rich, and W. Garrett Mitchener, Department of Mathematics
Alem Teklu, Department of Physics and Astronomy

We developed a mathematical model of a complex diffraction experiment and tried to look for evidence of parametric resonance and chaos. We used a system of nonlinear mass-spring ODEs with a driving force to simulate ultrasonic standing water waves and Mathematica's NDSolve function to solve the Wave Equation for the water. We also solved the Wave Equation for laser light passing through the water. This required a finite difference method called Leap Frog. We tested it by simulating double slit experiments.

64. Geomorphologic Characterization of Current and Pre-Existing Slump Features at Campeche Escarpment

Skye Pelliccia and Leslie Sautter, Department of Geology and Environmental Geosciences

The Monterey Bay Aquarium Research Institute conducted bathymetric surveys along the Campeche Escarpment in the southern Gulf of Mexico. Multibeam sonar data were collected onboard the R/V *Falkor* and post-processed using CARIS HIPS 10.2. The escarpment traces the platform of the Yucatan Shelf, representing the closest Cretaceous-Paleogene boundary outcrops to the 65 Ma Chicxulub impact structure. Consequently, Cretaceous landslides were generated along the escarpment. The survey spans approximately 600 km in length, encompassing 80+ submarine canyons. Associated slump features, debris flows and other geologic indicators of slump failure were identified within the canyons. In this study, we characterize 50 of the submarine canyons using cross-channel profiles along each canyon's axis, measuring variations in width and symmetry at selected depths above the thalweg. The canyons were then categorized into 3 distinct canyon types (A, B, & C). Additional investigations would provide further understanding of the geologic history of the region.

65. Statistical analysis of localized temporal clustering of aerosol particles

M. Mullis, M.L. Larsen, and J. Niehaus, Department of Physics and Astronomy

The environment around aerosol particles can influence coagulation, activation rates, and other microphysical processes. These processes rely on the presence or absence of other particles nearby, thus identifying particle clustering becomes important. Here we use statistical tools to determine whether aerosol particles are perfectly randomly distributed on small scales, We used the raw transducer signals from a TSI 3321 Aerodynamic Particle Sizer to capture and analyze a tagged time-series of individual, known size, particle detection. Then, we statistically analyzed the resulting time-series to search for deviations from Poisson statistics by looking at interparticle arrival time distributions and the pair-correlation function, which did not reveal any evidence of spatial clustering.

66. Sulfidation of Silver Nanoparticles by Zinc Sulfide

Heather Lieb and Katherine Mullaugh, Department of Chemistry

Silver nanoparticles (Ag NPs) are among the most common forms of nanoparticles in consumer products, raising concerns about the environmental implications of their use. Sulfidation of Ag NPs results in the formation of a stable silver sulfide product and may be an important removal mechanism of bioavailable silver in natural waters. We investigated the reaction of zinc sulfide (ZnS) with Ag NPs to assess the potential of metal sulfides to act as a source of sulfide for Ag NP sulfidation. We developed an *in situ* voltammetric approach that provided better sensitivity and enhanced temporal resolution. The voltammetric analysis was used to monitor the reaction of Ag NPs of various sizes with ZnS. Our results indicate Ag NP size is an important predictor of Ag NP sulfidation kinetics with the high relative surface area of small nanoparticles resulting in higher rates of reaction of Ag NPs with ZnS.

67. Contributing to Code for Social Good: An Exercise in Humanitarian Free and Open Source Software

Emily Coleman, Gabrielle Cozart, Savannah Floyd, and Jim Bowring, Department of Computer Science

The Software Engineering Practicum for the Computer Science Department leads efforts to contribute to Humanitarian Free and Open Source Projects. For this project, Code for Social Good, a website dedicated to connecting volunteers who have technical skills with the volunteer organizations that need them, was selected. Existing issues in the project were

selected to be fixed, additional issues were created, and new features were added to the Android mobile application. While the mobile application is still in its starting phase, the website is in a production state and therefore new releases are made as more work is completed in development. The additions to these projects were made by students of the College of Charleston.

68. Ultraviolet Spectra of Massive Binary Stars Data Processing

McKayla Conahan, Laura Penny, Astronomy and Physics Department

When two stars or more orbit each other, we can analyze their orbit and mass by looking at the Doppler shifts in their spectral lines. This is the only way to get a non-theoretical measurement of a star's mass. This semester I have been taking ultraviolet spectral data of massive binary star systems from IUE (International Ultraviolet Explorer) and reprocessing it without smoothing the lines so that we can analyze the data with more precision and attention to detail. The reason we are using UV is that they are formed deep within the star and so are not as contaminated by stellar winds. Researchers after me will take the data I'm processing and cross-correlate the observed spectrums with synthetic spectrums. This will allow future researchers and our advisor, Dr. Penny, to more easily see individual peaks and troughs that may contain important information about red-shifted and blue-shifted emission lines.

69. Projective realizations of the Nonlinear Schrödinger equation

Katelynn Huneycutt[1,2], Annalisa Calini[2]
(1)Department of Physics and Astronomy
(2)Department of Mathematics

The KdV equation is a completely integrable system with both projective and euclidean realizations which come from invariant evolutions of curves. The Nonlinear Schrödinger equation (NLS) is also a completely integrable system with a well known euclidean realization, the vortex filament equation (VFE); however, the existence of a corresponding projective realization is unknown: Investigating this question is the main goal of the proposed project.

70. Investigating the Formation and Evolution of Peptides in a Model Prebiotic Environment

Jabbarrius N. Ervin, Keon Rezaeerod, Sloane L. English, Rachel E. Simoneaux, and Jay G. Forsythe, Department of Chemistry and Biochemistry

One of the focal points of origins-of-life research is to decipher how peptides, or short pieces of proteins, were formed from amino acids in prebiotic times. The chemical reaction to form peptides from amino acids requires the evaporation of water. An early hypothesis was that small tidal pools, which cyclically gain and lose water each day, could have been model environments for this process. However, many experiments have shown that the heating of amino acids alone forms cyclic products that stunt peptide elongation. The aim of this research was to mix amino acids with another type of molecule, hydroxy acids, in order to make peptides more efficiently. Here, various amino acid solutions were mixed and heated to evaporation with hydroxy acid solutions in order to form peptides containing both types of monomers. These peptide mixtures were then characterized by infrared spectroscopy and mass spectrometry.

71. The climatology and variability of tropical cyclones impacting Jacksonville, FL

Kirsten Broussard and B. Lee Lindner, Department of Physics and Astronomy

The climatology of tropical cyclones is essential because it helps for a better understanding of how climate changes over time and affects humans. In this research I analyzed hurricanes and tropical storms and how climatology is useful for planning for emergency purposes, inside medical facilities, infrastructures and insurance, and wildlife. My methodology for this research included using the archive maps, the Atlantic hurricane database, and historical hurricane tracking from the National Hurricane Center through the NOAA website. I analyzed all hurricanes and tropical storms in the 75 nautical mile radius of Jacksonville, FL. Specifically I evaluated the closest points on the paths of the tropical cyclones to find their date and times, wind speeds, translational velocity, and approach angle.

