



# RISE

## END OF SUMMER

### RESEARCH SYMPOSIUM

FRIDAY, AUGUST 24, 2018



# Schedule of Events

**WELCOME 3PM — 3:15PM**

**DR. DAVID WARD, PROVOST**

**ORAL PRESENTATIONS 3:15 PM — 4PM**

**SANDRA HUNEYCUTT**

Qualitative Characterization of Solar Cells Through Electroluminescence Analysis.

**KAITLAN SMITH**

The Mechanism of FOXO1 Nuclear Translocation during Embryo Implantation.

**NICOLE STUMBLING BEAR**

Developing Positive Lysosomal Modulators for Treating Alzheimer's and Parkinson's Disease.

**DR. MARIA SANTISTEBAN**

"CRISPR-Cas9 technology in the student lab: take one"

**POSTER PRESENTATIONS 4:15PM — 5:15PM**

**KEYNOTE ADDRESS 5:15PM — 6PM**

**DR. JOANNA COOPER**

**"TIMING OUR LIVES: LESSONS FROM A PHD IN CIRCADIAN RHYTHMS"**

The RISE program is delighted to welcome Dr. Joanna Cooper back to UNCP. Dr. Cooper is a UNCP alumna. She graduated from UNCP in 2011 with a B.S. in Biology. She was a RISE Fellow in cohorts 4 & 5. As a UNCP undergrad Dr. Cooper was mentored by Dr. Ben Bahr.

She is one of the first UNCP RISE Fellows to complete a Ph.D. program in biomedical research. Dr. Cooper recently earned a Ph.D. in Biochemistry and Cellular & Molecular Biology from the University of Tennessee-Knoxville. She is now a postdoctoral fellow at the University of Maryland School of Medicine.



# Faculty Presentation

**Santisteban, Dr. Maria**

**Biology Department**

**CRISPR-Cas9 technology in the student lab: take one**

CRISPR–Cas is an adaptive immune system found in Bacteria and Archaea that confers sequence-specific protection against invasion by nucleic acids from bacteriophages. CRISPR–Cas has gained widespread notoriety because it has been adapted to be a high precision gene editing tool, with the consequent applications to health and non-human health areas such as agriculture and plant genomics, and animal biotechnology.

The popularity of CRISPR-Cas, amplified by news reports and social media centered on the potential of gene editing for human health and its ethical issues, has got students interested in this “phenomena”. Instructors can use this opportunity to introduce CRISPR-Cas in the undergraduate classroom/laboratory. Moreover, CRISPR-Cas is now ubiquitous in research and industry labs internationally, which begs that we familiarize our biology students with it as early as possible.

CRISPR-Cas lends itself to be adapted to Classroom Undergraduate Research Experiences (CUREs) and recently some institutions have started to develop such courses. Often, these are semester or year-long courses, where students are guided through much of the whole process. We sought to determine if even a shorter implementation in a 5-week Molecular Biology summer course would provide students with a good understanding of the technology, its methods and applications. Another goal was to use CRISPR-Cas to teach valuable techniques of Molecular Biology such primer design, polymerase chain reaction (PCR), in vitro transcription, nuclease digestions, polyacrylamide and agarose electrophoresis. The course was developed very shortly after attending the CRISPR-Cas workshop offered in advance at the 2018 Association for Biology Laboratory Education (ABLE) and with a \$700 budget. It was all hands-on and blended dry and wet labs. In the dry lab, students were introduced to bioinformatics techniques while performing annotation of a contig of *Drosophila takahashii* and in the wet lab they carried out the in vitro steps of a CRISPR-Cas9 protocol to knock out a gene in the zebrafish *Danio rerio*. These two seemingly disparate activities were blended under the context of genomics and personalized medicine.

All 6 students in the class designed sgRNAs for the same *D. rerio* gene and then each group of 2 was assigned the synthesis and in vitro validation of one guide. Remarkably, all students were able to successfully create functional guides. Students wrote a lab report to summarize their work and filled a survey to gauge their gains.

This experience demonstrates that even with a limited scientific scope and a small budget, it is possible to have a successful implementation of CRISPR-Cas that, through the hands-on experience, provides students with a conceptual understanding of this cutting-edge research technology and teaches them Molecular Biology techniques while allowing them to fail and improve.

