SCAS ABSTRACTS
(Listed alphabetically by presenter’s last name)

DEVELOPING A DNA TRANSPONSON-BASED VECTOR TO EXPRESS ANTI-HIV GENES
Brittney Adams and William Jackson, PhD
University of South Carolina Aiken

Human immunodeficiency virus (HIV) is a retrovirus that infects CD4+ T lymphocytes, and progressively degrades the immune system. Thus far, there are antiviral drugs being used to reduce viral replication; however, there are no treatments that are curative. Gene therapy studies are being conducted as a new possible treatment for HIV. Most of these studies use retroviral vectors to deliver anti-HIV reagents, but the combination of a transposon-based vector with anti-HIV reagents could provide a long-term transgene expression without compromising biosafety. The HIV genome expresses nine proteins, one of the regulatory proteins, Tat (trans-activator of transcription) is responsible for up regulation of viral transcription and is therefore vital for replication. In this project, Tat will be targeted for degradation using RNA interference. Transposons, or transposable elements, are DNA sequences that can change position within a genome via a transposase. For this project, Sleeping Beauty (SB) was selected as a DNA based-transposable system to deliver anti-HIV small-interfering RNAs (siRNAs). The SB transposon has been modified to express two selectable markers, neomycin phosphotransferase and enhanced Green Fluorescent protein from an internal CMV promoter. In addition, a siRNA targeted to HIV Tat at nucleotides 5892-5991 of the HIV-1LN4-3 subtype (Accession #M19921) was cloned under the control of the RNA Polymerase III H1 promoter. Currently a control siRNA plasmid is being designed and cloned. This design will allow for co-transfection of cells to measure the potential inhibition of HIV replication by using a DNA based vector containing a siRNA.

MATHEMATICAL MIND: INSIDE ARTIFICIAL INTELLIGENCE
Wesley Alexander
Morris College

This summer we have been working on coding a NAO robot in ‘Python’ to perform three different autonomous tasks: design of winning strategies to games, design on human-like behavior motion planning for obstacle avoidance, and vision recognition applied to music sheets to identify and play songs. These three tasks are a clear exponent on how basic mathematics helps achieve very complex feats in artificial intelligence. The design of strategies to win at games is done by generalizing root-finding techniques in Calculus. The analysis of the different strategies is performed with techniques of statistics. Motion planning is carried within the field of computational geometry, while the design of smooth paths is merely an application of interpolation. Finally, the project related to vision recognition is done under the scope of image processing and analysis, which is in a set of basic application of multivariate Calculus. This resulted in a game winning, music reading, and obstacle-avoiding body of artificial intelligence. The main focus of this research is the process of designing those strategies so that the NAO robot could efficiently beat its opponents.

GENETIC MAPPING OF ARABIDOPSIS MUTANTS INVOLVED IN TRANSLATIONAL REGULATION OF MIRNAS
Amber Bailey, Ingrid Bonilla, and Charlotte Song
Charleston Southern University

MicroRNAs (miRNAs) have been a fairly recent discovery in the scientific world. These small RNAs have been found to be important as post-transcriptional regulators of gene expression. Through either cleavage or translational repression, miRNAs regulate specific genes. In plants, these miRNAs play important roles in development, stress response, and protein degradation, to name a few. To test whether these miRNAs can act through translational regulation, we have engineered artificial miRNAs to Chalcone synthase (CHS) that act through translational repression in the plant Arabidopsis thaliana. Through the creation of loops, we can prevent cleavage and shift to translational regulation. We performed EMS mutagenesis and screened these mutants for suppression. These identified mutants will be further mapped and characterized.

ZINC IS THE MOLECULAR “SWITCH” THAT CONTROLS THE CATALYTIC CYCLE OF BACTERIAL LEUCYL-TRNA SYNTHETASE
Layla Baykal and Dr. Rachel Whitaker
Coastal Carolina University

The Escherichia coli (E. coli) leucyl-tRNA synthetase (LeuRS) enzyme is part of the aminoacyl-tRNA synthetase (aaRS) family. LeuRS is an essential enzyme that relies on specialized domains to facilitate the aminoacylation reaction. Herein, we have biochemically characterized a specialized zinc-binding domain (ZN-1). We demonstrate that the ZN-1 domain plays a central role in the catalytic cycle of E. coli LeuRS. The ZN-1 domain, when associated with Zn2+, assumes a rigid architecture that is stabilized by thiol groups from the residues C159, C176 and C179. When LeuRS is in the aminoacylation complex, these cysteine residues form an equilaterial planar triangular configuration with Zn2+, but when LeuRS transitions to the editing conformation, this geometric configuration breaks down. By generating a homology model of LeuRS while in the editing conformation, we conclude that structural changes within the ZN-1 domain play a central role in LeuRS’s catalytic
cycle. Additionally, we have biochemically shown that C159, C176 and C179 coordinate Zn2+ and that this interaction is essential for leucylation to occur, but is not essential for deacylation. Furthermore, calculated Kd values indicate that the wild-type enzyme binds Zn2+ to a greater extent than any of the mutant LeuRSs. Lastly, we have shown through secondary structural analysis of our LeuRS enzymes that Zn2+ is an architectural cornerstone of the ZN-1 domain and that without its geometric coordination the domain collapses. We believe that future research on the ZN-1 domain may reveal a possible Zn2+ dependent translocation mechanism for charged tRNALeu.

A NEW HYBRID METHOD FOR SOLVING OSCILLATORY INITIAL VALUE PROBLEMS.
Jenny Beebe and Dr. Fidele Ngwane
USC Salkehatchie

A continuous hybrid method using trigonometric basis with an off-stop point is developed and used to construct a new method by using collocation and interpolation techniques. The new method is implemented in block form. Numerical examples are presented and the efficiency and accuracy of the new method are discussed.

APPLICATION OF THE VIBRATIONAL SPECTROSCOPY FOR MONITORING THE ENZYMATIC HYDROLYSIS OF SOY HULL
Rashshana Blackwood and Dr. Uruthira Kalapathy
Clafin University

Soy hull is a biodegradable waste that can be used to produce glucose which can be fermented to produce ethanol. An enzymatic treatment with suitable pre-treatments to disrupt the structure of the soy hull is examined. Raman spectroscopy was used to monitor the glucose production by enzymatic hydrolysis of the soy hull. Glucose, fructose and sucrose show very similar Raman spectra with characteristic vibration between 1000- 1200 cm-1. Raman spectral data showed significant changes in peak intensities for concentrations between 0.2 M and 2M of fructose and sucrose solutions. In the case of glucose, changes in peak intensities did not reflect the changes in concentrations, probability due to intermolecular interaction and hydrogen bonding that may play a significant role in the vibrational spectra of glucose. However, Raman spectral data clearly showed the progress of the enzymatic hydrolysis of soy hull. Cellulases from Aspergillus niger and Trichoderma reesei were used for the enzymatic hydrolysis of soy hull and the reactions were monitored for 5 days using peak intensity of characteristic vibration. At the experimental conditions used, there was no significant sugar production observed until 3rd day of hydrolysis. Maximum concentration of sugar observed on 4th day with a decrease in concentration thereafter. This decrease may be result of concomitant fermentation in the medium at later days of the experiment. This study shows that Raman Spectroscopy can be used to monitor cellulolysis hydrolysis of waste products such as soy hull.

IDENTIFICATION OF THE CIONA INTESTINALIS FO XO DNA BINDING DOMAIN AND TARGET GENE SEQUENCES
Lucas Boncorrado and Dr. Heather Evans-Anderson
Winthrop University

Ciona intestinalis is a useful model for studies examining heart development. The cardiac gene program is highly conserved across chordates, including C. intestinalis. FoxO1 is a highly conserved gene as well as an important transcription factor that regulates myocardial development. Previous in vitro experiments in our lab have characterized the interaction between the forkhead DNA binding domain of FoxO from C. intestinalis and target sequences of complementary Human and Drosophila melanogaster DNA. These studies confirmed that the C. intestinalis FoxO DNA Binding Domain (DBD) is able to bind to target sequences from other organisms. Our next step is to determine which regions of the genome FoxO binds to in C. intestinalis. This will help to identify which genes are targeted and regulated by FoxO in C. intestinalis, which will help us to understand the function of FoxO during heart development. We will utilize Chromatin Immunoprecipitation (ChIP)-Seq assay to identify sequences of the Ciona intestinalis genome that FoxO binds to as well as the potential target genes. A hexahistidine-tagged FoxO DBD sequence was inserted into a pCes vector containing a H2B-cherry fluorescent tag to produce an expression plasmid (FoxO DBD-H). Once confirmed by sequencing, the FoxO DBD-H expression plasmids were electroporated into Ciona intestinalis embryos prior to the first cell cleavage. The ultimate goal of this project is to generate transgenic Ciona intestinalis embryos that express the FoxO DBD-H sequence so that it will interact with chromatin in vivo. The resulting embryos will be collected and their chromatin isolated in order to perform a ChIP-Seq assay that will identify the FoxO1 target DNA sequences.

The project described was supported by NIH Grant Number P20 RR-16461 from the National Center for Research Resources for support of the program entitled “South Carolina IDeA Networks of Biomedical Research Excellence” (SC-INBRE); NIH Grant Number 1R15HL104587-01 (HJEA) form the National Heart, Lung, and Blood Institute and SC Experimental Program to Stimulate Competitive Research and Institutional Development Awards (EPSCoR/IDeA) Science Affiliate Network grant (HJEA and NG).
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CR 6+ RESISTANCE OF BACTERIAL WASTEWATER ISOLATES
Shatresa Bradley and Dr. Randall Harris
Claihn University

Bioremediation is the treatment of pollutants and waste by the use of microorganisms that break down the undesirable substances. Chromium is used in industries such as metallurgical (alloy, and steel), chemical (pigments and tanning) and refractory (chrome and chrome magnetite) industries. Chromium has two main oxidation states, Cr (III) and more carcinogenic Cr (VI). Cr (VI) is mainly used for its anti-corrosive properties. Influent is the raw material that enters the plant through the collection system. Sludge is the growth of microorganism to break down suspended solids. The purpose of this research is to isolate and characterize bacterial isolates from wastewater environmental samples and determine if the bacterial isolates are resistant to Cr (VI). Influent and sludge samples were collected from a local wastewater treatment facility, serially diluted and plated onto brain heart infusion agar. After two days of incubation, the unique bacterial colonies were re-streaked. Of the eight sludge isolates, S14 were resistant to at least 200 ppm of Cr (VI) using a plate assay. Of the six influent isolates I4 were resistant to at least 100 ppm of Cr (VI). Growth of three sludge isolates (S3, S11, and S14) in liquid culture reveal that S3, S11, and S14 grew in 50 ppm, 25 ppm, and 200 ppm of Cr (VI), respectively. Future experiments are to test the isolates for Cr (VI) reduction.

USING A SUITE OF ANTIBODIES TO EXAMINE THE HOST-PARASITE RELATIONSHIPS IN HEAD KIDNEYS OF FUNDULUS HETEROCLOITUS FROM NORTH INLET
Caitlin Brickley and Marlee B. Marsh
Columbia College

Fish innate immune responses can be evaluated as indicators of immune function and status following exposure to pathogens, biological response modifiers, immunotoxicants, and nutritional regimes. We have developed several monoclonal antibodies used to recognize immune responses in several species of fish, including Fundulus heteroclitus. Immunohistochemistry was performed on head kidney tissue. Antibodies used included probes against lysozyme (neutrophils and macrophages), eosinophilic granular cells (possible mammalian eosinophil homolog), and Cox-2 (various cells during inflammation). We hope to discover direct role(s), if there are any, of innate immune cells in fish immune responses to parasites. Data collection is still in progress and will be completed by March.
In this study a bioacoustics monitoring system was used to collect data on the bat populations of Florence County. Wildlife Acoustics Echo Meter Touch provides spectrograms of bat calls and auto identification. Bat populations were monitored between the months of May to March. A route was selected that sampled a variety of areas including ponds, open fields, neighborhoods, and city streets. The route was driven every two weeks to record bat populations. For the Pee Dee region, the Echo Meter Touch auto identifies nine species of bats. Based on the bat calls recorded eight of the nine species were collected. The most commonly detected species were Tadarida brasiliensis (Mexican free-tailed) and Nycticeius humeralis (Evening bat). The numbers of recordings collected in the study were higher in the summer and fall compared to the winter. This data will provide a baseline for a long term bat monitoring project.