72. Classification of Bedrock Structures in Brandon and Ballyheige Bays, West Coast of Ireland

Kirk McIntosh, Hugh Lincoln, and Leslie Sautter, Department of Geology and Environmental Geosciences and Department of Biology

Brandon and Ballyheige Bays, located on the southwestern coast of Ireland were surveyed by Ireland's INFOMAR Program aboard the R/V *Celtic Voyager* in July-August, 2014. Multibeam sonar data were acquired to generate bathymetric surfaces using CARIS HIPS and SIPS 10.4. The terrestrial geology of the areas adjacent to the two bays consists of metamorphosed and folded

beds of sandstones, shales, and limestones. Bedrock structures are a product of extensive folding and faulting that have occurred over the past 390 million years, and have been modified by Pleistocene glaciation beginning 2Ma. Three study sites representing different geomorphologies typical of this region were analyzed using cross-sectional profiling, backscatter intensity mosaics, the orientation of jointing and fracturing, and geology of County Kerry documented by the Geologic Survey of Ireland. Study sites showed patterns of jointing and faulting similar to local lithologies, evidence of glacial scouring, and submarine river channel erosion.

73. The Use of Near-Infrared Spectroscopy to Measure Adipose Thickness

Linsey S. Passarella and Linda R. Jones, Department of Physics and Astronomy

Measuring adipose tissue in humans is important for assessing health and nutritional status. Using near infrared (NIR) spectroscopy to estimate adipose thickness would allow for all body types to be measured in a noninvasive, efficient way. To measure the thickness of adipose tissue in vivo, this study analyzed the reflection spectrum of visible and near-infrared light using optical fibers on the abdomen. The resulting change in reflectance around 930 nm, corresponding to a peak in absorption due to adipose tissue, was hypothesized to relate to the amount of tissue present. A polynomial relationship was found between the percent change in reflectance and adipose tissue thickness. This may be an effective method for determining adipose thickness that can be used in the lab to gather anthropometric data in future studies.

74. The Effects of Mixed Urban Runoff and Legacy Pollution on Noisette Creek's Water Quality

Sullivan Ford, Shannon Whitehead, and Sara Watson, Department of Geology

Noisette Creek is surrounded by a mixed urban area of industrial, commercial, and residential inhabitants in North Charleston, South Carolina. Noisette Creek was suspected to have contaminants from nearby urban runoff and potential legacy pollution by old industrial plants. This study was prompted because there are no documented studies involving the water quality of Noisette Creek. Measurements were conducted in the field for water quality parameters (pH, turbidity, dissolved oxygen, conductivity) at two different sites. Water samples were then taken from both sites and tested in the lab for trace chemical parameters (Cr^{6+}, Cu, NO_3^-, and PO_4^{3-}). Some levels of the chemical parameters were above the EPA standards for fresh surface water, while most of the water quality parameters were below the standards. These results indicate that there are some dangerous trace elements present in Noisette Creek, potentially from legacy pollution and urban development.

75. Geological Correlation of Terrestrial and Marine Bedrock Formations of Courtmacsherry Bay, Southwest Coast of Ireland

Cuff Gleaton and Leslie Sautter, Department of Geology and Environmental Geosciences

A bathymetric survey was conducted aboard the R/V *Celtic Voyager* in April – May 2013 by the Marine Institute of Ireland, the Geological Survey of Ireland, and INFOMAR project. Data were collected using a Simrad EM 3002D multibeam echosounder, and post processed using CARIS HIPS and SIPS 10.4 to create 2D and 3D surfaces. The study area is located on the southwest coast of Cork County, Ireland in Courtmacsherry Bay. The study's purpose was to correlate and understand local terrestrial and marine bedrock formations which were formed 416 to 299 mya during the late Devonian and Carboniferous periods. A variety of marine geomorphologic features were successfully identified and correlated to terrestrial formations at Courtmacsherry Bay.

76. Constraining Quasar Wind Geometries by Modeling P-Cygni Profiles

Wendell Roberson and George Chartas, Department of Physics and Astronomy

P-Cygni profiles are spectral features that imply the presence of outflows in objects ranging from stars to quasars. We present results from investigating the P-Cygni profiles in the quasars Q2237+0305 and SDSS J1353+1138. We model the spectra of the two quasars, collected by the Chandra X-ray Observatory and XMM-Newton, by creating various models of increasing sophistication and fitting them to the data. From modeling the spectra, we were able to determine mass outflow rates of about 1.7 solar masses/yr and 1.60 solar masses/yr for Q2237+0305 and SDSS J1353+1138, respectively. We were also able to constrain the covering fractions and outflow velocities of the gas of the outflows which suggest wide-angle outflows at relativistic speeds. We conclude that these outflows are energetic enough to have lead to considerable feedback between the quasars and their respective host galaxies.

77. Comparative Analysis of the Interaction of Cultural Practices with Sea Turtle Conservation Efforts in the Tropics

A.P. Noonan and O.H. Razafindratsima, Department of Biology

As natural habitats continue to be affected by anthropogenic pressures, there has been a growth in conservation efforts of an interdisciplinary nature. Sustainable conservation requires considering both ecological and human dimensions, including local culture, socio-economic and political aspects. We took this triple-bottom line approach to examine the success and sustainability of sea turtle conservation efforts in three regions with unique bioregional identity in Central America, through literature review. By comparing nesting rates of the turtles with

levels of positive local interaction, conservation efforts can be refined based on values in the area. The creation of protected areas has proven to be both effective and an integral aspect of conservation in each country, on varying levels of success, finding that conservation efforts incorporating local cultural needs have been most effective. The findings highlight the importance of cultural practice and community-based solutions in tackling conservation issues, due to their interconnected nature.

78. X-Ray Variability of Ultrafast Outflows

Manuel H. Cañas, George Chartas, Department of Physics and Astronomy

Powerful winds from active galactic nuclei (AGN) are now considered to be the main mechanism that regulates the evolution of galaxies through a feedback process. We use Principal Component Analysis (PCA) to investigate the variability of winds of two distant AGN, APM08279+5255 and IRAS13224-3809. The X-ray spectra of these AGN were obtained from observations taken with the XMM-Newton Observatory. By applying PCA to these spectra we inferred the strength of the spectral variability as a function of energy. We find enhanced variability at several energies that imply the presence of gas outflowing at a relativistic speed. We confirm the presence of the previously published outflow in IRAS13224-3809, however, we also find that several of the claimed results were influenced by significant background. In APM08279+5255 we confirm the presence of a relativistic outflow and for the first time find several additional elements outflowing at similar velocities.

79. The Rankability of Data

Erin Langenstein, Amy Langville and Kathryn Behling, Department of Mathematics

In a world that revolves around BIG Data, ranking such data structures is crucial in order to translate algorithmic results from abstract to applicable. Ranking poses the question “what/who the best is?” We however pose a new question, “can we trust this ranking?” When a ranking method is applied to a data set that is not suitable for ranking, the linear ordering is thus meaningless. We are taking a graphical approach to the rankability problem and thus our data set is an adjacency matrix to an unweighted directed graph. There exist specific data structures such as a dominance graph that are intuitively rankable. The dominance graph adjacency matrix is in perfect upper triangular form. In order to quantify the rankability of a data set, a Brute Force algorithm is utilized to quantify the number of changes needed in order to transform a data set to a dominance graph.