# Student Presentations

## Barlogio, Cassandra

**Mentor:** Rachel Bleich, UNC Chapel Hill

### **The Biogeography of Molecularly-Barcoded *E. coli* in the Lower GI Tract**

Crohn's disease, a type of Inflammatory Bowel Disease (IBD), affects about 700,000 Americans every year. It is categorized by chronic inflammation of the gastrointestinal tract (GI) and increases the likelihood of developing inflammation-associated colorectal cancer. Development is multifactorial. Currently there is no known cure. Our goal is to determine the preference of adherent invasive *Escherichia coli* (AIEC) and non-AIEC strains isolated from Crohn's disease patients to colonize an IBD mouse model of GI inflammation. **We hypothesized that AIEC strains would preferentially colonize inflamed mucosa.** To determine the location and prevalence of genetically similar strains, we used a novel molecular barcoding system. The IBD model *Il10<sup>-/-</sup>* mice were gavaged with the barcoded *E. coli* strains and put on antibiotic water. After 10 weeks, samples were harvested from along the gastrointestinal tract. *In vitro* experiments were performed to ensure that the addition of the barcode did not affect the fitness of the bacteria. The locations and abundances of each barcode were determined using PCR techniques. Also, qPCR was used to determine the relative abundance of the barcoded strains when grown in co-culture. We were able to identify several strains that colonize all areas of the GI tract and will do more sequencing and comparative genomics in the future.

## Cade, Joshua

**Mentor:** Anthony Mangan, University of North Carolina at Chapel Hill

### **Focal Adhesion Kinase Regulates Plasma Membrane Expansion During Neuronal Development**

Neurons go through a series of developmental stages to form mature cells that can make the necessary connections to effectively transport signals. During those stages, both dendrites and axons are formed and must rapidly expand their plasma membrane as they extend. Exocytosis, a process that involves the fusion of membrane bound vesicles to the plasma membrane, provides one possible mechanism for this expansion during development. These exocytic vesicles fuse through the interaction of SNARE protein family members on both the vesicle (VAMP2) and at the plasma membrane (Syntaxin and SNAP25). Previous work in the Gupton lab used live imaging to show that inhibition of Focal Adhesion Kinase (FAK) significantly reduces the number of exocytic events in cultured mouse cortical neurons. Although FAK has been identified as a key regulator of other cellular functions, it had not been previously connected to exocytosis. To further determine the effect of FAK on SNARE proteins, we used western blots to show that the addition of FAK inhibitor (added at different time intervals), increases the concentration of VAMP2, Syntaxin, and SNAP25 found in complex. Continued results showing that FAK inhibition affects neuron development and exocytic events would lead to new information about the role of FAK pathways in neuronal development.

## Chavez, Maria

**Mentor:** Dr. John Roe, UNC Pembroke

### **Personality Profiling in Eastern Box Turtles**

Eastern Box turtles face challenges every day in their environment from predators, finding resources and a mate, prescribed burning, and diseases. With these factors coming into play, personality could be a defining factor in their day to day survival. Analyzing personality behavior with growth rates, emergence, and home range size we hope to determine a correlation between personality and area travelled. Turtles were radiotracked to identify sizes and home range sizes while we performed personality tests which told us how social an individual was. We placed each individual in a dark mesh bag for one minute and monitored how long it took each turtle to come out of its shell with a time limit of 15 minutes for each turtle. When we analyze these findings, we hope to find a correlation between social behavior and successful survivorship based on how far these individuals may travel and how their growth may benefit from being more social and more likely to travelling distances for resources or mating/nesting capabilities. We expect the turtles that have a shorter emergence time to have a bigger home range and better survivorship because they take more of a risk to find resources and put forth more energy into finding nesting habitats and mates.

## Clayton, Hannah

**Mentor:** Dr. Maria Santisteban, UNC Pembroke

### **Utilizing the genome sequence of *D. melanogaster* to interpret the annotation of *D. takahashii* contig39**

# Student Presentations

## Crenshaw, Colton

**Mentor:** Dr. Conner Sandefur, UNC Pembroke

### **Genetic Diversity of *Phoradendron leucarpum* and *Verbesina virginica*: Initial Steps**

*Phoradendron leucarpum* and *verbesina virginica* are traditionally medicinal plants used for a variety of remedies by southeast American Indian communities. Due to its cultural importance to these communities, it is possible these plants were moved during removal of some southeast American Indian communities in the late 1800's. By identifying and characterizing variable number repeat regions in the genomes of these two plants, we may be able to identify within species relatedness of each plant taken from different regions of the United States. Over the summer, we were successful in isolating DNA from *Phoradendron leucarpum* but not *Verbesina virginica*. Polymerase chain reaction tests to amplify regions of the *Phoradendron leucarpum* genome had limited success. Future research will require alteration to the process of extracting the DNA and adjustment of polymerase chain reaction conditions.