**EXPRESSION OF HEART-SPECIFIC CONSTRUCTS IN CIONA INTESTINALIS EMBRYOS**

Katlyn Brumley and Dr. Heather Evans-Anderson

Winthrop University

Ciona intestinalis is a useful animal model system for studying developmental processes. It is particularly helpful in studies of heart development since many of the developmental steps and genes are conserved in C. intestinalis. This system replicates early heart development in other chordates, such as vertebrates. In addition to evolutionary conservation of genes and developmental features, there are many advantages to using this model system including rapid development and simple maintenance. Our main focus is the process of myocardial growth in Ciona. In order to monitor the growth of the heart during development, we have constructed an expression vector using a fluorescently-labeled, heart-specific gene (BC030863/Micalce, transcript model ci0100139114 from the ANISEED database). Previous studies have shown that development of Ciona embryos is altered if the PI3K/AKT signaling pathway is disrupted. Ciona embryos treated with PI3Kor AKT-specific inhibitory drugs at the larval stage just prior to metamorphosis and heart formation have a reduced heart size and delayed development. We will quantitatively assess heart growth using the reporter plasmid we constructed that contains a heart-specific promoter to generate fluorescently labeled hearts in juveniles. In addition, we also have obtained similar reporter constructs from the C. intestinalis transgenic line resource (CITRES, Japan). The requested plasmids, pMiGtNgI and pMiGtNIGCiprmG, are specifically expressed in muscle cells, including the heart. Electroporation of these plasmids is currently underway.

The project described was supported by NIH Grant Number P20 RR-16461 from the National Center for Research Resources for support of the program entitled “South Carolina IDeA Networks of Biomedical Research Excellence” (SC-INBRE) and NIH Grant Number 1R15HL104587-01 from the National Heart, Lung, and Blood Institute.

**OPTIMIZING GERMINAL TRANSPOSITION OF MPING IN ARABIDOPSIS THALIANA**

Courtney Burckhalter and C. Nathan Hancock

University of South Carolina Aiken

Transposable elements (TE) are repetitive sequences that are able to move throughout the genome. Some types of TEs, including mPing from rice, are mobilized by a cut and paste mechanism catalyzed by transposase and ORF1 proteins. The overall goal of our research is to develop mPing into an efficient mutagen for gene discovery in plants. To be effective, mPing must produce heritable insertions that disrupt gene function. Previous studies have shown that mPing preferentially inserts near genes and can cause mutant phenotypes in plants. The objective of this project is to test novel mPing mutagenesis constructs to determine if they increase the germlinal mPing transposition rate in plants.

A chimeric ORF1 (ORF1S-C1) made by combining the Pong and Ping ORF1 and adding a strong nuclear import signal was shown to drastically increase transposition of mPing in yeast. Our hypothesis is that using the ORF1S-C1 protein will increase the transposition rate and the number of germlinal transposition events in A. thaliana. Constructs with the RPS5A promoter driving either Pong ORF1 or ORF1S-C1 and the GmUbi promoter driving Pong TPase LA were transformed into Arabidopsis using the floral dip method. mPing transposition in the T1 generation was monitored by the use of a GFP reporter construct. The ORF1S-C1 constructs produced a higher percentage of plants with sectors of GFP expression, indicating that this altered protein also has higher transposition in plants. The T2 generation of this population is being analyzed to determine the germlinal transposition rate. When complete, this research should provide more information about how to optimize using mPing as a mutagenesis tool.

**EVALUATING MPING TRANSPOSITION IN MIMULUS LEWISII**

Autumn Busbee and C. Nathan Hancock

University of South Carolina Aiken

A variety of techniques are used to expand what is known about plant genomes and the genes that control important traits. Mutagenesis has historically been a useful technique used for the modification and identification of plant genes. Transposable elements, which are small pieces of DNA that are able to move within a genome, can be used for mutagenesis in a technique called transposon tagging. When a transposon is inserted in a gene, it can disrupt gene function, often resulting in a detectable phenotype. mPing is a transposable element that was discovered in rice and is mobilized by the Open Reading Frame 1 (ORF 1) and Transposase (TPase) proteins. mPing has been shown to transpose and induce mutations in rice and
soybean. Due to the success of mPing in rice and soybean, we sought to determine if mPing would mobilize within the genome of Mimulus lewisi, an up and coming model organism due to its phenotypic plasticity. M. lewisi plants were transformed with two separate constructs, one with a mPing-GFP reporter and the other encoding ORF 1 and TPase. These lines were then crossed and the F2 progeny was analyzed for the presence of ORF 1, TPase, and the mPing-GFP reporter using PCR. The inheritance of the two constructs and whether or not mPing was mobilized was analyzed.

SEARCHING FOR EMISSION EPISODE SELF CONSISTENCY IN GAMMA-RAY BURST LIGHT CURVES

Thomas Cannon and Jon Hakkila
College of Charleston

Using light curves of gamma-ray bursts (GRBs) detected by the Burst And Transient Source Experiment on NASA’s Compton Gamma Ray Observatory, we introduce a new method of self-consistent GRB categorization. We compile a table of ‘similarity distances’ measuring the degree of correlation between any two GRB light curves. We then apply automated data mining tools such as Self-Organizing Maps and decision trees to sort like-GRBs into groups according to their similarity distances. The results give us an additional method for classifying GRB light curves.

DEVELOPING MPING-BASED ACTIVATION TAGS

Tiana Chandler and Dr. C. Nathan Hancock
University of South Carolina Aiken

Transposable elements (TEs), also known as “jumping genes,” are DNA sequences that move from one location on the genome to another. A TE discovered in rice, mPing, has been shown to transpose at high rates, creating mutations and generating genome diversity. mPing is being used for plant genome mutagenesis and gene discovery. This element has been shown to jump into regions just upstream and downstream of genes. This insertion preference is optimal for activation tagging, where an insertional sequence that contains promoter elements can cause transcriptional activation of nearby genes. Activation tagging is a powerful gain-of-function approach to reveal the functions of genes because overexpression of genes can reveal their function. Our goal has been to modify mPing into an activation tag by adding enhancer elements from strong promoters. We made a number of mPing-based activation tags and tested their transposition rates in yeast transposition assays. These experiments showed that inserting various enhancer sequences into mPing causes a major decrease in the transposition rate. This is probably due to the increase in TE size and inhibition of transposition complex formation. This negative effect can be countered by using a hyperactive version of mPing recently discovered in the lab.

DETERMINATION OF BPA IN ENVIRONMENTAL SAMPLES

Adrian Coates and Adrienne Oxley
Columbia College

Bisphenol A, commonly known as BPA, is a plasticizer that is used to manufacture common, everyday items, such as water bottles, canned food and drinks, and baby bottles. It is typically used as a monomer in order to produce polycarbonate plastics and epoxy resins which are used in the manufacturing of food storage containers. At increased temperatures, BPA has been found to leach into foods and drinks stored in these containers. There are also large amounts of BPA found in water sources and soils as the result of environmental pollution. This project will explore BPA in environmental samples, fish in particular, through the use of fluorescence spectroscopy.

SUSTAINING THE SOUTH: THE MOVEMENT OF URBAN CENTERS TOWARDS SUSTAINABLE DEVELOPMENT

W. Hayden Couvillion and Dr. Jessica Vogt
Furman University

Abstract: By 2050, 85% of OECD populations will be living in cities. In the Southeastern U.S, urban areas are projected to grow 160% by 2060, forming a “megalopolis” that stretches 400 miles across Georgia and both Carolinas. Simultaneously urban cores in mid-small sized metropolitan areas are being 'regenerated.' A term of European origin, urban regeneration seeks to improve the economic, physical, social, and environmental form of an area. Once declining city centers now contribute to communities through increased services and tax revenues. The new urban core is the product of a movement to regenerate existing infrastructure through individual regeneration projects. Often, these regeneration projects, and more largely the urban centers in which they reside, are declared sustainable. However, there is little consensus on what ‘sustainable urban development’ (as exemplified by these regeneration projects) actually means. In this poster sustainability is defined as economic, ecological, and social systems that meet the needs of current generations without compromising the ability of future generation to meet their own needs. Using Greenville, SC, Chattanooga, TN, Wilmington, NC, and Birmingham, AL as case studies, this poster depicts both the successes and difficulties of urban regeneration projects and how they are moving their respective urban centers towards economic, ecological, and social sustainability.
Multiple cationic biocides are routinely incorporated into multipurpose contact lens solution (MPS) to inhibit microbial growth. The most widely used cationic additives are polydisperse, complicating their analysis using conventional HPLC with UV detection. This study provides a novel method by which to analyze the biocide polyhexamethylene biguanide (PHMB) using Ultra Performance Liquid Chromatography (UPLC) with UV detection and electrospray Quadrupole Time-of-Flight Mass Spectrometry (QTOF-MS). The resulting UPLC methods developed were found to provide sensitive and reproducible measurements at sub-ppm concentrations with UV detection when authentic MPS samples were prepared via weak cation-exchange solid phase extraction (> 92% recovery) and analyzed via the method of standard additions (R² > 0.95). Further, mass analysis of the eluting UPLC peaks has provided mass identification of multiple structures from the PHMB polymer, with oligomers ranging in size from 1 – 6 units. Additionally, studies involving the uptake of PHMB and alexidine dihydrochloride have been performed with a range of lens materials. Contact lenses immersed in stock biocide solutions in conventional contact lens cases for varying amounts of time (i.e., up to 96 hours) were analyzed by UPLC to ascertain the remaining biocide concentration. The results demonstrate substantial uptake of these biocide materials by the contact lens, corresponding in a significantly reduced concentration of biocide in the lens cases. Elucidation of the molecular weight distribution of PHMB via dialysis is also explored.

CHARACTERIZATION AND UPTAKE STUDIES FOR THE BIOCIDES POLYHEXAMETHYLENE BIGUANIDE AND ALEXIDINE WITH EMPHASIS ON CONTACT LENS SOLUTION
Hazel Davis and John Wheeler
Furman University

Recent years have found an increasing growth in the number of antibiotic-resistant bacteria. A new avenue of study has developed to meet the need for the characterization and investigation of biocidal compounds with a broad range of use in personal care and medicinal applications. Among these substances are the polycationic biocides polyhexamethylene biguanide (PHMB) and alexidine dihydrochloride, which are often found in commercial multi-purpose solutions (MPS) for the care of contact lenses. Whereas alexidine displays a single cationic structure, PHMB has recently been characterized as a complex, polydisperse structure. Through ultra-performance liquid chromatography (UPLC) as well as the method of standard additions, techniques have been developed to analyze and quantitate both alexidine and PHMB, including partial resolution of PHMB’s polydisperse mixture. ES(+)- Spectrometry (MS) has also been used to characterize the elution components of PHMB, and we have additionally initiated uptake studies for both biocides in order to elucidate the adsorption and absorption isotherms associated with these compounds in contact lenses.

OPTIMIZATION OF THE RETROVIRAL VECTOR, PLGN, FOR DELIVERY OF ANTI-TAT SIRNAS FOR INHIBITION OF HIV REPLICATION
Jennifer Deily and Dr. William H. Jackson
University of South Carolina Aiken

Human Immunodeficiency Virus (HIV) is a retrovirus characterized by the infection and loss of CD4+ T lymphocytes, which are normally responsible for mounting effective immune responses. A significant loss of CD4+ T lymphocytes, combined with one or more defined opportunistic infections, leads to the Acquired Immunodeficiency Syndrome (AIDS). The aim of our lab is to inhibit HIV replication by taking advantage of the post transcriptional gene silencing pathway, RNA interference (RNAi). To target HIV mRNAs for degradation, we have designed a number of anti-HIV siRNAs to specific genes in the HIV genome that are essential for HIV replication, in particular the trans-activator of transcription (Tat), which is crucial for transcription. We hypothesize that by targeting Tat using RNAi, HIV transcription, and subsequently HIV replication will be inhibited. In order to test these siRNAs for their effectiveness at inhibiting Tat, each was endogenously expressed in cells using a retroviral vector. The siRNAs were initially tested using the retroviral vector, pSuper.Retro.neo-eGFP, and siRNA5892 was shown to be promising at inhibiting Tat; however, because this retroviral vector is inefficient at generating recombinant retroviral particles, the goal of this project is to investigate the use of new retroviruses to deliver siRNAs. p1744 is a self-inactivating retroviral vector that has been shown to efficiently generate recombinant retroviral particles; however, p1744 lacks some important features such as the H1 promoter and Green Fluorescent Protein (eGFP), which we find useful as an indicator of retroviral gene delivery. p1744 will be optimized by replacing the β-galactosidase reporter with eGFP and inserting the RNA Pol III H1 promoter creating vector pLGN. This optimization will result in the ability to observe live cells that express this vector using eGFP, and to express our siRNAs from the H1 promoter.
RELATIONSHIPS BETWEEN LOCATION OF BRAIN INJURY OR CONCUSSION AND RECUPERATION TIME IN NFL FOOTBALL PLAYERS
Brianna Dyar, Brandon Johnson, David Prager and Diana Ivankovic
Anderson University

Concussions have recently become a hot topic in media concerning collision sports like professional football: where a single concussion can end a healthy career. However the lack of information surrounding sports concussions makes it difficult for athletes to know how soon they can expect to return to a competition after a concise incident. In order to construct a reasonable model for recovery, we analyzed data from the PBS series Frontline that has catalogued the number of weeks missed by players after sustaining a concussion during the National Football League's 2013-2014 seasons. After analyzing each hit to the head, we constructed a statistical model using the One-Way Anova method to show how concussing specific regions of the brain directly influences the length of the recovery period. We analyzed the variance between brain injuries and recuperation time to show how damage to certain regions of the brain are more likely to carry lengthy recovery periods in terms of a player’s overall missed games after a concussive incident.