80. Measuring the Innermost Stable Circular Orbit of Supermassive Black Holes

Lukas Zalesky and George Chartas, Department of Physics and Astronomy

We present a promising new technique, the g-distribution method, for measuring the inclination angle (i), the innermost stable circular orbit, and the spin of a supermassive black hole. The g-distribution method uses the observed energy shifts of the relativistic iron line emitted by the accretion disk of a supermassive black hole due to microlensing by stars in a foreground galaxy and compares these shifts to calculated values and simulations to constrain the properties of the black hole. We apply the method to the gravitationally lensed quasars RX J1131−1231, QJ 0158−4325, SDSS 1004+4112, and Q2237+030. Using new observations from the Chandra X-Ray Observatory we find that these quasars all have spin parameter $a < 0.9$ and inclination angle $i > 50^{o}$. Finally, we present future prospects for the application of this method.

81. Melting Mucho Magma in the Mantle: Using Geochemistry to Assess Tectonic Influences on Magma Production at Open Vent Volcanoes

Noah Katz, Dawn C. S. Ruth, and John Chadwick, Department of Geology and Environmental Geosciences

Many of the volcanoes on Earth occur at subduction zones, where melting occurs deep in the mantle because the introduction of water by the slab lowers its melting point. Some of these volcanoes erupt more frequently, and these happen to be associated with local regions of extension, where the crust is pulling apart. We hypothesize that these volcanoes have a higher magma supply because additional melting is occurring in the shallow mantle. To test this hypothesis, we analyzed the geochemistry of lava from Llaima Volcano (Chile) and Colima Volcano (Mexico) using major elements (using X-ray Fluorescence), trace elements (Inductively Coupled Plasma Mass Spectrometry; ICP-MS), and isotopes of strontium (multi-collector ICP-MS). We also used Electron Microprobe and Laser Ablation ICP-MS to analyze compositions of glass trapped in crystals. The results suggest a hybrid magma from deep and shallow mantle sources is likely for these volcanoes.

82. Using Brain Waves to Predict Imminent Failure

Courtney Beckham, Department of Mathematics

SPAWAR ran a test where subjects had to play a memory matching game with three levels of difficulty. Each test consisted of 310 trials with five phases each; the study, recall, detect, report, and intertrial phases. Electroencephalography (EEG) data was gathered from these tests with the goal of finding a method for using it to predict when a subject will fail to identify all of

the target symbols in a trial. In our ongoing research we've developed two possible methods of detecting when the subject will fail. The first uses the logarithmic regression to predict failure based on the results of previous subjects. The second uses voltage information to distinguish between pass and fail trial characteristics. Our results show promising development towards being able to use EEG data in order to predict when a subject is going to fail a memory matching game.

83. The Roles of the Yellowstone Hotspot and Crustal Assimilation in Generating Pleistocene-Holocene Basalts on the Eastern Snake River Plain

Best of Geology

Hana Mintz and John Chadwick, Department of Geology and Environmental Sciences

The southwest motion of the North American plate across the Yellowstone hotspot created a chain of age-progressive rhyolitic calderas over the past 16 Myr. in southern Idaho. Yellowstone activity now resides in Wyoming, but basaltic volcanism has continued in its wake on the eastern Snake River Plain. These younger basaltic lavas are non-age progressive and buried the Yellowstone rhyolites. Lava samples were acquired and analyzed from the Black Butte Crater (10,100 years), Cerro Grande (13,400 years), and Hell's Half Acre (4,000 years) flows, which were erupted at distances from between about 200 km to 300 km from the current location of the hotspot. Crustal thickness varies from 47km to 40 km for these flows. Trace elements and Pb and Sr isotopes were used to confirm the influence of crustal assimilation on the lava chemistry. The differences in crust thickness is likely responsible for the chemical variations measured in the lavas.

84. Developing Steam-Girdling as a Method of Inducing Fine Root Senescence

Best of Biology

Julie Raiguel, Bridget Piculell, Seth Pritchard, and Allan Strand, Department of Biology

Given the importance of root senescence in nutrient cycling, a reliable method of inducing senescence would greatly enhance our study of this essential process. We investigated steam-girdling as a method of inducing senescence by exposing *Pisum sativum* roots of different diameters to steam treatments ranging from 5 to 120 seconds, followed by a triphenyltetrazolium chloride (TTC) assay. Cell viability at the steam site was indicated by reduction of clear TTC to red tetraformazan. Absorption values (at 490 nm) decreased with increasing steam times. However, only roots steamed for 45 seconds were not significantly different from boiled controls. Larger diameter samples showed greater absorption within treatments, but this trend was also present in non-steamed controls. While this study was unable to determine the length of steaming necessary to induce senescence, it does provide evidence that steaming can result in cell death and suggests avenues of future research to hone this method.

85. Synthesis and Substrate Testing of a Bis(diphenylthiophosphine)methanediide Platinum(II) Pincer Complex for the Catalytic Synthesis of Lactones and Lactams

Alec Esper[1], Anthony Pujol[2], Marie Boutignon[2], Nicolas Mézailles[2]

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Lactones and lactams are organic molecules that are useful in variety of organic synthesis useful for drug and polymer syntheses. Commonly synthesized by traditional organic syntheses, recent research has shown they may be cycloisomerized from unsaturated acids and amides in good yield by utilizing an organometallic complex as a cooperative catalyst. Such complexes require an electrophilic metal center and a basic ligand, the electrophilic metal activating the unsaturation toward cyclisation, and the basic ligand deprotonating the acid or amide function

to increase its ability to initiate the cyclization. In our system, bis(diphenylthiophosphinoyl)methane, a bi-dentate pincer ligand, is deprotonated twice and coordinated in tri-dentate fashion to a platinum(II) center, forming a pseudo-carbene bond between the methylene and platinum centers that stabilizes the metal along with a triphenylphosphine co-ligand. Initial cycloisomerization catalysis and basicity tests were promising with partial product formation from 4-pentynoic acid and resistance to protonation by diisopropylamine and *N*-methylbenzamide.

86. Building Sakai: Working with established FOSS

Maz Little, Zack Cuomo, Josh Jettie, and Joseph Ayers, Department of Computer Science

Apereo Sakai is a FOSS learning management system used by teachers and students worldwide to manage gradebooks, assignments and tests, announcements, and many other useful tools. The software relies heavily on an active community of contributors who maintain and update the existing structure. We sought to enter that world of contributors and help the software, and also build additional tools to assist other contributors, new and experienced, in making the process easier for everyone involved. We focused on fixing bugs (managed through an issue tracking website called JIRA). We also looked to create a script in bash (a terminal language for Linux) which would simplify the installation process down to a small handful of steps in an attempt to expedite the process for new contributors. Ultimately, we were able to gain knowledge about what contributing to an existing and longstanding Free and Open Source Software project as relatively inexperienced programmers.