## Dean, Jessica

**Mentor:** Dr. Conner Sandefur, UNC Pembroke

### **Investigation of the Biodiversity in the Lumber River**

Microbes are microscopic organisms which include fungi, viruses and bacteria. They work collectively to bring about favorable conditions that support a healthy environment through decomposition and the recycling of nutrients. There is undoubtedly a relationship between biodiversity and environmental stability. Yet despite the great importance of microbes in the environment, their biodiversity remains poorly described. The focus of this project is to investigate the microbial diversity of the Lumber River so that any threats to microbial life or consequences of biodiversity loss can be better understood and prevented.

## Dong, Xin

**Mentor:** Dr. Paul Flowers, UNC Pembroke

### **A Spectroelectrochemical Assay for Vitamin C**

Ascorbic acid (Vitamin C) is an essential nutrient needed to maintain the health of skin, teeth, bones, and blood vessels. Vitamin C is found in many fruits and vegetables, and it is a popular ingredient in dietary supplements due to its many confirmed health benefits and very low toxicity. Measuring the amount of vitamin C in consumer products is an important part of quality assurance efforts in the food and pharmaceutical industries, as this enables accurate reporting of nutritional information. For some food products, the vitamin C level must be monitored and adjusted during processing to avoid negative effects on taste, aroma and shelf life. A variety of analytical methods are used to assess vitamin C content, each with practical benefits and drawbacks, and the development of improved methods is an active area of research.

Work in our lab is focused on developing new assays for various compounds of biological importance that are based on making light absorption measurements (spectrometry) on samples undergoing electrolysis (electrochemistry), a technique known as spectroelectrochemistry (SEC). These SEC measurements are capable of providing advantages in analysis speed, cost, and selectivity. This poster describes the traits of a new vitamin C assay recently developed in our lab, including results obtained for the analysis of several food and pharmaceutical products and a comparison to those of a reference assay. This material is based upon work supported by the National Science Foundation under Grant Number 1506817.

## Downs, Gabrielle

**Mentor:** Dr. Len Holmes & Devang Upadhyay, UNC Pembroke

### **The Effects of Fertilizers on the Mortality Rate of Entomopathogenic Nematodes**

Entomopathogenic nematodes (EPN's) are microscopic round worms that can be used to as an alternative for commercial insecticides to control a variety of agricultural pests. The successful integration of EPN's as regular use biological control agents, however, requires specific knowledge and understanding of the adaptation and establishment of applied biological control agents in agricultural ecosystems. Understanding how fertilizers affect nematode communities is necessary if growers seek to convert from using market chemical insecticides to organic biopesticides like entomopathogenic nematodes. In this study, ten were examined and used to explore the effects of NPK on the bacterial symbionts of *S.carpocapse* and *H.Bacteriophora*. The effect of nitrogen is apparent and consistent in both species. This poster summarizes the effectivity of various concentrations organic and inorganic fertilizers on nematode mortality.

# Student Presentations

**Edwards, Ayanna**

**Mentor:** Dr. Monika Shawney, UNC Charlotte

## **Tracing the Under-reporting of Tuberculosis in men across Developing Countries**

Tuberculosis (TB) has been known to cause massive suffering and many deaths. Tuberculosis is a potentially lethal infection that is known to infect the lungs, but it is not partial to infecting other organs in the body. The organism that causes TB, Mycobacterium Tuberculosis is capable of spreading through droplets released in the air by coughing, sneezing or even talking. Tuberculosis started to increase in 1985, inside developing countries. Though they were able to contain the disease and create a treatment for it. There is still concerns it could be one of the top killers in the world. Just in 2015 it was listed with the highest death by infection, making TB the deadliest disease topping HIV. The global impact still remains enormous. There are specific countries that have been known to have a constant rate of Tuberculosis, however the number of people it is affecting still remains unknown. Studies suggest this gap of unknown TB findings have something to do with developing countries and inconsistent issues with underreporting. TB has always been known to be prominent in these developing countries and just recently there has been a gap in the amount of cases of TB reported compared to the point that should be expected. In developing countries there has been more findings of tuberculosis, since there is a raise in the infection, there could still be many people who are not aware that they have. This could raise a problem with underreporting of this potentially deadly disease. Underreporting creates an inaccurate interpretation of how the infection may or may not be spreading. We aim to look closer at the underreporting of Tuberculosis in developing countries among men. Though TB can infect both men and women. There have been more records of women being treated for tuberculosis compared to the amount reported compares to men. We hypothesize that determining the gap between men with TB and the reason why most men are not reporting, we will be able to close in on the spread of Tuberculosis. Making us one step closer to detaining a deadly infection.