RESISTANCE AND REDUCTION POTENTIAL OF Serratia marcescens in Hexavalent Chromium
Ijoma Ekpenuma
Clafin University

Heavy metal pollution due to legacy waste from the Cold War nuclear proliferation remains a huge problem at federal and industrial sites. Microbial bioremediation is a cost effective method for removing heavy metals from soil and groundwater. The purpose of this study was to characterize the growth pattern of a Serratia marcescens strain 93-1399-1 in the presence of the heavy metal hexavalent chromium (Cr [VI]) and its ability to convert Cr (VI) to the less toxic Cr (III). When S. marcescens was grown on LB agar with increasing concentrations of Cr (VI) as potassium dichromate, the bacteria survived at all concentrations tested up to 200 ppm. Growth curves of S. marcescens in Cr (VI) showed that the bacteria exposed to 25 ppm grew in similarly to bacteria without Cr (VI), had reduced exponential growth at 50 and 100 ppm and poor growth in 200 ppm after 24 hours. Plate count assays showed that the 65% of the bacteria survived in 25 ppm of Cr (VI) but only 5% survived at 50 ppm. In preliminary chromium reduction assays, S. marcescens was grown for 24 hours in 25 ppm of Cr (VI), S. marcescens reduced 60% of the Cr (VI) to Cr (III) as compared to 4% reduction in broth alone. These data suggest that the S. marcescens strain may be useful in bioremediating Cr (VI) at contaminated sites. Future studies will focus on identifying the genes responsible for Cr (VI) reduction.

AN INVESTIGATION OF THE ANTI-PROLIFERATIVE EFFECTS OF ELLAGIC ACID ON HUMAN MESOTHELIOMA CELLS
Devan Fisher, Diana Ivankovic, and Donna Weinbrenner
Anderson University

Punica granatum, better known as pomegranate, contains several interesting phytochemicals that have shown anti-proliferative effects in various cancer cell lines. This particular fruit contains a multitude of constituents including ellagic acid, ellagitannins, punicic acid, flavonoids, anthocyanins, estrogenic flavonoids, and flavones. In this experiment, the ellagic acid derived from pomegranate was applied in different concentrations ranging from 0.25mg/mL to 10mg/mL to the mesothelioma cancer cell line and tested for effects via MTS assay, Trypan Blue exclusion, and Live/Dead count.

DIRECT IMAGING OF CONCENTRATION-INDUCED FLUCTUATIONS IN NANOCOLLOIDS
Lincoln Fraley and Dr. Ana Oprisan
College of Charleston

Nanocolloids are ideal systems for investigating both spatial and temporal processes using optical methods since they have particle sizes larger than the characteristic size of atomic or molecular systems. We performed direct imaging experiments in order to investigate the concentration-driven non-equilibrium fluctuations. Our direct imaging experimental setup involved a glass cell filled with colloidal suspension and water with the concentration gradient oriented against the gravitational field and a superluminescent diode (SLD) as the light source. Nonequilibrium concentration-driven fluctuations in silver nanocolloidal suspensions with a range of particle sizes and at different concentrations were recorded using direct imaging technique. We used a dynamic structure factor algorithm for image processing in order to compute the structure factor and to find the power law exponents and the correlation time of these fluctuations. The investigation of time evolution of concentration induced fluctuations allowed us to evaluate the dynamics of critical wave number.

IDENTIFICATION OF CHROMIUM RESISTANCE GENES
Jessica A. Fuller and Randall Harris, PhD
Claflin University

Hexavalent chromium pollution is steadily increasing with continuing industrial practices. Consequently, Chromium (VI) has been considered as one of the major environmental contaminants of soil and groundwater at industrial waste sites. Because of the toxic effects of hexavalent chromium to human health and the environment, remediation strategies are imperative in order to reduce chromium (VI) into a less harmful form. Pseudomonas species have been recognized as an efficient chromate
reducer under both aerobic and anaerobic conditions. The goal of this research was to generate chromium sensitive mutants in P. fluorescens Pf-5, examine them for chromium reduction capabilities, and identify the genes that are responsible for reducing Cr (VI) to Cr (III). Initial growth curve studies showed the optimal working concentration of R2Cr2O7 was 50 ppm. Pf-5 was conjugated with Escherichia coli BW20767 (pMiniHimarRB1) and mutants were generated using transposon mutagenesis. Ex-conjugates were plated on Luria Bertani medium with kanamycin and mutants were replica plated to identify chromium sensitive bacteria. Approximately 50,000 mutants were screened and three potential chromium sensitive mutants were identified. Possible methods to enhance mutant generation of chromium sensitive bacteria are currently being explored. Further analysis is being done to identify the genes responsible for chromium reduction.

IMMOBILIZATION OF POLYDIACETYLENE SENSORS ONTO CELLULOSE
Sara J. Garbowsk, Sailey A. Reamer, Sarah C. Hill, and William T. Pennington
Department of Chemistry, Clemson University

Polydiacetylenes (PDAs) are conjugated polymers with interesting optical properties. PDAs exhibit a chromatic response to a variety of chemical, biological and environmental stimuli. In order to develop cheap and effective sensors for food safety applications, we have coated cellulose-based media (cotton fibers and paper) with 10,12-pentacosadiynoic acid (PCDA) and derivatives. The characterization, properties, and potential applications of these sensors will be reported and discussed.

ASSESSING Cr(III) COMPLEXES AS POTENTIAL ANTICANCER AGENTS USING PCR, CAPILLARY GEL ELECTROPHORESIS AND GEL ELECTROPHORESIS
Yasmin Alvarez García and John Wheeler
Furman University

Transition metal complexes that establish interactions with DNA are being extensively studied for their potential as photodynamic therapy photosensitizers with increased selectivity over traditional chemotherapeutics. For years, our lab has been focused on Cr(III) diimine complexes as alternatives to current anticancer therapeutic drugs (e.g., cisplatin) that are highly toxic and unselective. [Cr(diiimine)]3+ complexes were chosen because of their high excited state oxidizing power and their long excited state lifetimes. Previous research in our lab has demonstrated that excitation of Cr complexes in the presence of DNA results in emission quenching accompanied by DNA cleavage. Polycrylamide gel electrophoresis (PAGE) and Capillary Gel Electrophoresis (CGE) is used to analyze the movement of DNA after treatment with Cr compounds in order to understand the binding mechanisms that ultimately achieve DNA damage. Polymerase chain reaction (PCR) and subsequent analysis by Agarose gel electrophoresis and Microcapillary Gel Electrophoresis (CGE) is utilized in order to study the effects that Cr(III) compounds have on the systematic replication of DNA.

PRECISE REPAIR OF MPING EXCISION SITES IS FACILITATED BY TARGET SITE DUPLICATION DERIVED MICROHOMOLOGY
David Gilbert and C. Nathan Hancock
University of South Carolina Aiken

DNA transposons are sequences that excise and re-insert into the genome, facilitated by transposase proteins. Some transposons, including miniature inverted transposable elements (MITEs), do not encode transposase proteins, but are mobilized in trans. In plants, these MITEs reach very high copy number and influence genome evolution. MITE insertion produces identical target site duplications (TSDs) flanking the element. Stowaway and Tourist MITE families differ in their alteration of the genome following excision. Stowaway-like MITEs (Mariner elements) leave short sequences from the end of the element at the excision site, while Tourist-like MITEs (Pif/Pong/Harbinger elements) usually excise precisely. Our goal is to determine what differences in the transposition mechanisms of these two classes of elements lead to this difference in genome alteration. We tested this by altering the TSDs of the Stowaway-like MITE 14T32-T7, and the Tourist-like MITE mPing in two different yeast strains, one of which is unable to perform non-homologous end joining. From these experiments, we conclude that mPing excises precisely due to microhomology created as a result of staggered cleavage of the TSDs. In contrast, 14T32-T7 transposase cleaves within the terminal inverted repeat sequences, leaving no microhomology.

SURFACE MODIFICATION VIA DIACETYLENE ALCOHOL SAM FORMATION
Maria S. Gonzalez and Laura Wright
Furman University

This research investigated the use of long chain alcohols in altering specific surfaces. High grade muscovite mica sheets were modified using various concentrations of 10,12-octadecadiyn-1-ol to form self-assembled monolayers. Due to the diacetylene linkage, molecules on the surface has improved layer formation and could be photo-cross linked via short wave UV exposure. These SAMs were monitored and imaged via Atomic Force Microscopy. Optimal concentrations and UV exposure times were determined. Changes in contact angle between plain mica, surface modified mica, and photo-cross linked mica samples were observed. A luminescent ruthenium(II) complex was synthesized and intercalated into the samples. Photo-polymerization promoted molecular immobilization. These samples were then imaged via fluorescence microscopy to ensure ruthenium intercalation and immobilization.
REVERSIBLE THERMOCHROMISM IN POLYDIACETYLENES
Garret I. Gotthelf, Sarah C. Hill, and William T. Pennington
Department of Chemistry, Clemson University

Polydiacetylenes (PDA) in the form of ordered assemblies such as single crystals, coatings, or liposomes exhibit a chromatic response to a variety of chemical, biological and environmental stimuli. A dramatic blue to red color change is accompanied by an on/off quenching mechanism and dramatic changes in Raman spectroscopic signature peaks, making PDAs a unique and effective sensing system. In most cases the change in color and other associated properties is irreversible. During the course of optimizing the adherence of 10,12-pentacosadiynoic acid (PCDA) onto cellulose-based media, we discovered a new reversible form of PCDA. The preparation and properties of this new material will be discussed.

BRAIN-PENETRATING HISTONE DEACETYLASE INHIBITOR RG2833 REDUCES THE GROWTH AND VIABILITY OF MALIGNANT MELANOMA CELLS IN VITRO
Lauren Green and Dr. Matthew Stern
Winthrop University

Histone deacetylases (HDACs) play an important role in the epigenetic control of gene expression in both normal and cancer cells. Previous studies have demonstrated that pharmaceutical inhibition of HDACs can kill and/or suppress the growth of cancer cells. RG2833 is a brain-penetrating HDAC inhibitor that targets specific HDACs known to be active in cancer cells. Melanoma cells have previously been shown to respond to HDAC inhibitors that are structurally similar to RG2833. Thus, we hypothesized that the inhibition of HDAC activity by RG2833 would result in the reduced growth and/or death of cells from the malignant melanoma cell lines SK-MEL-5 and SK-MEL-28. To test our hypothesis, we exposed SK-MEL-5 and SKMEL-28 cells to increasing concentrations of RG2833. We found that concentrations of RG2833 that effectively inhibited HDAC activity also resulted in reduced melanoma cell growth and viability. These results demonstrate the effectiveness of RG2833 in reducing the growth and viability of malignant melanoma cells in vitro and warrant further investigation of the potential therapeutic use of RG2833 and related compounds in the battle against cancer.