87. Women in STEM at the College of Charleston: Recruitment and Retention Strategies

Misty Antonacci and Cynthia Hall, Department of Mathematics

Although women earn approximately 57% of all bachelor's degrees in the US, they make up only about half of all degrees in science, technology, engineering and math (STEM), according to the National Science Foundation. Excluding biological sciences, a field with a female majority, that number drops to about 37%. This gender gap in STEM may be caused by a variety of factors including math self-concept and stereotype threat. These gendered notions begin forming in students as early as elementary school, meaning work must be done to encourage more recruitment and retention of women in math and science fields. This project analyzes the undergraduate graduation rates of women in STEM at the College of Charleston in comparison to data from the US Department of Education. This information can be used to better examine the effectiveness of the College's recruitment and retention methods, as well as explore opportunities to improve future rates.

88. Validating shRNA virus against Arc protein in nucleus accumbens region using q-PCR

Kelsey G. Glover, Rachel D. Penrod-Martin, Christopher W. Cowan
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(2) Department of Neuroscience, MUSC

A key feature of addiction is the vulnerability to relapse due to the drug induced plasticity in the Nucleus Accumbens (NAc) region of the brain. ItPrevious research has shown that the activity-regulated cytoskeleton-associated protein (Arc) is upregulated when drugs are introduced to the NAc region. Although Arc Knockout shows enhanced drug sensitivity, it is undetermined whether development possesses a role in the increase of reward sensation. A shRNA adeno-associated virus was infused into the NAc region of an adult mouse through stereotaxic surgery unilaterally. After allowing the virus to express, the NAc region was isolated and then converted into cDNA for q-PCR analysis. Through q-PCR, the results show a decrease of Arc protein in the side of the brain the shRNA virus was introduced. Validating the effectiveness of the shRNA virus to inhibit Arc enables the further study of Arc in development of addiction.

89. Vector Potential: A Divergence Free Method for MHD Code

Payden L. Shaw and P. Chris Fragile, Department of Physics and Astronomy

We present the Vector Potential (VP) method, a divergence free magnetic field evolution method for the *Cosmos*++ code. We verify its use on Adaptive Mesh Refinement (AMR) and Static Mesh Refinement with three MHD test problems: the Orszag-Tang vortex, Field Loop Advection, and Smooth Alfvén Wave. It was found that the VP method is able to keep the divergence of the magnetic field close to zero for both refined and unrefined simulations. We also find that the VP method preserves a predictable convergence order in the Alfvén Wave problem.

90. Spectro-Temporal Pulse Modeling in Gamma-Ray Bursts

Rebecca Brnich and Jon Hakkila, Department of Physics and Astronomy

We discuss our development of an empirical model to replicate time-varying gamma-ray burst (GRB) pulsed emission. In developing this model we assume that GRB pulses have hard-to-soft (high energy to low energy) spectral evolution. Our approach is to reproduce GRB spectral and light curve parameters using a simple spectral model consisting of an energy-decaying broken power-law spectrum combined with a simple pulse light curve model; our results will allow us to place constraints on observed GRB pulse evolution. We discuss our greatest concern at

present, which is the correct modeling instrumental properties. When operational, our model will be tested on a variety of GRB pulses to see if it can reproduce the range of observed GRB pulse spectra, and thus to determine constraints on GRB pulse physics.

91. Contributing to Hospital Run

Scott Stolarski, Ben Muldrow, J-M Baldy, and F. Atoche, Department of Computer Science

Our project for CSCI 462: Software Engineering Practicum was to pick a Humanitarian Free Open Source Software (HFOSS) to contribute to. We chose Hospital Run over a few other projects because of its simple mission, active community, and easy to use build instructions. When we started looking at Hospital Run, we began by looking at their issues and scanning the codebase. We saw that there were many depreciation issues and that the spanish translations were inaccurate. Throughout this semester we improved the the Spanish translations and fixed deprecation issues.

92. Synthesis of 2-amino oxazolines and oxazines via halocyclization of urea derivatives

Cameron Twitty and Timothy Barker, Department of Chemistry and Biochemistry.

An efficient synthesis of 2-amino-oxazolines and 2-amino-oxazines via the coupling of isocyanate derivatives with various amines is described. A variety of isocyanates and amines, that vary electronically and sterically, are tolerated. The resulting urea derivatives can undergo a halocyclization process to provide a variety of 2-amino-oxazolines or 2-amino-oxazines. This 2-amino-oxazoline functionality is present in the natural product Allosamidin. Furthermore, the resulting alkyl halide serves as an opportunity for further synthetic efforts to provide more complex oxazolines and oxazines.

93. Gamma-Ray Burst Classification: New Insights from Mining Pulse Data

Stanley McAfee and Jon Hakkila, Department of Physics and Astronomy

Despite being the most energetic electromagnetic explosions in the universe, gamma-ray bursts (GRBs) are still poorly understood. The literature recognizes two potentially different types of GRB progenitors, although statistical data suggest the existence of three GRB classes. Reliable inference of GRB physics depends on the identification of appropriate classification attributes, as well as on the statistical classification techniques used. It has recently been shown that pulses are the basic unit of GRB emission. We use new data describing GRB pulse characteristics, in conjunction with data mining tools, to provide a more reliable gamma-ray burst classification system and place additional constraints on GRB physics. We demonstrate that fewer pulses are needed to describe GRB emission than has been suggested by previous analyses, and find pulse duration to be one of the greatest delineators between GRB classes.

94. Matplotlib: An Experience in Open Source Software

Matthew Adamson, Matthew Bell, Ben Buckwalter, Phillip Wilson, and Jim Bowring, Department of Computer Science

Matplotlib is a free and open source graphing library for the Python programming language. Free and open source software (FOSS) is developed by volunteering philanthropists, and can be used by anyone for free. FOSS requires a niche method of software development to be successful due to complex nature of coordinating volunteer development remotely. We sought to investigate the software development techniques of FOSS by contributing to the development of Matplotlib. We joined the Matplotlib development community, actively conversing with the project's developers through a public chat room. Our team focused on updating documentation within the software, since many components of the library were not documented. We also worked on making new graph examples to help acclimate new users, the new examples complement existing graphs. Additionally our team clarified several obscure examples for Matplotlib features. Our team has found FOSS development techniques to be highly effective, although with some complexities.

95. Determining the role of the extracellular matrix environment on cell signaling, behavior, and differentiation

Caitlin R. Brown[1,2], Christine B. Kern[2]
(1)Department of Biology
(2)MUSC Department of Regenerative Medicine and Cell Biology

Cardiac valve disease affects about 5% of the adult population with developmental malformations believed to contribute to disease initiation. Cardiovascular valve development from a fetal homogenous proteoglycan-rich extracellular matrix (ECM) to mature specialized and stratified ECM is not fully understood. Typically, the cleavage of proteoglycans is associated with degenerative diseases, however our research shows that cleavage by ADAMTS5, and ECM protease, is required for normal development and homeostasis. We address the hypothesis that proteoglycan accumulation in myxomatous valves results from reduced ECM cleavage and directly contributes to anomalous valve maturation. We test this by using mouse models to observe cardiac morphology in the presence and absence of ADAMTS5.