**Hudson, Abbie E.**

**Mentor:** Dr. John Roe, UNC Pembroke

## **Temperature and Personality Correlation in Eastern Box Turtles (*Terrapene carolina carolina*)**

Body temperature affects many aspects of a box turtle's performance and physiology. Their temperature is determined by their environment, making it challenging to maintain optimal temperatures without over exposure. Turtles have been shown to have different temperaments, which we classified as risk-taking (bold) or risk-averse (shy). Other studies have shown that temperament impacts how turtles interact with their environment (Kashon and Carlson 2017, Ward-Fear et al. 2018). We predicted that bold turtles would take risks by basking in exposed areas to increase body temperature, while shy individuals would select sheltered areas and experience lower temperatures. We studied two populations at two locations and placed radiotransmitters and temperature logging iButtons on each turtle, recording temperatures during June and July. The iButtons were removed after 6 weeks. We concluded that there was no relationship between personality and temperature at time of measurement, temperatures selected, or percentage of temperature measurements within thermal preference range. We believe the climate of our study areas allows turtles to reach optimal temperatures easily, making it unbeneficial for bolder turtles to seek open environments. Turtles at Weymouth experienced higher temperatures than those at the Lumber River, which may be due to varied forest compositions. Females experienced higher temperatures than males at Weymouth; however sexes experienced similar temperatures at the Lumber River. Many females used open and recently burned areas at Weymouth, likely accounting for their higher temperatures. Future studies are needed to understand if temperature selection plays a role in other aspects of the turtle's daily lives.

# Student Presentations

## Huneycutt, Sandra

**Mentor:** Dr. Abasifreke Ebong, University of North Carolina Charlotte

### Qualitative Characterization of Solar Cells Through Electroluminescence Analysis

The reliability of a solar cell is very critical to the adoption of solar electricity as well as cost reduction. Therefore, the parasitic resistance in a solar cell, especially the contacts, must be minimized to avoid failure and reduction in the cell output power in the field. In order to evaluate the parasitic resistance, in particular the series, the electroluminescence technique in which the radiative recombination images of five solar cell structures were captured in dark when voltage is supplied to the solar cell. The electroluminescence uses a charged coupled device (CCD) camera, power supply, Arduino board to process MATLAB code, and a computer. The images of four Aluminum-Back Surface Field (AL-BSF) – (i) segmented five busbar (S-5BB), (ii) continuous five busbar (C-5BB), (iii) continuous two busbar (C-2BB), (iv) segmented three busbar (S-3BB), and segmented four busbar (S-4BB) Passivated Emitter Rear Cell (PERC) were analyzed qualitatively using an open source software “Image J”. Thus, the estimated percentage of series resistance for each of the five solar cell structures is presented. Also, suggestions on how to improve the method and data acquisition, specifically obtaining brighter images, is discussed.