SPECIFICITY OF KLEPTOPLASTY IN SOUTH CAROLINA MARSH FORAMINIFERA
Cobi Guilbeau and Megan Cevasco
Coastal Carolina University

The phenomenon of kleptoplasty in which the plastids of algal prey are sequestered by predators/hosts and are kept functional (photosynthetically active) for an extended period of time (weeks/months), is examined in foraminiferal taxa collected from tidal lagoons habitats along the SC coast. The identities of both hosts and the sequestered plastids are determined using both sequence and microscopic data to address the overall specificity of the kleptoplastic condition in foraminifera of coastal South Carolina.
The presentation investigates Augmented Happy Functions of Higher Powers, defined as

$$T_{[c,q]} \left( \sum_{i=1}^{n} 10^{a_i} \right) = c + \sum_{i=1}^{n} a_i^q$$

with $a \in \mathbb{Z}$ and $c, q \in \mathbb{Z}^+$. This function takes the digits of a positive integer, raises each digit to the power $q$, sums the results, and adds a constant, $c$, to the sum. In particular, the iterative properties of this function are investigated for a range of values of $c$ and $q$.

**Biophysical Parameters that Determine RNA-Metal Complex Formation**

Mariah Harden and Dr. Rachel Whitaker
Coastal Carolina University

Ribonucleic acids (RNA) are known to primarily interact with Mg$^{2+}$ when assuming higher-ordered tertiary configurations. Structurally, when tRNA molecules interact with Mg$^{2+}$, they consistently form a tRNA isotype-specific “L-shape” conformation each time they are synthesized. The tRNA’s L-shape conformation is assumed only in the presence of Mg$^{2+}$. Therefore, we hypothesized that if Mg$^{2+}$ can induce tertiary structure formation, then binding to alternative cations could potentially produce alternative tertiary structural conformations. By utilizing circular dichroism and mobility gel-shift assays we have observed that tRNA structure can be dramatically altered when in the presence of different cationic species. We further validated the formation of these aberrant structural configurations by aminoacylating these tRNA structural anomalies with their native enzyme. From these biochemical tests, we found that the aminoacyl-tRNA synthetase could not recognize numerous altered tRNA structures. Thus, we have confirmed that severe structural changes do occur when tRNA forms complexes with different cations. Lastly, we have observed through the determination of kon and koff rates that tRNA can associate/dissociate from different cations to varying degrees, thus forming cation-specific complexes at unique rates. From the data that has been gathered thus far, we conclude that the tRNA molecule can chelate numerous cations in solution and that it could possibly be used to remove heavy metals from aqueous solution when tethered to a solid support system.

**Effects of Ganoderma lucidum Extracts on the Viability of Cancerous vs. Non-Cancerous Breast Cancer Cell Lines**

Brooke Harrison and Neval Erturk
Converse College

Ganoderma lucidum (reishi) is a fungal supplement known for its therapeutic properties. In this project, we investigated the effects of ethanol and water extracts of reishi on the viability of cancerous and non-cancerous breast epithelial cell lines. We report that water and ethanol crude extracts of reishi reduce cell viability in breast epithelial cells in a dose dependent manner. The reduction on the viability of reishi treated non-cancerous cells is significantly lower than the reduction observed on cancerous cells. Therefore we conclude that reishi might have a specific effect on the viability of cancerous cells. In our laboratory we use the freshly prepared reishi extracts for each treatment. Recent reports that use refrigerated reishi extracts have been published. Using refrigerated reishi will reduce the experiment time for two hours per treatment day. In this project we also compared the effects of fresh versus refrigerated reishi on cell viability. We observed that both water and ethanol extracts of refrigerated reishi lose their effect on cell viability after a week of storing for the water extracts and after two weeks storing for the ethanol extracts. This shows the reishi compound that causes reduction on viability is not stable in solution even when refrigerated. The compound in the ethanol extracts seemed to be stable for a longer period of time since the effect on viability stayed similar to fresh extracts for 2 weeks. We recommend the use of fresh reishi extracts. Further research investigating mechanisms of reishi on cancerous cells is underway.

Acknowledgements: This research was funded by South Carolina IDeA Networks of Biomedical Research Excellence (SC-INBRE). National Institutes of Health 2P20 RR016461, 2010-2015.

**Soybean Isoflavone Effects Against Cervical Carcinoma**

Kristen Hawkins, Michael Hart, Diana Ivankovic, and Donna Weinbrenner
Anderson University

Current treatments of cervical cancer include surgery, radiation, and chemotherapy and can be deleterious to the patient. Cervical cancer prevention is warranted. Soybeans have low methionine and high arginine content, which is known to inhibit tumor development. Effects of the phytochemical isoflavone from soybeans were tested on cervical carcinoma cells using the MTS, Trypan Blue exclusion, and Live/Dead analysis. Extract concentrations of 1 mg/mL to 100mg/mL extract were tested. The minimum inhibitory concentration was determined using an alpha of 0.05 (p=0.517) comparing, 10mg/mL of extract in medium to 10mg/mL extract in medium with 1 x 10^5 cells/mL killed the cervical cancer cells at 48 hours of exposure. Ellagic
acid from pomegranate was also tested from 0.25mg/mL to 20 mg/mL against the cervical carcinoma cell line. Using an alpha of 0.05, 18mg/mL killed the cervical carcinoma (p=0.438) comparing to the 10mg/mL extract in medium alone. Thus, soybean isoflavone and pomegranate ellagic acid may serve as cancer treatments with less deleterious effects to the patient.

INHIBITORY EFFECT OF PARTIAL DECOUPLING AGENTS AS AN ALTERNATIVE THERAPY FOR CANCER  
Kareem Heslop and Dr. Omar Bagasra  
Claflin University

Cancer therapies are generally non-specific for cancer cells and affect cells in the body, resulting in severe side effects. We are working on an alternate method to prevent and treat cancer. Hypothesis: All replicating cells require energy in the forms of ATP and raw material to reproduce. Cancer in a human body generally is the most energy consuming foci; therefore, it will be logical to down regulate the highest energy output pathways that do not harm the human being treated for a cancer. Two of the most prevalent cancers are adenocarcinomas of prostate and breast. We hypothesized that if we treat cancer cells to a partial electron transport inhibitor that results in reduction in total ATP output it may significantly reduce cancer cell proliferation without interfering with normal functioning of other physiologic and immune functions. We chose Amygdalin (D-mandelonitrile-gentiobioside) which is found in seeds of prunasin family, plants such as peaches, apricots, almonds, apples, and other rosaceous plants and have been used as a traditional alternative medicine for treating terminal cancers and other illnesses. We evaluated the optimal dose that can inhibit various breast and prostate cancer cell lines as well two stem cell lines derived from neuroblastomas. We determined that cancer cell line and stem cell line proliferation rates were significantly inhibited by 0.9 µL concentration of amygdalin. This level of Amygdalin can be achieved by consuming 4-6 bitter almond and 2-3 apricot seeds daily. In addition, we observed that Amygdalin induced apoptosis in prostate and breast cancer cell lines.

INVESTIGATING DARK MATTER COMPOSITION THROUGH DECAYS INTO FLAVOR CONSERVING TAU PAIRS  
William Hester and Dr. Gardner Marshall  
College of Charleston

In this project the program Pythia is used to simulate the decay of scalar, weakly-interacting, massive, dark matter particles into flavor conserved tau pairs. Data on the neutrino energy distribution from these decays is taken and compared to data gathered from the IceCube experiment in Antarctica. This information is used to place bounds on what the lifetime of a dark matter particle can be, narrowing our scope for future investigations.

THE BODY PROJECT 4 ALL: A COMPARISON OF A FEMALE-ONLY TO A CO-ED BODY IMAGE PROMOTION PROGRAM  
Amanda Hock and Dr. Kerstin Blomquist  
Furman University

UNDERSTANDING THE RELATION BETWEEN VACUOLAR PROTEIN SORTING GENES AND AFLATOXIN EXPORT IN ASPERGILLUS PARASITICUS  
Shaquille Jackson  
Morris College

Filamentous fungi in the genus Aspergillus produce a variety of natural products, including aflatoxin, the most potent naturally occurring carcinogen known. Aflatoxin biosynthesis, one of the most highly characterized secondary metabolic pathways, offers a model system to study secondary metabolism in eukaryotes. This study focused on the molecular mechanisms responsible for secondary metabolite export and fate. Thirty-Eight (38) vacuolar protein-sorting (VPS) genes were acquired from the fully characterized genome of Aspergillus flavus, a close relative to Aspergillus parasiticus, with a high genetic homology. This study was designed to understand the genetic regulation of vacuolar protein-sorting genes associated with aflatoxin export. In this work, we were able to see trends of expressed genes in each of the three variables tested: time period (24hr, 48hr, and 72hr), media (Yeast Extract Sucrose and Yeast Extract Peptone), and genetic composition (Afs10).

USING THE CRISPR/CAS9 SYSTEM TO UNDERSTAND THE FUNCTION OF THE PHF21A COMPLEX IN DANIO RERIO CRANIOFACIAL DEVELOPMENT  
Khadijah Jihad and Dr. April DeLaurier  
University of South Carolina Aiken

The purpose of this study is to understand the basis of craniofacial defects associated with Potocki-Shaffer, a genetic disorder that also results in mental retardation and delayed development. The goal is to make novel zebrafish mutants for the kdm1a, zymm2 and zymm3 genes to understand their function singularly and working together with PHF21A during craniofacial development. Previous research has indicated that defects in these genes underlie Potocki-Shaffer syndrome and craniofacial abnormalities. PHF21A encodes for a plant finger protein and its expression seems consistent with the function of craniofacial development.
and neurofacial development. Constructs for targeted mutagenesis of kdm1a, zymy2 and zymy3 will be generated using the CRISPR-Cas system. CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a system that first evolved in bacteria as a defense mechanism to silence foreign viruses and plasmids, and can now be used as a tool for targeted mutagenesis in vertebrates. The CRISPR system involves making guide RNA (gRNA) to target specific genes and co-injecting gRNA constructs along with Caspase (Cas9) mRNA into 1-cell stage embryos, where gRNA binds to the gene, recruiting Cas9, which induces permanent double-strand breaks in DNA. gRNA constructs targeting zebrafish kdm1a, zymy2, and zymy3 genes have been generated, and will be injected into 1-cell stage embryos. Prospective mutants will be raised to adulthood, outcrossed, and F2 mutant larvae will be screened for phenotypes. Ultimately, the goal is to understand the singular and combined requirements for these proteins in regulating downstream expression of genes required for craniofacial development.

DETERMINING THE PRESENCE OF THE ARYL HYDROCARBON RECEPTOR (AhR) IN FUNDULUS HETEROCLITUS LIVER TISSUES FROM THE BELLE BARUCH MAR
Jasmin Jones and Marlee B. Marsh
Columbia College

Fish innate immune responses are routinely evaluated as indicators of immune function and immunotoxictants. Fundulus heteroclitus, an estuarine fish commonly used as a model in immunotoxicological studies, were collected from the North Inlet of Belle Baruch Marine Sanctuary in Georgetown, SC. In order to analyze the fish, an antibody specific for the Aryl hydrocarbon receptor (AhR) will be used as a biomarker. Biomarkers of exposure reflect the presence of toxic compounds in the environment and the value of each biomarker depends on its specificity, sensitivity, simplicity, and stability (Arrellano-Aguilar et al., 2009). In this leg of a longer scientific project, I will be examining Ah receptors (AhRs) and their presence in fish who are found in a marine sanctuary to provide baseline data. Ah receptors are cytoplasmic proteins that bind certain aryl hydrocarbons, translocate to the nucleus, and activate transcription of particular DNA segments. AhRs are identified by their high-affinity for binding to several carcinogenic or teratogenic environmental chemicals. It has been suggested in a previous experiment that AhRs, and especially AhR2, may be recurring targets for selection during local adaptation of fish to dioxin-like aromatic hydrocarbon contaminants, although the specific molecular changes may vary among independently adapting populations or species (Reitzel et al., 2014). Later studies in the project will examine fish from contaminated sites and compare to our data. The samples of the Fundulus heteroclitus are currently being processed with all experimentation expected to be completed by early March.