96. Environment-Dependent Conformational Behavior of Endomorphin-1

Best of Chemistry and Biochemistry

Alexandra C. Schwartz[1], Stuart Parnham[2], and Michael W Giuliano[1]

(1) Chemistry and Biochemistry

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The neuropeptides are a large family of signaling peptides responsible for a wide array of functions in the human nervous system. We hypothesize that many neuropeptides alter their structure as their environment changes from aqueous to lipidic as these molecules approach their membrane protein receptors. In this study, NMR structures of the μ-opioid receptor agonist endomorphin-1 (EM-1) were determined under aqueous and membrane-bilayer conditions. We report these structures and a study of the interaction of EM-1 with isotropic lipid bicelles via DOSY NMR experiments.

97. E. T. Drone Home (working title)

Xenia Mountrouidou and Nate Smith, Department of Computer Science

With the increased usage of Internet of Things (IoT) devices, the attack surface of the internet has grown rapidly. IoT devices sometimes make our lives easier, but the industry's rush to production makes them vulnerable. The majority of these devices do not have enough power to run any software or firmware over base functionality. We explore the vulnerabilities of digital assistants and amateur drones. Research has been done with Digital Assistants to command them with low frequency voice packets inaudible to the human ear. Various Drones can be used as a rogue access point. We hypothesize that long distance attacks are viable and these devices can be used as part of a botnet, surveillance network, or pivot devices to gain access to important assets. Through network traffic analysis and scanning techniques, we seek open services, weak passwords, and Operating System (OS) or firmware vulnerabilities.

98. Functional Traits of *Arabidopsis* Mutants in Varied Environments

Olivia D. Musselman and Courtney J. Murren, Department of Biology

Mutations are commonly investigated under benign lab conditions, but such studies may mask environmentally sensitive effects. To address this, we selected lines with insertion mutations in root genes, root-shoot integration genes, and genes with no known root function. We grew these lines with controls in three nutrient treatments and measured for above- and belowground traits. From these lines, we chose a subset to study as seedlings in the same treatments and measured them for a subset of the above traits. By comparing these two experiments, we also investigated the effects of developmental stage on whole-plant traits. We found that mutational effects vary across environments, depend on insertion position (exon vs. promoter), and gene class. Seedling morphology within environments is a poor predictor of adult morphology. Taken together, these results highlight the importance of studying mutants throughout development and across environments to uncover multiple possible effects of a single mutation.

99. Contributing to Free and Open-Source Software: Experiences with CodeCombat

Jim Bowring, Tristan McCarty, Michael Eskew, Ricky Ramos, Matendo Rugema, Department of Computer Science

The open-source project CodeCombat is an online game meant to introduce programming languages to younger students. Initially, CodeCombat started as closed-source. It then became open-sourced in 2014 and now benefits from a community of contributors. The authors joined this community, and were able to experience how an open-source project can still market itself while they leverage the community of users and contributors for working on bugs and features.

100. Primary Cause of Coral Bleaching on the Freddy Day Reef and Adaptations to Increasing Sea Temperatures

Brianna Porter, Phillip Dustan, and Anastasia Zimmerman, Department of Biology

Experimental studies have shown that reef corals expel their symbiotic zooxanthellae or bleach when environmental temperatures 2°C are higher than the summer mean maximum are encountered over an extended period of time. The lengths of time corals spend in these elevated temperatures were calculated as degree heating hours (DHH). Using HOBO Temperature Data Loggers (Onset Computer Corp.), we recorded water temperatures at the Freddy Day Reef, Charleston, SC (2009 – 2017) in order to investigate the relationship between coral bleaching events and water temperature fluctuations. Sea surface temperatures (SSTs)

data and coral bleaching events from NOAA were referenced for comparison. We found that DHH were the strongest indicator of coral bleaching and the maximum SST was not statistically significant. Research into the flexibility of corals to shift the composition of their algal symbiont communities supports the hypothesis that certain species of corals may be able to adapt to their changing environments.

101. Interactive Effects of Nitrogen and Vitamin B12 limitation of DMSP lyase Activity in the Marine Coccolithophorid, *Emiliania huxleyi* 373

Kirk McIntosh, Giacomo R. DiTullio, and Peter A. Lee, Department of Biology

Laboratory experiments were performed on the marine coccolithophore *Emiliania huxleyi* CCMP373 (*E. hux*) to determine the effects of vitamin B12 and nitrate limitation on intracellular dimethylsulfoniopropionate (DMSP) concentrations and DMSP-lyase activities (DLA). DLA is found in certain species of marine algae and bacteria and is responsible for the cleavage of DMSP to dimethylsulfide (DMS). DMS is a volatile organic compound that plays a critical role in the global sulfur cycle and cloud formation. *E. hux* was semi-continuously cultured under three experimental conditions: low nitrate, low vitamin B12, and combined low nitrate/B12. DMSP levels and DLA were measured using a head space analysis technique and a mass spectrometer. Data was normalized to chlorophyll and cell count measurements. Results revealed no statistical differences in DLA between the experimental groups and the control group suggesting the role of DLA in *E.hux* 373 was not directly related to alleviating oxidative stress in our experiment.

102.Bioinformatics Analysis of Karyopherin Expression in Sea Urchin Development

Ramsha Shams, Madison Davis, and Christine Byrum, Department of Biology

Karyopherins, essential for nuclear cargo transport, can be classified into three groups: exportins, importins, and transportins. Exportins transport cargo out of the nucleus, importins transfer cargo into the nucleus, and transportins relay cargo in both directions. In this study, we utilized bioinformatic resources to perform transcriptomic expression analysis of importins and transportins. We also performed phylogenetic analysis to examine homology between karyopherin sequences in *Lytechinus variegatus*, *Strongylocentrotus purpuratus*, and humans. We confirmed orthology between *L. variegatus*, *S. purpuratus*, and human sequences for IPO4, IPO5, IPO7, IPO9, IPO11, IPO13, KPNB1, TNPO1/2, and TNPO3. When comparing *L. variegatus* and *S. purpuratus* expression, we observed highest expression of IPO7, IPO13, and TNPO3 during cleaving and mid-gastrula stages. We also observed highest expression of KPNB1, IPO4, and IPO9 during cleaving and pluteus stages. Based on these preliminary results, expression of these karyopherins is comparable in these two sea urchin species.

103. Does Elevated Pressure Influence Brain Cell Migration?

Stephen Frederico[1,2], Ryan Gedney[4], Michael E. Smith[2], Ramin Eskandari[2,3]
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(2) Department of Neurosurgery, MUSC
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(4) College of Medicine, MUSC

Mechanisms of secondary brain injury from sustained increases in intracranial pressure (ICP) are not fully understood and may account for deficits even after a primary injury occurs (i.e. trauma, hydrocephalus or hemorrhage). This study examines changes in human astrocytes migration following pressure exposure using an *ex-vivo* model combining 3D cell cultures and a pressure-controlled cell culture incubator (PC_3I). The PC_3I allows increased pressure environment under controlled conditions, enabling the study of the pressure effects on cellular growth, proliferation, migration, and cell death. Compared to controls, accelerated astrocyte migration was observed when astrocytes were exposed to sustained pathologic pressure of 30mm H_2O for 24 to 48 hours. This acceleration could be a direct reaction of astrocytes to pressure insult, dependent on the amount of exposure. Future experiments with other cell types are under way at this time.