## Deionja Johnson & Allison Rockenbach

**Mentor:** Dr. Maria Santisteban, UNC Pembroke

### Utilizing the genome sequence of *D. melanogaster* to interpret the annotation of *D. takahashii* contig17

*Drosophila melanogaster* is a well-known species that has been thoroughly annotated. Its genome sequence has been used in comparative genomics approaches to annotate newly sequenced species of other *Drosophila* species. The rationale is that important proteins would be conserved through evolution and hence, the coding parts of the genes would be conserved in between the *D. melanogaster* and the species to be annotated. For this work, undergraduate and graduate students were tasked with identifying and annotating genes in a region of the newly sequenced *Drosophila takahashii*. Gene prediction or gene finding refers to the process of identifying the regions of genomic DNA that encode genes; gene annotation refers to the process of “labelling” the different parts of the gene. Students used several lines of evidence ranging from conservation, to RNAseq data, to computer generated gene predictions, to algorithms that predict intro/exon boundaries to annotate their project. By completing this annotation project, students are introduced to various bioinformatics tools (BLAST, UCSC genome browser mirror) and databases (Flybase, NCBI) and are provided with the opportunity to cooperate with scientists from the Biology Department at the McDonnell Genome Institute of Washington University in St. Louis, the creators of the GEP Browser. The project to be annotated was a 100,000bp region (contig17) of the *D. takahashii* species. There were only two genes located within this region. They were *yellow-h* which only showed 1 isoform and *CG1674* which showed 10 isoforms, 7 unique and 3 identical in their CDSs. Evidence provided by the Gene Model Checker suggest that the predicted annotations of contig17 were likely correct.

## Lamberton, Dana

**Mentor:** Dr. Paul Flowers, UNC Pembroke

### Microscale Spectroelectrochemical Flow Cell Design and Development

The work of this research group has involved the development of microscale SEC devices, which are used to analyze small samples of solution using SEC. Recently we have developed a flow cell which can be used to perform SEC analysis without the application of Nafion film, which was used in prior research. Initially it seemed that the absorbance reduction of 95-96% that was achieved with the Nafion-coated cells would not be possible using this other technique, as initially the absorbance was reduced only by ~70%. Effort was made to streamline the device by reducing the width of the flow cell channel to <100 microns, by employing two opposing WE in the cell, and by masking the view of the channel so that only the light which passed through the solution directly between the two electrodes was exposed. Using the cell of this design absorbance reduction >90% was achieved.

# Student Presentations

## Lee, Cheyenne

**Mentor:** Benjamin Reading, North Carolina State University and Scott Salger, Barton College

### **Skin Microbiota Dynamics of Anadromous Striped Bass**

Knowledge of shifts in skin microbiota of diadromous fishes is important to elucidate changes in the function of the mucosal barrier during transition between freshwater and saltwater. Striped bass (*Morone saxatilis*) are anadromous fish which spawn in freshwater and migrate to saltwater and are native to eastern United States and the Gulf of Mexico. The changing dynamics of the microbiota of striped bass following the shift between freshwater and saltwater is unknown. In this project, a 16S rRNA marker gene sequencing study was performed to investigate microbial community changes on the skin of the fish during this transition. DNA was extracted from skin and subopercular swabs taken from wild fish captured off coastal Virginia, in the Roanoke and Neuse Rivers of NC, and from cultured fish in either flow-through or recirculating systems and prepared for sequencing. The resulting sequences were analyzed using the microbiome analysis package QIIME2. There was no difference in microbial community diversity between swabs taken from the skin or under the operculum of the fish ( $p < 0.92$ ). The fish in fresh water had a notably higher proportion of Actinobacteria compared to the fish in saltwater. The fish in saltwater had a higher proportion of Proteobacteria and unassigned bacteria. This striped bass model may be utilized to represent changes in the skin microbiota of other diadromous fishes during these transitional life stages. Also, it may be possible to determine the source of migrating fishes for stock enhancement purposes by utilizing these methods.

## Lee, Dakota

**Mentor:** Nan Xu, Georgia Tech

### **Utilizing the Thresholding-based Segmentation Approach to Segment Synapse Active Regions in *C. elegans***

Technological advances such as GFP reconstitution Across Synaptic Partners (GRASP) technology and dual channel confocal microscopy have allowed imaging the synaptic connections of pairs of neurons. However, identifying all synapses in complex neural structures of the nematode *C. elegans* has been labor intensive and thus very challenging. To establish a connectome composed by over hundreds of pairs of synaptic connections, it will be necessary to have an efficient image segmentation approach to isolating synapse rich regions which is universally applicable for all different pairs.