A COMPREHENSIVE SURVEY AND COMPARISON OF BREEDING HABITATS FOR THE PINE BARRENS TREEFROG (HYLA ANDERSONII) AT CAROLINA SANDHILLS NATIONAL WILDLIFE REFUGE
Gregory T. Joye1, Eran S. Kilpatrick2, Nancy Jordan3, and Will Dillman4
1University of South Carolina Columbia, Department of Civil and Environmental Engineering; 2University of South Carolina Salkehatchie, Division of Mathematics and Science; 3Carolina Sandhills National Wildlife Refuge; 4South Carolina Department of Natural Resources

Hylyla andersonii (Pine Barrens Treefrog), a state-listed species with significant conservation status, was first surveyed at Carolina Sandhills National Wildlife Refuge from 1975 to 1982. A span of thirty years passed before the next comprehensive survey, which detected fewer H. andersonii in actively managed habitats compared to habitats within a gas line right-of-way. Monitoring continued in 2013 to further explore H. andersonii occurrence at right-of-way sites and to document the associated anuran community. From May 30 - August 15, 2014 two gas line right-of-way sites, two non right-of-way sites, and two sites where H. andersonii occurred historically were surveyed using Song Meter digital recorders. H. andersonii was detected 347 times with the majority of detections (69%) occurring at right-of-way sites and 27% of detections occurring at non right-of-way sites. Acris gryllus (Southern Cricket Frog), Hyla femoralis (Pinewoods Treefrog), Lithobates catesbeianus (Bullfrog), Lithobates clamitans (Green Frog), and Lithobates virgatipes (Carpenter Frog) were detected most often with H. andersonii. The trend for H. andersonii to be detected more frequently, and produce more active choruses in right-of-way sites could be attributed to vegetation structure, associated anuran assemblage, and watershed properties. The gas line right-of-ways, which are not actively managed for H. andersonii, are serving as productive surrogate habitats and source populations for this species on the refuge. Habitat measurements will take place in 2015 and an analysis of these variables, in combination with H. andersonii call data, will help guide future management decisions for this important species in South Carolina.

THE EFFECTS OF STRESS, SUGAR AND EXERCISE ON DEPRESSION AND HIPPOCAMPAL NEUROGENESIS IN RATS
Austin Kaiser and Michelle Vieyra
University of South Carolina Aiken

Major Depressive Disorder (MDD) is one of the most common mental illnesses in the United States, having a lifetime risk of approximately 17%. Only 1/5 of Americans perform an adequate amount of exercise and they eat a diet that has 400% of daily sugar requirements, on average. This study sought to test the efficacy of exercise as a treatment for depressive symptomatology in the context of a high-sugar diet and chronic stress, which mimics the average Western lifestyle, using Sprague-Dawley rats as an animal model. Twenty-one rats were subjected to the chronic-mild stress (CMS) model of animal depression, and placed into four groups that were treated with different combinations of exercise and high-sugar diet for a period of eight weeks. The rats were subjected to behavioral testing of depression before the CMS model, after the CMS model,
and after the eight week trial period to measure depressive symptomatology. The rats were then sacrificed and blood and brain samples were taken. Total brain weight was measured and the hippocampus was removed from each subject for neural density histology. Raw data appear to suggest that exercise groups performed better on behavioral testing, regardless of diet treatment. This would suggest that exercise can be used as a treatment for depression without requiring the patient to undergo a complete lifestyle change, and that this could be a safe, low-cost alternative to therapies and pharmaceuticals currently used to combat MDD.

SOUTH CAROLINA PLEISTOCENE TERRESTRIAL VERTEBRATE DIVERSITY
Adam Kirtley, Dakota Pruitt, and Joseph Shillinglaw
Charleston Southern University

The published Pleistocene terrestrial vertebrate fauna of South Carolina includes mammals, reptiles, and birds. A faunal list based on Sanders (2002), Roth and Laerm (1980), Bentley and Knight (1998), Chandler and Bentley (2007), and Chandler and Knight (2009) was compiled and compared with published faunas from Virginia (Eshelman and Grady, 1986; Holman, 1986) and Florida (Hurlbert, 2001). The faunas were compared for general body size and biogeography. The South Carolina fauna has fewer localities, a lower taxonomic diversity, and fewer taxa with a small body size than the faunas of Virginia and Florida.

MASS SPECTROMETRY ANALYSIS OF THE ANTIOXIDANT ACTIVITY OF SULFUR AND SELENIUM COMPOUNDS
Emily Kurfman and John Wheeler
Furman University

Sulfur and selenium compounds can prevent oxidative damage to DNA, proteins, and lipids; however, their mechanisms of action are not fully understood. Previous studies suggest thione- and selone-containing compounds utilize the antioxidant mechanisms of radical scavenging and metal chelation. To understand thione and selone antioxidant mechanisms when bound to hydroxyl-radical-generating iron, two Fe(II)-thione and -selone complexes have been synthesized: Fe(L)2Cl2 (L = N,N'-dimethylimidazole thione or selone). Analysis of the products of the oxidation of these complexes is currently being investigated using electrospray ionization (ESI) mass spectrometry. Preliminary results suggest formation of iron tetrachloride structures. Future research will focus on elucidating mechanisms for the oxidation reactions of these sulfur and selenium antioxidants.

DETERMINATION OF BISPHENOL S LEACHED FROM PLASTIC BOTTLES
Quentin Lane, Bettie Obi Johnson and Jill Castiglia
University of South Carolina Lancaster

Bisphenol A (BPA) has been replaced by bisphenol S (BPS) in some plastics, but both compounds have similar estrogen activity (EA). These compounds have been found to have negative health effects on vertebrates. Currently, methods such as Liquid Chromatography Mass Spectrometry (LC-MS) are used to detect low concentrations of BPS. However, LC-MS is expensive and not widely available in labs. Due to rising concerns of BPS in our food supply, a readily accessible and economical method is needed to determine low levels of BPS in solutions. In this study, Ultraviolet-Visible Spectrophotometry (UV-Vis), High Performance Liquid Chromatography (HPLC), and pre-concentration by Solid Phase Extraction (SPE) were evaluated with standard solutions and plastic leachate samples. The limit of detection for BPS using UV-Vis was found to be 500 nmole/L (125ug/L). BPS levels from water microwaved in polysulfone plastic bottles for five minutes measured between 700 and 9,200 nmole/L (175-2300 ug/L). A variety of plastics have been tested using the same method, and detectable amounts of aromatic compounds with potential EA have leached from them. The compounds are currently being identified by HPLC. Future work will involve applying these test methods to a broader range of plastics.

EXPLORING RAINDROP ARRIVAL Time CORRELATIONS VIA A DROP SIZE DEPENDENT PAIR CORRELATION FUNCTION
Robert Lemasters and Dr. Michael L. Larsen
College of Charleston

There is empirical evidence that large raindrop arrival times are not perfectly random. Additionally, it has been observed that a substantial portion of smaller drops tend to be falling at superterminal velocities. The exact mechanism for these phenomena is not clear and it is uncertain whether they are related. In an effort to identify any correlation, the authors use a generalized notion of the temporal cross-correlation function for use with discrete data. This tool, which will be called the “size dependent pair correlation function” (SDPCF), is applied to data provided by a 2-dimensional video disdrometer.
SUM OF SQUARES OF LUCAS NUMBERS
Kaige Lindberg, Dr. Rigoberto Florez, and Dr. Antara Mukherjee
The Citadel

In this talk I will be talking about how I found the closed form for a finite sum of the square of two consecutive Lucas numbers. I will discuss the identities and techniques I used. I will additionally talk about the potential generalizations of this result to generalized Fibonacci numbers. The summation was an open problem in the Fibonacci Quarterly.

TOWARDS A LOW-DIMENSIONAL MODEL OF THE NEURAL NETWORK RESPONSIBLE FOR GAMMA SYNCHRONIZATION USING OPTOGENETICS
Patrick Lynn and Dr. Sorinel Oprisan
College of Charleston

Optogenetics allows optical control of neuronal activity by using genetically altered neural cells and optical tools. Briefly, optogenetics uses a photosensitive element that, upon absorption of light, produces some change in the activity of the cells. By precise spatial and temporal delivery of light pulses we can identify the local interconnections among neurons and investigate their dynamical response under different conditions.

In this study, we investigated the response of prefrontal cortical cells under a 40 Hz intermittent stimulus. We found that there are significant differences between response of neural cells in mice under systemic cocaine injection compared to control. We recorded the spiking responses of interneurons and analyzed them using nonlinear dynamics tools.

HEAVY METAL CONCENTRATION IN DONAX CLAMS FOUND IN MYRTLE BEACH ANALYZED USING ATOMIC ABSORPTION
Harley Coates, Larissa Martin, and Dr. Kevin McWilliams
Coastal Carolina University

The coquina clam, Donax variabilis, is a ubiquitous invertebrate along the eastern seaboard that, due to its placement in the food chain and intertidal habitat, makes it an ideal indicator for the health of the surrounding ecosystem. The clams, along with water and sand samples, were collected from three separate locations in Myrtle Beach, SC and analyzed for heavy metals using an atomic absorption (AA) instrument. This is a temporal study to see how the concentration changes with time. It is hypothesized that the concentrations will increase during the summer months due to increased foot and vehicle traffic from tourists.

A MULTIVARIATE APPROACH TO MEASURING ACCESSIBILITY TO HEALTHY AND AFFORDABLE FOOD IN GREENVILLE COUNTY, SC
Will McCabe, Dr. Suresh Muthukrishnan, and Dr. Alicia Powers
Furman University

Food deserts, or disadvantaged areas with low access to a variety of healthy and affordable food options, represent issues related to public health and social justice. Studies suggest that residents in deprived communities are exposed to the lowest quality in-store food options, which in turn contributes to spatial inequalities in chronic diseases. The purpose of this study is to identify areas with poor geographic access to healthy food and high social deprivation in Greenville County. Four population-weighted measures of physical accessibility to supermarkets were calculated for county block groups using road network distances. A social deprivation index was calculated using variables from the 2008-2012 American Community Survey. The Nutrition Environment Measures Survey (NEMS-S) measured the availability, price, and quality of healthy food options in 23 supermarkets. Lastly, a hierarchical cluster analysis uncovered seven classes of accessibility to supermarkets that were constructed using a k means classification procedure, mapped, and superimposed over high deprivation areas. Supermarket accessibility decreases towards the peripheral county areas where population density is the lowest. The most socially deprived populations are found in Greenville’s urban areas with an average population density of 990.4. The four measures of access reveal no systematic socioeconomic inequality in access to supermarkets, as the most socially deprived people have the highest access to supermarkets. The in-store NEMS-S measure shows that supermarkets in areas of high social deprivation carry a significantly less variety in affordable, quality healthy food options than those areas of low social deprivation. Thus, there is no injustice in access to supermarkets in Greenville County, however there is injustice in the overall class of those supermarkets. The results of this study expose the importance in evaluating multiple measures within the consumer and community nutrition environments in order to sufficiently describe the complexity of a population’s access to healthy food.
Ribonucleic acids (RNA) are known to primarily interact with Mg2+ when assuming higher-ordered tertiary configurations. Structurally, when tRNA molecules interact with Mg2+, they consistently form a tRNA isotype-specific “L-shape” conformation each time they are synthesized. The tRNA’s L-shape conformation is assumed only in the presence of Mg2+. Therefore, we hypothesized that if Mg2+ can induce tertiary structure formation, then binding to alternative cations could potentially produce alternative tertiary structural conformations. By utilizing circular dichroism and mobility gel-shift assays we have observed that tRNA structure can be dramatically altered when in the presence of different cationic species. We further validated the formation of these aberrant structural configurations by aminoacylating these tRNA structural anomalies with their native enzyme. From these biochemical tests, we found that the aminoacyl-tRNA synthetase could not recognize numerous altered tRNA structures. Thus, we have confirmed that severe structural changes do occur when tRNA forms complexes with different cations. Lastly, we have observed through the determination of kon and koff rates that tRNA can associate/dissociate from different cations to varying degrees, thus forming cation-specific complexes at unique rates. From the data that has been gathered thus far, we conclude that the tRNA molecule can chelate numerous cations in solution and that it could possibly be used to remove heavy metals from aqueous solution when tethered to a solid support system.

DEVELOPING A FUSION GENE UNDER THE CONTROL OF AN HIV-1 LTR PROMOTER  
Erin M. McLaughlin, Natalie M. Arthur and William H. Jackson, PhD.  
University of South Carolina Aiken

The Human Immunodeficiency Virus Type 1 (HIV-1) is the causative agent of AIDS (Acquired Immunodeficiency Syndrome) and acts to infect the CD4+ T-Helper subset of immune cells. The loss of these cells results in a gradual decrease in the ability to mount an immune response to pathogens and ultimately complete failure of the immune system. Although current HIV treatments may reduce viral load, they are not curative. A potential treatment method may be the artificial induction of apoptosis in cells infected with HIV-1. One of the goals of our lab is to study the use of pro-apoptotic genes to induce cell death only in the presence of the HIV regulatory genes, tat (trans-activator of transcription) and rev. In this regard, Tat functions to increase expression of viral genes through the HIV promoter, while Rev functions in exporting viral mRNAs from the nucleus to the cytoplasm. This project will use the HIV-based retroviral vector, pLRed[INS]2R, to express pro-apoptotic genes, along with a suitable reporter gene to easily detect expression. To determine proof of this concept, the enhanced Green Flourescent Protein (eGFP) and the Renilla Luciferase (LucR) genes will be expressed from the HIV-1 promoter by creating a fusion gene between the two. Expression of these genes will then be tested in the presence of HIV-1 Tat and Rev. Two different fusion genes will be generated by PCR: one will contain a nuclear localized eGFP that is designed to monitor apoptotic change in the nucleus, the other will express eGFP in the cytoplasm. If this system works as hypothesized, LucR will be replaced with a pro-apoptotic gene that should induce apoptosis only in HIV-infected cells.