104. Kinetic Isotope Effects in the Kemp Elimination

Briana Taormina and Marcello Forconi, Department of Chemistry and Biochemistry

The Kemp elimination is a reaction that has been used for years as a model for proton transfer from aromatic carbon and, more recently, as a benchmark for the de-novo computation of enzymes. Although this reaction is often base-catalyzed, recent results have shown that heme proteins can catalyze the Kemp elimination via redox mechanism. We used a water-soluble analog of heme to determine the substrate kinetic isotope effect (kie) for the redox-catalyzed pathway. We found that whereas the kie for the base-catalyzed pathway is about 6, its value is reduced to less than 2 for the redox pathway, suggesting minimal degree of bond cleavage in the transition state of the reaction. Further experiments and calculations will be performed in the future to determine the rate-limiting step for the redox pathway.

105. Contributing to Jupyter Notebook

Drew Bigelow, Ethan Hendrix, Patrick McCardle, Cass Outlaw, and Jim Bowring, Department of Computer Science

This semester our software development team resolved issues for the Open Source Software(OSS), Jupyter Notebook. Jupyter is a software development company which produced the Notebook; an open source web-based Python code editor. The goal of this project was to gain experience contributing to OSS. Our team contributed to issues and bugs that Notebook

users reported. To resolve issues it was necessary that we coordinated with Jupyter's official team, the users experiencing the issues, and each other to resolve these bugs. A large part of this project was interacting with members of the Jupyter community, who are displaced geographically. Through our experiences our team has been able to merge a pull request and work on other issues reported by users. By resolving these issues our team has gained a valuable experience working with large scale software projects; as well as gained valuable credit in the Open Source community.

106. The effects of TOX3 regulation on breast cancer susceptibility and mammary gland development

Lauren Hollman, Lauren McLean, Royal Pipaliya, and Bartholomeus Smits, and Isaure de Buron, Department of Pathology and Laboratory Medicine at the Medical University of South Carolina

In the United States, 12.4% of women will develop breast cancer in their lifetimes. Genome Wide Association Studies (GWAS) found a number of risk alleles that are associated with breast cancer. Previous studies have established that TOX3 downregulation is correlated to a higher risk of breast cancer. This study investigated TOX3 using CRISPR/Cas9 technology to create rat mutants with decreased levels of TOX3. We found that there is no significant difference in TOX3 expression once the tumors have developed. Thus, it can be concluded that TOX3 is associated with breast cancer susceptibility. Mammary gland structure was also studied. The number of terminal end buds (TEBs) was increased in mutant rats. A greater number of TEBs could be correlated with a greater risk of breast cancer. Increasing TOX3 levels in women with the risk allele could mitigate breast cancer susceptibility for millions of women in the United States.

107. Enhancing Jupyter Notebook's UX

Matt Kay, Mac Knight, Charles Sommer, and Hitarth Patel, Department of Computer Science

Our goal was to gain experience working with larger projects by contributing to Free Open Source Software. We chose Jupyter Notebook; there were three main issues with the user experience that we sought to fix. One, Jupyter Notebook lacked a keyboard shortcut to close and exit out of the notebook windows. Two, alterations to Jupyter Notebook's metadata did not change the state of the application to "unsaved". And three, special "TODO" comments were not properly highlighted. By reading through the codebase and injecting our own test code we were able to figure out how new actions and logic could be implemented into the project. We successfully merged our solutions for issues 1 and 2 with the master branch of Jupyter Notebook's Git. Our solutions have improved the experience for all Jupyter Notebook users.

108. The Science of Forensic DNA Analysis

Agnes Southgate and Rachel Remsburg, Biology Department

DNA analysis on samples collected at crime scene has become a standard procedure in many criminal investigations. The science of forensic DNA has changed dramatically since it was first proposed. In this poster we present information on the type of DNA origins, as well as the DNA polymorphisms used for identity matching. Techniques used to analyze DNA samples are presented, as well as some data from our own analysis. More recent advances using microbiome analysis are also discussed.

109. A Geochemical Analysis of Mesozoic Dikes in Western South Carolina

Michael Shahin, Jeniffer Soto, and John Chadwick, Department of Geology

The supercontinent Pangea began to breakup in the late Triassic approximately 200 Myr. ago along North America's east coast. The rifting lead to voluminous volcanism called the Central Atlantic Magmatic Province. These lava flows are mostly eroded away, but the dikes that fed them are still present. One of the largest (245 m wide) is in western South Carolina, called the Great Dike. The goal of this study was to determine if it resulted from a single large intrusion or a series of overlapping intrusive events. Samples were acquired every 15 m. to understand the chemical variability of the magma. Trace elements and Pb and Sr isotopes were measured from samples, and the results show significant chemical variability and evidence from multiple eruption events, as well as evidence for modification of the mantle by subduction. This overlapping dike scenario is similar to the sheeted dikes found in mid-ocean ridges

110. Biogeography and Computational Analysis of Marine Iron-Oxidizing Bacteria

Katherine Duchinski, Heather Fullerton, Department of Biology

Communities adapted to extreme environments define the limits of survival and the elementary requirements of life. Diverse lifeforms can survive at the bottom of the ocean, in part thanks to the presence of microorganisms, which form thick biofilms called microbial mats. Prokaryotes govern the biogeochemical cycles of macronutrients essential to biochemistry, and they are the primary producers in hydrothermal-vent ecosystems. The Mariana Arc and Lō'ihi Seamount, a Hawaiian submarine volcano, both host hydrothermal vents and microbial mat communities. We performed comparative genomic analysis of communities at the two sites to discover patterns governing microbial ecology in hydrothermal vents, determine which site

promotes greater microbial diversity, and determine community overlap between the two sites. We processed variable sequences in the 16S ribosomal subunit using the Mothur pipeline and ZetaHunter tool to classify species into operational taxonomic units (OTUs) and statistically analyzed the data in R.

111. Comparative Analysis of Slope Characteristics of Ontong Java and Nukumandu Atolls

Jessica Hendricks and Leslie Sautter, Department of Geology and Environmental Geosciences

During October-November 2014, scientists from the Schimdt Ocean Institute and the University of Tansania surveyed one of the world's largest submarine platforms, the Ontong Java Plateau, including two atolls: Ontong Java Atoll, and the Nukumanu Atoll. Multibeam sonar data were collected using Kongsberg EM302 and EM710 echosounders aboard the R/V *Falkor*. CARIS HIPS & SIPS 10.4 was used to process the bathymetry, which revealed geomorphological evidence of slope failure associated with tsunami generation along the Ontong Java Atoll. Sites of potential slope failure along the Nukumanu Atoll were identified from slope measurements ranging from 3 to 72°, backscatter intensity was used to identify the relative substrate hardness of the surrounding seafloor as well as aiding in morphological characterization of features such as gullies. These features, along with downslope debris accumulation, are identified near the southern flank of the Nukumanu Atoll, and are indicative of mass-wasting.