THE DOSE DEPENDENT EFFECTS OF CAFFEINE ON COGNITIVE PERFORMANCE AND NEURONAL ACTIVATION  
Helen Morris and Michelle Vieyra  
University of South Carolina Aiken

People often assume that the more caffeine you drink, the more focused you can become, and students are drinking caffeinated beverages more than ever. Over-consumption of caffeine has many negative effects including bouts of nausea, gastrointestinal upset and cardiovascular issues. If there are no dose related cognitive benefits to caffeine consumption people should limit their intake and look to healthier alternatives, such as improved diet, exercise or sleep patterns. This study compared cognitive performance after consumption of 0mg, 100mg or 200mg caffeine. It also looked at whether there would be a correlation between cognitive performance and neuronal activation at these different doses. Sixty-six participants were tested in three separate trials after receiving either 0mg (placebo), 100mg or 200mg caffeine tablets. In each trial, participants performed the N-back memory test while an fNIR (functional Near-Infrared) recorded neuronal activity. Preliminary results show that scores on the N-back task improved with the consumption of 100mg of caffeine as compared to the placebo; however improvements decreased in the 200mg trial. This suggests that cognitive performance is highest with low doses of caffeine. Neuronal activation decreased over baseline in the 0mg trial on all cognitive tasks. There was an increase in neuronal activation in both caffeine trials which was greatest in the 100mg trial while performing easier tasks and the 200mg trial while performing the harder task. The results suggest that there is not a correlation between increases in neuronal activation and cognitive performance.

USING MAB M24-2 (A FISH LYSOZYME) TO EXAMINE THE HOST-PARASITE RELATIONSHIPS IN LIVERS OF THE FISH FUNDULUS HETEROCLITUS FROM NO  
Lillian Neal and Marlee B. Marsh  
Columbia College

Fish innate immune responses are routinely evaluated as indicators of immune function and status following exposure to pathogens, biological response modifiers, immunotoxins, and nutritional regimes. Recently, we developed monoclonal antibody (mAb) M24-2 that recognizes lysozyme in several species of fish (e.g. Fundulus heteroclitus) used in comparative immunological studies. Lysozyme is found in macrophages and neutrophils and is one of several humoral and cellular factors
THE ANTI-PROLIFERATIVE EFFECTS OF LAMIUM AMPLEXICAULE EXTRACTS ON HUMAN T-LYMPHOCYTES  
Braxton Noll and Diana Ivankovic, Frank Norris, Donna Weinbrenner  
Anderson University

In this experiment I tested various concentrations of Lamium amplexicaule, (commonly known as henbit dead-nettle) extract on human Jurket (T-Cell leukemia) cells. The main goal was to determine an effective extract dose that induces an apoptotic death within the cells, with the main focus on one chemical constituent of the extract, Caffeic acid Phenyl-ethyl Ester. Caffeic acid phenyl-ethyl ester has been shown to induce an apoptotic death through mitochondrial membrane potential disruption by interrupting the proton motive force, that in turn halts ATP synthase, and without any energy to the mitochondria the cytochrome c is released and signals for whole cell apoptotic death. With various concentrations of the extract the LD50 was determined to be 3 mg/mL, which half the cells in culture were killed when exposed to the extract. The methods of determination of these numbers were through various dye exclusion assays, MTS assays, and fluorescent staining.

ERRONEOUS DROP SIZING IN IMPACT DISDROMETERS  
Kate O’Dell and Dr. Michael L. Larsen  
College of Charleston

Recent studies have found small raindrops to fall at velocities exceeding their expected terminal velocity. The Joss-Waldvogel disdrometer, which utilizes pressure sensors and the terminal velocity of raindrops to determine their size, would thus produce an erroneous inferred raindrop size. The magnitude of this effect was investigated using two dimensional video disdrometers for several storms in South Carolina to infer Joss-Waldvogel-like disdrometer data. Z and R relationships were found using both the two dimensional video disdrometer data and the inferred pressure sensor disdrometer data. Differences between the resulting Z-R scatter plots and statistical fits were explored.

IDENTIFYING SEQUENCES RESPONSIBLE FOR THE HIGH TRANPOSITION RATE OF A TOURIST MITE  
Daymond Parrilla and C. Nathan Hancock  
University of South Carolina Aiken

Transposable elements are DNA sequences that have the ability to move from one location to another in the genome. These elements can be used as tools to for mutagenesis and gene discovery. The focus of this study is the transposable element mPing, a 430-bp deletion derivative of the natural occurring Ping element that exhibits high transposition activity and can reach a high copy number in rice. In comparison, mPong, an artificial deletion derivative of the natural occurring Pong element exhibits low transposition activity. The question we are trying to address is which regions of the mPong element control its transposition and allow it to be so much more active than other elements. By comparing chimeric constructs of mPing with mPong we were able to identify a region in the first half of the element (90-215bp) that could potentially promote transposition in mPing. Similarly, by screening a library of mutagenized mPing elements, we identified high and low activity mutants, each having approximately 7 base changes from the original mPing. Analysis of one of mutants that has high activity (mmPing20) suggests that the region between 260-360bp may inhibit mPing’s transposition. To analyze these regions further, we performed assays on elements in which these regions have been deleted. These constructs also provide a platform to help answer the question of what role these regions play in the transposition success of MITEs.

DIURNAL RHYTHMS OF NEAR SURFACE WINDS’ POWER SPECTRUM  
Alexis Payne and Dr. Michael L. Larsen  
College of Charleston

Our project studied near surface winds’ power spectrum and its shift through a diurnal cycle. Data was gathered using three sonic anemometers located within the atmospheric surface layer (less than 2 meters above the surface). The 1D fast Fourier transform was calculated for the data, and the data was analyzed using traditional tools, i.e. the power spectrum. Subdividing the data into pieces, the shift in wind’s statistical structure is explored. A diurnal signal is anticipated due to the total power of wind coupled to daylight. The way the structure shifts through the day is presented.
The discovery of antibiotics has drastically altered the prognosis of bacterial infections over the last century. One intriguing example is Staphylococcus aureus, which causes skin and wound infections. To prevent this infection doctors regularly prescribe antibiotics, but some strains of Staphylococcus aureus have become resistant to antibiotics and are named Methicillin-resistant Staphylococcus aureus (MRSA). In 2013, the Centers for Disease Control and Prevention classified MRSA as a serious threat, which “Requires prompt and sustained action to ensure the problem does not grow.”

The rise in antibiotic resistant bacteria has resuscitated bacteriophage research as an alternative to antibiotics. Bacteriophages are host-specific viruses that solely infect and lyse bacteria without harming the supraorganism. These microscopic viruses are naturally occurring in the human population and have the capability of genetically evolving with the bacteria, prohibiting bacterial resistance.

The purpose of this study was to collect and isolate naturally occurring bacteriophages that could be used as potential therapeutic agents. To obtain samples, human participants volunteered to be swabbed behind the ear and just inside the nostril. These swabs were then placed in a phosphate buffered solution (PBS), and subsequently filtered. Then the sample was introduced into a solution of log phase pathogenic bacteria to amplify the bacteriophages present within the sample. The presence of bacteriophages, within a sample, was determined by plaque assay. If zones of inhibition were present the sample was considered to be positive. PCR was performed on the positive samples, which allowed for further identification and characterization of the sequestered phages.

**BACTERIOPHAGES FOR ESCHERICHIA COLI AND STAPHYLOCOCCUS AUREUS PRESENT WITHIN THE STUDENT POPULATION**
Derek Pride and Paul E. Richardson
Coastal Carolina University

There is a growing medical concern regarding bacterial resistance to antibiotics. Therefore, the quest to find an alternative treatment for bacterial infections through the use of bacteriophages was undertaken. A bacteriophage (phage) is a virus that solely infects bacteria, and they are commonly found behind the ear and inside the nostrils. Coastal Carolina University students volunteered to be swabbed in these locations in attempts to sequester phages for additional study. The samples were filtered and plating techniques were performed to identify the potential presence of phages; capable of lysing *Escherichia coli* (*E. coli*) or *Staphylococcus aureus* (*S. aureus*). Once found, the phages were confirmed and classified using polymerase chain reaction (PCR) and gel electrophoresis.

**PROBING THE ENTRYWAY FOR INFECTION: AN EXAMINATION OF THE GI TRACTS OF FUNDULUS HETEROCLITUS FOR IMMUNE RESPONSES TO METACESTODE**
Mara Reiss and Marlee B. Marsh
Columbia College

Fifty Fundulus heteroclitus from the North Inlet Estuary at Hobcaw Barony in Georgetown, South Carolina, were collected and examined for parasites. The predominant parasite found were metacestodes located in abdominal mesenteries and in the livers. *F. heteroclitus* acquire this parasite through their diet, and parasites must penetrate the gastrointestinal tract to establish infection. Fish innate immune responses are routinely evaluated as indicators of immune function and status following exposure to pathogens, biological response modifiers, immunotoxicannts, and nutritional regimes. Recently, we developed two monoclonal antibodies (mAb) that are useful in identifying fish innate immune cells. mAb M24-2 recognizes lysozyme in several species of fish and has been used in comparative immunological studies. Lysozyme is found in macrophages and neutrophils and is one of several humoral and cellular factors associated with innate immunity in all vertebrates. mAb 2C11 recognizes eosinophilic granular cells in fish- a cell whose presumed function is similar to that of the mammalian eosinophil (anti-parasite). The purpose of this study is to use these antibodies to examine cellular profiles of immune cells in the gastrointestinal tract of parasite-infected and uninfected gastrointestinal tracts. The data collection is currently in progress and will conclude in early March.

**CHARACTERIZATION OF IMMOBILIZED RUTHENIUM(II) EMITTERS INTERCALATED DIACETYLENE SELF-ASSEMBLED LAYERS**
Nathan Rivers and Laura Wright
Furman University

Diacetylene (DA) self-assembled monolayers (SAMs) have the ability to allow intercalation of other compounds and become immobilized by irradiation. Because of these unique characteristics, it has a wide variety of potential uses such as biological sensors, microelectronics, or adhesives. Herein we report the synthesis and characterization of PDA self-assembled mono- and multilayers on high grade ultraflat mica using ethanol as a solvent. Characterization was done by atomic force microscopy (AFM), fluorescent microscopy, and contact angle. Optimal conditions for the formation of SAMs of 10,12-octadecadiynoic acid...
(DA) were found to be a soak time of 45 seconds in 1mM solutions. 10,12-octadecadiynamide,N-1,10phenanthrolin-5-yl (DAphen) was synthesized to use as a ligand on a ruthenium (II) complex. Using this ligand, bis(2,21-bipyridyl)(10,12-octadecadiynamide-N-1,10phenanthrolin-5-yl)ruthenium (II) hexafluorophosphate (RuDAphen) was then synthesized. RuDAphen was intercalated into the DA SAMs on mica, photopolymerized, and characterized through AFM, fluorescent microscopy, and contact angle.

A PHOTOMETRIC STUDY OF AH HERCULIS
Christopher Sherman and William Baker, David Moffet
Furman University

The objective of this study is to make an analysis of the Z-Cam type, cataclysmic variable AH Herculis (AH Her). Specifically, to add any information about the current state of the star that is lacking and to look for changes in the star system over the past fifty years with archival data from the American Association of Variable Star Observers (AAVSO). With this information we can better predict the dynamical evolution of cataclysmic variables.

CLONING AND EXPRESSION OF THE DNA BINDING DOMAIN OF FOXO FROM CIONA INTESINALIS THAT CONTAINS AN N-TERMINAL NUCLEAR LOCALIZATI
Mikala Smith and Dr. Heather Evans-Anderson
Winthrop University

FoxO proteins are a subgroup of the Forkhead family of transcription factors. FoxO proteins are highly conserved and regulate expression of genes that control a wide variety of cellular processes including: apoptosis, cell differentiation and proliferation, and atrophy. Ciona intestinalis is a useful model system to study developmental biology, particularly heart development since all chordates share a conserved cardiac gene program as well as similar cellular processes during development. Ciona FoxO (ciFoxO) protein is very similar to the FoxO1 protein in humans. In order for ciFoxO to transcriptionally regulate gene expression, it must localize to the nucleus. The major goal of this project is to add a nuclear localization signal (NLS) to an expression vector containing ciFoxO sequence that will be electroporated into Ciona embryos where it will be expressed. The N-terminal NLS will direct the exogenous ciFoxO sequence to the nucleus of cells where it will be able to bind to target DNA sequences in the Ciona genome. The ultimate goal is to express ciFoxO constructs containing a NLS in vivo and then isolate chromatin in order to perform a ChiP-Seq assay to determine ciFoxO target genes. The ciFoxO target genes will be compared to vertebrate FoxO1 target genes to determine the level of conserved function of FoxO family members in chordates during heart development. To date, we have successfully inserted the NLS into the vector and produced dechorinated embryos; electroporation optimization is under way.

The project described was supported by NIH Grant Number P20 RR-16461 from the National Center for Research Resources for support of the program entitled “South Carolina IDeA Networks of Biomedical Research Excellence” (SC-INBRE); NIH Grant Number 1R15HL104587-01(HJEA) from the National Heart, Lung, and Blood Institute and SC Experimental Program to Stimulate Competitive Research and Institutional Development Awards (EPSCoR/IDeA) Science Affiliate Network grant (HJEA and NG).

BUILDING CONSTRUCTS FOR CATHEPSIN K-MEDIATED EXPRESSION OF EGFP OR MCHERRY TO STUDY BONE RESORPTION IN THE DEVELOPING ZEBRAFISH
Brianna Snelling and April DeLaurier
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The goal of this project is to use transgenic reporter lines to study osteoclast activity in the developing zebrafish so as to better understand how the processes of bone formation (by osteoblasts) and resorption (by osteoclasts) shape the skeleton. Fluorescent reporter lines that label specific cell populations allow the study of the role of cells in tissue patterning during development. This project aims to use eGFP and mCherry as reporter genes under the control elements of cathepsin K to study osteoclast activity in the developing embryo. A construct containing regulatory elements of cathepsin K driving eGFP, along with a transposon element iTol2 has been constructed (ctsk:EGFP-iTol2), and generation of a construct containing mCherry (ctsk:mCherry-iTol2) in the place of eGFP is in progress. Once both constructs are completed, they will be microinjected into separate 1-cell stage zebrafish embryos to generate germ lines expressing EGFP or mCherry in osteoclasts. Using these osteoclast reporter lines along with lines created previously that label osteoblasts (sp7:EGFP), we will observe how osteoclasts and osteoblasts work together to shape bones during development and maintain homeostasis of bone matrix in the adult fish. Understanding how the skeleton is formed in development and maintained throughout life in zebrafish has implications for studying developmental diseases and osteoporosis in humans.
The American Crow (Corvus brachyrhynchos), also known as the “Common Crow”, is a medium-sized, stocky, black, perching bird of the Corvidae family. American Crows mainly reside in woodland, farmland, and also suburban areas. They require open spaces for feeding, scattered trees, woodlots, and forest edges must be present in order for the birds to have a safe place to nest and roost. The campus of Francis Marion University provides a sufficient habitat in which American Crows can thrive.

In this study, bioacoustic monitoring equipment was used to collect data on the population of American Crows living in the campus area from August 2013 to March 2015. A double-microphone recording unit was placed in several wooded regions across FMU’s campus for the span of three to five days at a time. Recorded files were then analyzed by using Song Scope Software where audial activity was displayed as a sound spectrogram. From this format, the distinctive “caw-caw” call of the American Crow could be easily identified and used to determine the exact hours throughout the day when the birds are most vocally active. American Crows residing in the area were most active and produced the highest number of vocalizations between the hours of 7:00am and 12:00pm. Also, seasonal changes and weather factors were discovered to have significant effects on the overall activity of this population. Furthermore, the specific types of crow calls were identified by recognizing various patterns in frequency levels and call length. Seasonal changes can account for the variation in different types of calls throughout the year.

A PRELIMINARY STUDY OF THE VASCULAR FLORA OF STRAWBERRY SWAMP, GEORGETOWN COUNTY, SOUTH CAROLINA

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The objective of this preliminary study is to investigate the vascular flora at Strawberry Swamp at Hobcaw Barony. Vouchers of vascular plant species collected at this site will be housed at the A. C. Moore herbarium at the University of South Carolina. The study was initiated in October 2014 and will be terminated around October 2016. A preliminary list of the flora includes 82 species in 70 genera within 54 families. Only two non-native taxa have been identified to date, Sapium sebiferum and Phragmites australis. Salinity, conductivity and pH of the water and soil at the site will be provided by Clemson University scientists at several sites within the swamp. Salinity at the swamp may vary according to rainfall as some years may be drier or wetter than others. We will also monitor and map the spread of Phragmites australis as this non-native taxon generally can out compete other vascular plant species. We have observed monocultures of Phragmites in portions of three of our abandoned rice field study sites and expect Phragmites may have the same impact here where it becomes established. As sea level rises this century swamp vegetation may be replaced by marsh taxa. Ultimately, salt tolerant taxa such as Spartina alterniflora may eventually colonize the site.
Adipose-derived stem cells (ADSCs) are multipotent somatic stem cells obtained from the microvasculature of adipose tissue. ADSCs cannot match the differentiation potential of pluripotent embryonic stem cells (ES cells). However, previous studies have suggested that the non-traditional method of culturing ADSCs as three-dimensional spheroids can induce the expression of factors associated with pluripotency, including the transcription factor Oct-4. We hypothesize that nontraditional, three-dimensional spheroid culturing of ADSCs can upregulate the expression of several genes associated with pluripotency as well as increase the differentiation potential of ADSCs. Here we show that murine ES cells cultured in our lab maintain expression of genes associated with the pluripotent state and known to be expressed in ES cells, thereby validating our ES cell culture conditions for future studies. We also show that ADSCs cultured under traditional two-dimensional conditions do not express markers of pluripotency. Interestingly, the expression of several genes known to be expressed in populations of somatic stem cells does vary with the level of confluence of ADSCs and is also affected by medium supplementation with murine leukemia inhibitory factor (mLIF), which is used to maintain pluripotency in cultured murine ES cells. Future work will examine the expression of the same subset of genes in ADSCs cultured as three-dimensional spheroids in the presence/absence of mLIF and murine embryonic fibroblast feeder cells.

CONFORMATIONAL ISOMERIZATION AND CHEMICAL REACTIVITY INDICES OF BUT-2-ENEDIOIC ACID: A COMPUTATIONAL STUDY
Britney Stewart and Dr. Johnson Agbo
Coastal Carolina University

The gas phase conformational isomerization of trans-butenedioic acid is studied computationally. The potential energy surface is explored using ab initio methods and the reaction pathway is studied using density functional theory (DFT) at B3LYP level of theory. The kinetic and thermodynamic properties of this reaction are calculated at the B3LYP level using the augmented correlation-consistent polarized Valence-only Double Zeta (aug-cc-pVDZ) basis set. The isomerization rate constants are determined using the Rice–Ramsperger–Kassel (RRK) theory and the transition state (TST) theory at 298 K and 1.00 atm. The HOMO – LUMO energies are used to compute the chemical reactivity indices.

TARGETED INSERTION OF THE TRANSPOSABLE ELEMENT, MPING
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Transposable elements, including mPing from rice, are mobile pieces of DNA that move throughout the genome through a cut-and-paste mechanism. mPing, is mobilized by two proteins, ORF1 and Transposase, encoded by the autonomous transposons, Ping and Pong. This element preferentially inserts in gene-rich regions and has high transposition activity, making it a great tool for disrupting genes to determine gene function. Our overall goal is to design a mechanism that would allow mPing insertion to be directed to a specific location within an organism’s genome. If mPing insertion can be targeted to specific sequences, specialized mutagenesis applications, including disruption of gene function and alteration of promoters, could be performed. The resulting mutant phenotypes could then be compared to control plants, allowing researchers a better understanding of the targeted gene’s function. Our strategy is to fuse the Transposase protein with the Cas9 D10A protein from the CRISPER/Cas9 system. Cas9 D10A is a partially disabled version of the Cas9 protein, which has a targeted endonuclease activity. The Cas9 D10A protein is guided by a gRNA that can be synthesized to correspond to any target site within the genome. To determine if targeted insertion of mPing is possible, we fused the Cas9 D10A protein to the N-terminus of the Transposase protein. The targeted sequence was the CAN1 gene that when mutated will allow yeast to grow on plates containing the toxin canavanine. We tested if expressing the Cas9 D10A Transposase fusion protein along with the ORF1 protein in the presence of mPing and the gRNA would impact the transposition rate and location of mPing insertions.

CHARACTERIZING A NEW METHOD OF HARVESTING ENERGY FROM THE NATURAL ENVIRONMENT AND EXPLORING THE PHYSICS OF THE TRIBOELECTRIC EFF
Ryan Michael Sullivan and Dr. Alem Abraha Teklu
College of Charleston

A prototype DC triboelectric generator (DC-TEG) is presently undergoing a proof of concept investigation to determine its feasibility as a new system for harvesting energy from the natural environment. The DC-TEG converts rotational motion into electrical energy through the utilization of the triboelectric effect between Nylon and PTFE in its design. Preliminary results show that the DC-TEG generates several open-circuit DC voltages. Also, the output current is measured to be directly proportional to the tangential velocity of the rotating triboelectric-wheels (TWs) and it remains constant with changes in the contact force associated with the triboelectric interface (TD). Future work will determine the time it takes to charge a capacitor, the quantitative relationships between the contact force at the TI and the tangential velocity of the TWs with the output current, and also to place constraints on the minimum distance between the triboelectric materials that yield measurable charge separation.
Molecular imaging provides unique biological information that cannot be revealed by conventional imaging. Since malignancies overexpress certain membrane receptors, probing changes in gene expression that lead to phenotypic alterations will make it possible to detect cancers earlier and with more specificity. The ultimate goal of this project was to design and develop a molecular imaging system capable of detecting the presence of multiple markers. In order to achieve this goal, a construct must be designed with an imageable probe conjugated to antibodies. This construct will bind to specific cell surface proteins (via the antibodies) and will be visualized through molecular imaging modalities. The probe of choice is the enzyme β-galactosidase (β-gal), which can be broken into discrete subunits, allowing imaging of multiple cell surface markers simultaneously. Our current studies demonstrate that we can target the β-gal to specific cells overexpressing a biomarker and that it is internalized within the cells.

**USING VOLUME FRACTION AS A STATISTICAL MEASURE OF THE RAINDROP SIZE DISTRIBUTION**

Joshua B. Teves and Professor Michael L. Larsen
College of Charleston

Using a dense optical rain gauge array near Charleston, SC, a novel measure of rain is used to categorize and analyze storm behavior. Using 14 non-overlapping raindrop size categories, the fractional contribution of each size category to overall accumulation is determined. This “accumulation contribution fraction,” fa, is calculated for a range of time-averages from one minute to one hour for each instrument in the array. Relationships between these accumulation contribution fractions are investigated.

**NMR BASED METABOLIC STUDY OF CHROMIUM(VI) TREATED PSEUDOMONAS FLUORESCENS**

Yugaananthy Thanaiah and Dr. Randall H Harris
Claflin University

Soil and groundwater contamination by heavy metals from nuclear waste and industrial waste is one of the major problems found at sites within the United States. Out of the 1699 sites on the National Priorities List from the Superfund Program administered by the Environmental Protection Agency, 1127 sites were reported to be highly contaminated with the heavy metal chromium. Even though chromium(VI) has been discovered as a strong carcinogen, chromium(III) is reported to be less toxic. Bioremediation uses microorganisms to transform hazardous contaminants into forms that are less toxic than the parent materials and is considered to be a cheap and environmental friendly method. Pseudomonas fluorescens species were reported to reduce highly toxic chromium(VI) to a less toxic chromium(III).