112. Mining data to study volcanoes: comparing tectonics and geochemistry at oepn vent volcanoes using internet -based databases

Wm. Aidyn Trubey, Dawn C.S. Ruth, and Erin Beutel, Department of Geology

The eruption frequency of volcanoes range from erupting continuously (i.e. open-vent) to much less frequently (e.g., every 100,000 years). Open-vent volcanoes are interesting because special conditions are required to maintain the necessary magma flux for maintenance their behavior. To ascertain these conditions, we assessed the geochemistry and regional tectonics around 60 open-vent volcanoes using data mined from internet-based databases. To allow for analysis, we chose two volcanoes of similar setting but with longer periods between eruptions . Based on the analysis mentioned, open-vent volcanoes generally have a more enriched source than the control volcanoes. Yet, the chemical nature of these volcanoes shows no trend with those that erupt more often. Similarly, the tectonics appear uniform over the areas with high and low eruptive frequency. For further analysis, it could be beneficial to use a larger group of volcanoes, more localised focus, and higher spatial resolution tectonic data.

113. Complement Peptide C3a Treatment Induces Mitochondrial Changes and Respiration-Linked Cell Death in *Candida glabrata*

Hailey Kinsland[1], Jessica Dinh[2], Will Linder[2], and Caroline Westwater[2,3]
Department of Biology, College of Charleston
Department of Oral Health Sciences, Medical University of South Carolina
Department of Microbiology and Immunology, MUSC

Candida glabrata is a human opportunistic pathogen that can cause a range of infections in the host from superficial infections to deadly systemic infections. The rate of *Candida* infections, particularly those caused by *Candida glabrata*, is rising in the United States and these infections are increasingly resistant to most commonly used antifungals. Our lab has shown that complement peptide C3a exhibits direct antifungal action on *Candida* species and that treatment with C3a both induces plasma membrane depolarization and release of cellular ATP. We have shown that C3a treatment results in mitochondrial changes including morphology alteration, mtDNA increase, content increase, and reduction of membrane potential. We have shown through the use of Antimycin A that C3a mediated killing of *Candida* requires normal respiration within the cell. In conclusion, the Westwater lab has shown that C3a treatment of *Candida glabrata* alters pathogen mitochondria, induces cellular changes, and results in respiration-linked cell death.

114. Distribution of Maturity Stages across Salinity Gradients in the Atlantic Brief Squid

James Peyla and Robert Podolsky, Department of Biology

The Atlantic brief squid (*Lolliguncula brevis*) is an abundant and ecologically-important species unique among cephalopod mollusks in its ability to live in brackish water. Despite this capacity for a broadened habitat range, little work has been done on ontogenetic shifts in its distribution. To investigate how individuals of this species move among the various geographic and chemical environments found in estuaries during maturation, squid from coastal waters in South Carolina were collected, weighed, measured, sexed, and examined to determine maturity. Here, we compare distributions of the ontogenetic stages of this species along two drainage transects that each span a wide range of salinities: the Ashley River, a site that has relatively high disturbance from development, and the Coosawatchie River, a relatively pristine site. Our results indicate that squid may move to different parts of estuaries as they develop from juveniles to adults, suggesting possible benefits of euryhalinity for this species.

115. Behavioral Effects of Fluoxetine and its Phototransformation Products on Southern Toad Tadpoles

Jordan Bralley[1], Wendy Cory[1], and Allison Welch[2]
Department of Chemistry
Department of Biology

The problem of pharmaceuticals in the environment has yet to be thoroughly studied. Of particular note are selective serotonin reuptake inhibitors (SSRIs), like fluoxetine (Prozac), which can potentially impact the behavior of aquatic organisms at low concentrations. We evaluated the effects of sublethal concentrations of fluoxetine and its phototransformation products on the behavior of southern toad tadpoles. Tadpoles were exposed to fluoxetine solution that had and had not been exposed to UV radiation for 144 hours. We assayed tadpole startle response, as a measure of response to potential danger in the environment. Tadpoles exposed to the untransformed fluoxetine showed a more pronounced decrease in startle response, suggesting that phototransformation reduces the overall effect of the solution, likely by reducing the concentration of active compounds. This study demonstrates that pharmaceuticals in the environment can negatively impact aquatic organisms, even at sub-lethal concentrations.

116. Functional Anatomy of the Reward Pathway in Mice

Reilly Kilpatrick and William Griffin, Department of Psychiatry and Behavioral Sciences, Addiction Studies Division, The Medical University of South Carolina

Alcohol dependence is an issue that impacts many facets of our society. Much has been done in addiction studies to learn more about the development of harmful addictive behaviors. We aim to explore the neuroanatomical pathways associated with reward and addiction, specifically between the Ventral Hippocampus (vHC) and the Nucleus Accumbens (NAc). Study mice received an excitatory DREADD (Designer Receptors Exclusively Activated by Designer Drugs) microinjected into the vHC. The DREADD activator, clozapine-n-oxide (CNO), was subsequently administered to half of the mice in the study, and the others received saline. We focused on quantifying neural activity. The mice were sacrificed, their brains were sectioned, treated with double-label immunohistochemistry, and imaged to confirm DREADD placement and quantify cfos, an indicator of neuronal activity. Cfos expression was markedly higher in the NAc of mice that received CNO versus saline. This brings us a step closer to better understanding the neuroscience of addiction.

117. Lunar Analysis and Sampling for Exploration and Research: NASA LASER Mission Orbiter Science Team

Stanley McAfee, Cass Outlaw, Aaron Neuhauser, Kyle Cooper, Zach Coffman, and J. Hakkila, Department of Physics and Astronomy

The Lunar Analysis and Sampling for Exploration and Research (LASER) mission has been developed as part of CofC's NASA Space Mission Design course in collaboration with an engineering course at the University of Alabama in Huntsville. Our LASER orbiter works in conjunction with lander and rover vehicles to ascertain the content, origin, and evolution of the solar system. The orbiter's science goals build on evidence from previous lunar missions which suggest volatile molecules, such as water, are trapped in permanently shadowed regions in the Moon's South Pole-Aitken Basin. The orbiter will constrain the age of the Moon by imaging craters with ages verified by the rover, and will use a suite of versatile instruments to answer questions about the presence, distribution and transport of lunar volatiles.

118. Temporal changes in the elasmobranch community in Bulls Bay, South Carolina

Alison L. Gaffney[1], Bryan Frazier[2], and Gorka Sancho[1]
(1) Department of Biology
(2) South Carolina Department of Natural Resources

Long-term sampling data was used to quantify temporal changes in the population of sharks residing in Bulls Bay, South Carolina. As a known nursery area for a variety of species, females come to give birth to their young, often during spring and summer months. The present study examines temporal changes in shark population in Bulls Bay over a 20-year sampling period. Increases were seen in overall catch per set per year, as well as in diversity, while species richness had no change and taxonomic distinctness decreased. Most of these changes were driven mainly by population shifts in the six most abundant species in the region: Atlantic sharpnose, bonnethead, scalloped hammerhead, blacktip, finetooth, and sandbar sharks. The abundance of sharks in Bulls Bay has increased over the past 20 years, and diversity is also increasing, however longer time series will be required to clarify the exact nature of these shifts.

119. The distribution of larval fishes within a south Pacific marine protected area

Alison L. Gaffney, Department of Biology and Sea Education Association

Larval fish distributions were measured across the Phoenix Islands Protected Area (PIPA) and compared with other environmental factors to look for potential influencers. Larval fishes are a key component in an ocean ecosystem, providing the basis of the new generation of fishes. Larval distributions are believed to be influenced by current patterns, as they cannot swim against the current in early life stages, and zooplankton density, as their main food source. This paper explores how these three factors—larval fish distribution, zooplankton density and currents—interact and affect the distribution of larval fishes. Distributions showed a potential correlation between current patterns and larval distributions, as well as between zooplankton and larval distributions. Currents appear to be the underlying driver in these two distributions. These results provide insight into the interaction of physical and biological systems within PIPA, as well as documents these distributions for the first time.

120. Optical Properties of Zinc Oxide Nanoparticles

Miranda Roesing, Jeffrey L. Wragg, and Narayanan Kuthirummal, Department of Physics and Astronomy

The optical properties of zinc oxide nanoparticles (ZnO NPs) annealed in different environments were investigated. Pristine ZnO NPs and ZnO NPs annealed in hydrogen, oxygen, and argon were examined. With the use of photoacoustic spectroscopy, UV-Vis absorbance spectroscopy, and scanning electron microscopy, information about band gap energies, morphologies, and absorbance wavelengths were found for the ZnO NPs. Band gap energies ranging from 3.28 to 3.31 ± 0.03 eV were found using photoacoustic spectroscopy. Steepness parameter calculations from the photoacoustic spectra indicated a higher crystalline structure quality for pristine ZnO NPs than the annealed samples. SEM images revealed similar morphologies for each of the ZnO NP samples from a 50 micrometer scale. UV-Vis absorbance spectra showed that each ZnO NP sample absorbs light from 350 - 380 nm and is a strong scatterer at other wavelengths.

121. PolyPy: A Tool for Randomly Generating Code for CS Education

Best of Computer Science

Austin Hunt and Ayman Hajja, Department of Computer Science

Recently, new teaching methodologies have been adopted in the realm of computing education, one of which is the use of interactive web platforms to increase students' engagement. These online tools enable students to practice course material and receive real-time feedback about their learning progress. It would be difficult, however, to manually create a comprehensive set of practice questions that adequately covers the complex nature of computer programming. Our project, "PolyPy", streamlines the process of generating Python code challenges by enabling instructors to create question templates with *randomizable* elements. The site then uses the template to generate numerous Python questions, along with their corresponding answers in real-time as students practice their coding skills on the site. Finally, the web-platform compares students' answers with the site-generated answers and provides them with feedback accordingly.

122. The Effects of Signal-to-Noise on Gamma-Ray Burst Pulse Structure

Drew Ayers and Jon Hakkila, Department of Physics and Astronomy

Gamma-ray bursts (GRBs) are the universe's most energetic radiative phenomenon. GRBs are associated with beamed supernovae and with neutron star-neutron star collisions. The emission of both types of events is primarily in the form of pulses, and the complex structures found in GRB pulse light curves contain clues to understanding the physics that produces them. We demonstrate, using GRBs observed by the Burst and Transient Source Experiment (BATSE) on NASA's Compton Gamma Ray Observatory (CGRO), that non-monotonic pulse structure decreases as signal-to-noise (S/N) decreases. We demonstrate that this is a probable instrumental bias.

123. 230 Ma-180 Ma Rotation of the Yucatan Microplate Based on Magnetic Data

Hannah Hartley[1], Erin K. Beutel[1], and Irina Y. Filina[2]
(1) Department of Geology
(2) University of Nebraska-Lincoln Department of Earth and Atmospheric Sciences

Between 230 Ma and 180 Ma the Yucatan microplate separated from North America, forming the Gulf of Mexico. While this is a widely accepted event, the interpretation of mechanisms and movement varies and doesn't account for deformation in Florida. We focus on understanding the rotation and motion of the Yucatan through the reconciliation of reconstructed euler pole rotations and magnetic data from the Gulf of Mexico area. We used the program Gplates to combine recently derived magnetic and gravity data with previously established models and compared the results. Based on magnetic data we found that the Yucatan microplate was likely originally positioned adjacent to Florida, and rotated counterclockwise to its present position against Mexico. Further investigation into these issues will lead into the next phase of our project, examining the effect of the rotation of the Yucatan on the South Georgia Rift.

124. Acousto-Optic Bragg Imaging with Schlerien imaging

Alem Teklu, and Gunther Martin, Department of Physics and Astronomy

I constructed an Acousto-Optic Bragg imaging system in the Solid State lab of the Department of Physics and Astronomy. Our main objective was to construct an inexpensive imaging system and be able to image a biological object using ultrasound. For this purpose, we constructed a 7 MHz square transducer using a 3D printer available at the College that saved us hundreds of dollars. The propagation of a high frequency wave and metal objects were successfully imaged using this newly constructed system. The next step is to image a biological object such as a leaf. Image processing techniques were utilized to enhance the images obtained. The schlieren photographic technique was also used to study the interaction between an ultrasound beam and laser light.

125. Myxospore Density of Myxozoan Pparasite *Kudoa inornata* in Spotted Seatrout Relative to Sex, Age, and Length

Waverley-Ann Mendoza-Walthall, I. de Buron, and E. McElroy, Department of Biology

Kudoa inornata is a myxozoan parasite with myxospores that infect the spotted seatrout, *Cynoscion nebulosus*s keletal muscle. The older the fish, the more often they are infected. Based on this evidence, we predicted that myxospore density increased as fish grew and aged. Three muscle biopsies were collected from 74 seatrout and homogenized. A subsample of each homogenate was weighed and trypsinized at 37^{o}C to release the myxospores, which were counted using a hemocytometer. The mean density of myxospores per gram of muscle was inferred. Data were analyzed according to fish length and age using a Wilcoxon test. The longer the females, the lower the myxospore density. Myxospore density was significantly higher in females age 1 than females age 2 and 3 and males of all ages. Results did not support our hypothesis; more data must be collected to further our understanding of the impact of this parasite on seatrouts.

126. Restoring Long Branch Creek through Stormwater Infrastructure

Allison Estes[1], Jessica Palazzolo[2], Lance Wactor[2], Timothy Callahan[2], and Joshua Robinson[3]

(1) Geology and Environmental Geosciences
(2) Graduate Program in Environmental Studies
(3) Robinson Design Engineers

Long Branch Creek is west of the Ashley River in Charleston, SC. Development in the Charleston area has affected watershed function and decreased flood resiliency. The system has low perceived value due to poor access, water quality impairments, and flooding. We developed stormwater management strategies with the goal of making this a place for benefit to the community.

We assessed the baseline watershed hydrology and estimated potential benefits of restoration such as reducing stream channelization. We studied low impact development measures such as pocket wetlands to help retain stormwater runoff, and also improve increase the green space of the creek. We propose outreach programs to educate community members on local actions to reduce stormwater impacts. We also plan to involve community members in vegetation restoration actions. Our goal is to make Long Branch Creek a much safer and more manageable waterway for the communities of West Ashley to enjoy.