In this study, we use NMR based metabolomics to study the changes in metabolic pathways due to chromium stress on P.fluorescens Pf-5. P.fluorescens Pf-5 over night cultures containing 50 ppm K2Cr2O7 were incubated at 25°C with shaking (200 rpm) for 6h and 24h. At each time point, samples were collected and processed to obtain bacterial pellets. The polar metabolites were extracted from the pellets through a methanol/water two phase solvent extraction process. The polar phase was dried and dissolved in NMR buffer. The NMR samples were analyzed using Bruker 700 MHz NMR. The results were statistically analyzed using Principal Component Analysis (PCA). Distinct metabolic profile separation was observed between each sample group (6h control versus 6h chromium stressed, 24h control versus 24h chromium stressed). Among all combinations, the metabolic profile separation observed in control samples at 24 h and chromium stressed samples at 24 h was most prominent. The metabolic profile separation observed in PCA suggests that the chromium stress could have induced a change in the metabolic pathway of P.fluorescens Pf-5. Currently, further research is being conducted to analyze and identify potential critical metabolic pathways responsible for chromium resistance in P.fluorescens Pf-5 that can serve as a possible biomarker of chromium resistance.

**THE EFFECTS OF CHRONIC STRESS, EXERCISE AND SUGAR CONSUMPTION ON BODY WEIGHT AND FAT PERCENTAGE IN RATS**

Christina Thomas and Michelle Vieyra
University of South Carolina Aiken

The objective of this study was to examine body weight and fat percentage in rats depending on three variables: exercise, sugar intake, and chronic stress. Previous studies have shown a relationship between obesity and each of these variables but not in combination. Twenty one female Sprague-Dawley rats were exposed to a four week period of chronic stress prior to a six week period of sugar/exercise treatments. Stressors included alterations to light cycles, moist bedding, predator sounds, and cage switching. At the initiation of the study baseline data was collected including results of behavioral tests of stress and urinary cortisol levels. Baseline tests were completed again at the end of the chronic stress period and at the conclusion of the study. The rats were divided into four groups receiving either 1) 10% sugar solution and exercise 2) 10% sugar solution and no exercise 3) exercise without sugar 4) no sugar or exercise (control). At the conclusion of the study, the rats were sacrificed and fat was collected from the body wall and genitals. The average body weight and fat percentage was calculated for each group. Results of this study suggest that even when allowed to exercise, rats that consumed sugar had approximately four times higher body fat percentage than those that did not. In previous work by this lab, rats that consumed sugar and...
exercised had significantly less fat than those that ate sugar alone. The chronic stress may have overridden some of the benefits of exercise in this study.

THE EFFECT OF DIETARY PHYTOESTROGEN ON THE ESTROUS CYCLE OF WISTAR RATS
Reshma Thomas, Nichole Tackett, and Edna Steele
Department of Biology, Chemistry and Physics, Converse College

Over the past few decades, there has been a steady decline in the age of menarche. This decline can be correlated with an increase in obesity and other health issues. There is a belief that this shift parallels with an increased consumption of high levels of dietary phytoestrogen, a common endocrine disrupting chemical present in the environment. Phytoestrogens are plant-derived chemicals that mimic the action of estrogen and could have an effect in the physiology and development of animals and humans. To study the effect of dietary phytoestrogen on the onset and characteristic of estrous cycle, vaginal secretions of 30 prepubescent (21-day old) Wistar rats were examined over the course of 3 months. The rats were randomly assigned into one of three groups: experimental, negative control, and positive control. The experimental group was fed a soy-based isoflavone-enriched diet while both control groups were fed an isoflavone-free diet. The positive control group received estradiol injections and the rest received placebo injections. All three groups started their estrous cycles within a few days of one another illustrating menarche was not linked to a change in the estrogen levels in the body. No definite inconsistencies within the cycles were visible throughout the course of the experiment. The level of phytoestrogen in the rat diet may not be high enough to produce an estrogenic effect on the rats. However, the weight was noticeably higher in rats with increased levels of estrogen.

DESIGN AND TESTING OF A RAINDROP VELOCIMETER
Derek Tuck and Dr. Michael L. Larsen
College of Charleston

Using affordable laser diodes and photodetecting transducers, a simple instrument was constructed. This instrument is designed to be capable of measuring raindrop arrival times at two locations with known vertical offset. Acquired data includes the fall speeds of large raindrops with the ultimate goal of identifying and analyzing drops falling slower than their terminal velocities. Here we present results from the early calibration and testing phases of the instrument prototyping process.

SYNERGISTIC EFFECT BETWEEN CAFFEINE AND SUGAR ON COGNITIVE PERFORMANCE
Sandra Urquiza and Michelle Vieyra
University of South Carolina Aiken

Many studies confirm that, working independently, both caffeine and sugar provide benefits to attention and memory. However, there is sparse literature on the synergistic effects of caffeine and sugar on improved cognitive performance when taken together. In this study, we explored the dynamics between caffeine and sugar when consumed under ordinary conditions – as a cup of coffee. 25 undergraduate students (16 women, 9 men) were asked to refrain from consuming caffeinated products for 12 hours and to fast 4 hours prior to the study. At the start of the session, participants completed a baseline cognitive test and one of the three variables was given at random in the form of a cup of coffee: decaffeinated with sugar (to assess performance after consuming only sugar), caffeinated with no sugar (to assess performance after consuming only caffeine), and caffeinated with sugar (to assess synergistic effects on cognitive performance between caffeine and sugar). The remaining two variables were administered over the next two sessions. After each variable, participants completed the same cognitive test, and results were compared within subjects and between subjects to assess effects on short-term memory and cognitive performance. Our hypothesis was that there would be a significant improvement on short-term memory by way of correct responses and shorter response times in the sessions where caffeine and sugar were consumed simultaneously vis-à-vis the caffeine or sugar independently. With the results of this study, we hope to elucidate the most effective way to consume this ubiquitous drink.

IDENTIFYING THE GENE UNDERLYING A JAW MUTATION IN ZEBRAFISH
Kayce Vanpelt and April DeLaurier
University of South Carolina Aiken

A line of mutant zebrafish discovered in a forward genetics screen was determined to have defects of jaw cartilage including fusions, and abnormal shaping of elements. Previous research has narrowed the location of the mutation to be between 29.1 Mb and 30.9 Mb on chromosome 19. Several genes within the aforementioned frame have already been sequenced, but none of the gene sequences have shown significant differences from the wild type (non mutant) zebrafish sequences. Further sequencing has been performed by designing primers to amplify candidate genes, and those results are being analyzed for possible mutations. If data analysis shows nearly identical sequences between mutant and wild type zebrafish, a reverse genetics approach will be taken by employing the CRISPR/Cas9 system as a mutagenesis tool. This study has the potential to reveal an entirely new gene or gene pathway involved in skeletal joint formation that could be applied to human disease research.
External stimuli, such as presynaptic inputs, reset the phase of neural oscillators. The phase resetting curve (PRC) determines the advance or delay of an action potential based on the strength and timing of the presynaptic stimulus. Since neural oscillators are nonlinear systems, the neural response to a set of external stimuli is not the sum of responses to an individual stimulus. We developed a systematic and consistent mathematical approach to predicting the phase resetting induced by multiple stimuli that arrive during the same activity cycle of a neural oscillator. Our approach is independent of oscillator’s biophysical details and generalizes the single-stimulus PRC.

OPTIMIZING IN VITRO FERTILIZATION PROCEDURES IN ZEBRAFISH

Madelyn Wasden
University of South Carolina Aiken

There are currently over 20,000 mutant and transgenic zebrafish lines used to study genetics, toxicology, human medicine, and so much more. Due to constraints on space and resources, not all lines can be maintained as adult fish, so sperm is frozen and lines are retrieved by in vitro fertilization (IVF). By not having an in vitro process that yields consistently successful fertilization, many of these lines are at risk. I aim to increase the success and consistency of the in vitro protocol, specifically the sperm freezing and thawing process, for our lab so that we may be able to continue Dr. DeLaurier’s invaluable work and research with zebrafish. I will begin by applying principles of cryobiology to the protocol as well as errors in gamete handling and pooling. After identifying problem areas in the protocol that are affecting fertilization, I will begin isolating each method and testing it for success. By process and elimination I hope to narrow down the various elements and steps of the sperm freezing and thawing process that are crucial to egg fertilization. Once I have established a protocol that has proved successful, Dr. DeLaurier and future lab members will have a standardized system by which to further these mutant and transgenic lines.

SIRNA-MEDIATED DOWNREGULATION OF AN ESSENTIAL HIV REGULATORY PROTEIN

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The Human Immunodeficiency Virus (HIV) is a retrovirus that infects CD4+ T lymphocytes causing progressive destruction of the immune system and its functions. Eight to ten years after initial infection, if treatment is not available, HIV infection results in the Acquired Immunodeficiency Syndrome (AIDS). Because current treatment options are not curative, it is necessary for further investigations into ways to combat HIV. Recently, there have been a number of studies concentrating on the use of small double-stranded RNA molecules, particularly short-interfering RNAs (siRNAs), to silence viral genes through RNA interference (RNAi). RNAi is an innate pathway that results in post-transcriptional gene silencing which is initiated by siRNAs and is facilitated by the RNA-induced silencing complex (RISC). A major focus in our lab is to take advantage of this pathway to target a HIV gene that encodes an essential regulatory protein known as tat. The presence of tat is not only required to up-regulate viral transcription, but is also crucial for successful HIV replication. Our lab has designed four siRNAs that each targets a specific site within the HIV tat gene. These anti-HIV tat siRNAs were subsequently converted to double-stranded DNA and cloned into a vector under the control of the RNA polymerase III H1 promoter. Preliminary results suggest these anti-HIV tat siRNAs are successfully downregulating the target gene. Currently, our research is focusing on optimizing the delivery of the anti-HIV tat siRNAs and measuring their activities through multiple assays.

INVESTIGATION OF AHR ANTAGONISTIC EFFECTS OF GANODERMA LUCIDUM

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The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor. It regulates the responses of the cell to a variety of polyaromatic hydrocarbons (PAH). AhR mediated toxicity to these chemicals is associated with a variety of pathological conditions, including cancer. Therefore AhR modulation currently is studied as an important physiological process. Ganoderma lucidum (reishi) is a popular fungal supplement used to prevent and treat a variety of illnesses including cancer. Here we report antagonist effects of the reishi water extract on AhR activation. Real-time RT-PCR was used to measure CYP1A1 gene expression in MCF-7 cells treated with the supplements and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD). Cells treated with TCDD alone showed an increase in expression of CYP1A1. This suggests that Ganoderma contains compounds that are AhR antagonists. Further research by using fractioned reishi extract will be conducted in order to isolate and identify the compound(s) that acts as an AhR antagonist.

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Nanoparticles (NPs) are being rapidly incorporated into a wide variety of commercial products (Alvarez et al., 2009), which increases their potential for environmental release. Silver (Ag) NPs are widely used for their antibacterial properties causing an increased risk and hazard to the environment, thus, causing toxicity to biota (Fabrega et al., 2011). There is debate over whether toxicity is due to dissolution of the Ag NPs or to the injection/uptake of the NPs. Here, we report a systematic method of creating tri-layered NPs with an Ag core, Au inner-shell and Ag outer-shell. A thick Au inner shell was used to prevent the Ag core from dissolving. We exposed the AgAuAg NPs to moderately hard OECD water for a 24 hour period and found that the Ag outer shell is rapidly removed. It was observed that the UV-visible spectra had shifted from 492.5 nm to 510 nm within 24 hours with the spectra being characteristic of a Au NP. The dissolution was measured with ICP-OES and showed Ag dissolution but no Au dissolution. Eventually this synthesis method will be used to create NPs with the core made out of the isotopes, Ag 107 and Ag 109. We will then be able to definitively pinpoint the location of the two isotopes of silver and so the fate and transport of these NPs.

ROS-MEDIATED NEURODEGENERATION IS INDEPENDENT OF THE RYANODINE RECEPTOR IN CAENORHABDITIS ELEGANS
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Despite the significant impacts on human health caused by neurodegeneration, our understanding of the degeneration process is incomplete. Two factors that contribute to neurodegeneration are excessive neuronal excitability (excitotoxicity) and stress due to reactive oxygen species (ROS). The nematode Caenorhabditis elegans is an emerging genetic model organism used to identify cellular mechanisms and molecular pathways of neurodegeneration. Disruption of the gene unc-68, which encodes the ryanodine receptor, abolishes excitotoxic cell death, indicating a role for Ca2+ signaling in neurodegeneration. We tested the requirement for unc-68 in ROS-mediated neurodegeneration using the genetically encoded photosensitizer KillerRed. Upon illumination of KillerRed expressing worms to produce ROS, we observed similar levels of degeneration in wild-type and unc-68 mutant worms. Our results indicate that ROS-mediated cell death is independent of unc-68 and suggest multiple molecular pathways of neurodegeneration.