## Locklear, Josi

**Mentor:** Dr. Cornelia Tirla, UNC Pembroke

### **Caffeine extraction of tea leaves**

This project developed an efficient method of the extraction of caffeine extracted from tea leaves using microwave extraction. The benefits of using microwave extraction is that of heating solvents and plant tissues create an enormous amount of pressure on the cell wall that causes it to burst. Different extraction conditions were analyzed with the purpose to develop an efficient method which will yield the maximum amount of caffeine

## Lytle, Ashley

**Mentor:** Dr. Lisa Kelly, UNC Pembroke

### **Primer Optimization for Next-Generation Sequencing of Invasive Fire Ant (*Solenopsis invicta*) Diets**

Invasive fire ants (*Solenopsis invicta*) are a huge problem in North Carolina; knowing their diet may determine what organisms are most consumed. They have a liquid diet, so one way to discover what they eat involves extracting prey DNA from them, amplifying the DNA via PCR, and performing next-generation sequencing on the amplified DNA. Two PCR primers that were used to amplify the DNA were "rbcL" to detect plant DNA and "16S" to detect amphibian DNA. Primers were optimized using different annealing temperatures, different concentrations of MgCl<sub>2</sub>, and different numbers of PCR cycles. The optimized PCR products displayed bands in gel electrophoresis. PCR products were sent off for Sanger sequencing, and these results were BLASTed to see if the amplified DNA was what we were trying to amplify. BLAST confirmed the rbcL PCR products as plant DNA, but BLAST showed the 16S PCR products were non-amphibian DNA, which indicates a nonspecific primer. The rbcL data indicate *S. invicta* had eaten plants, but our 16S primers were not specific enough to reliably detect amphibian prey. Further studies will involve next-generation sequencing of *S. invicta* samples using the rbcL primers and primers that will detect microbial and arthropod DNA. The outcomes may show previously unknown prey as a part of the diet of *S. invicta*, which is especially important to determine the risks to endangered and other rare species.

# Student Presentations

## McGirt, Ryan

**Mentor:** Dr. John Roe, UNC Pembroke

### Spotted Turtle Response to Flood – Drought Cycles

Our study focused on Spotted turtles response to drought and flood periods in the Lumber River State Park (LRSP). We tracked five individuals for one year using radio telemetry. The turtles were tracked weekly and each time a GPS coordinate was taken, and the environment was documented. The initial hypothesis was that the turtles would retreat to the river during drought periods and return to the streams and wetland areas during periods of flood. The results showed that no turtles retreated to the river during drought periods. The turtles chose to estivate or travel in search of shallow pools. The Minimum Convex Polygon was calculated for each individual. The average MCP in the study was 12.52 hectares. This is very similar to other studies on Spotted turtles. The results also show that the box turtles prefer to inhabit the unique extensive flood plain habitat at the LRSP. There has not been a sighting of a Spotted turtle in the Lumber River at any point of the study. We plan to continue the study to answer some of the remaining questions and to gather larger sample size, so data is more accurate. No study has ever been conducted on the Spotted turtles in North Carolina coastal plain environments or the Lumber River basin. The results could also be used to inform state officials that the size of the LRSP is not large enough to properly protect and contain the species.

## Mebans, Elijah

**Mentor:** Devang Upadhyay, UNC Pembroke

### The Effect of Virulent Properties Secreted by Entomopathogenic Nematodes Symbionts on other Bacteria

The *Photorhabdus luminescens* and *Xenorhabdus nematophilia* are both entomopathogenic bacteria that have been discovered to produce virulent properties to combat against the crop eating pest that infest our agricultural industries today. The entomopathogenic properties/traits of these bacteria are increasingly more effective when paired with their symbiotic partner *Heterorhabditis bacteriophora* and *Steinernema carpocapsae* nematodes. After performing many experiments on the satisfactory environment for these nematodes and understanding the ways of production for this symbiotic entomopathogen, we observed that the bacteria was being regurgitated by the nematodes for pesticide use. To test the positive and negative effects of the entomopathogenic production on environment, the effect of virulent properties was determined using seven different bacteria that are commonly found in the environment. The bacteria experimented were *Bacillus subtilis*, *Bacillus licheniformis*, *Enterobacter cloacae*, *Pseudomonas fluorescence*, *Pseudomonas putida*, *Rhizohium leguminosarum*, and *Serratia marcescens*.

## Morazan, Cody

### User Account Automation to Ensure Compliance and Mitigate Risk TrackWise

Biogen currently uses the Biogen Access Management (BAM) software system for requesting access to company-specific software, one of which is TrackWise. TrackWise is a Quality Management System that is used to track Patient, Provider, and Prescriber usage, subscription, and distribution of pharmaceuticals per both the FDA's mandatory policies and Biogen's corporate policy. It is also used to track Product Complaints. This requesting of software access is a means of controlling access to only authorized individuals. Individuals are authorized to access TrackWise if they have completed mandatory compliance training. The current process for verification of training is largely a manual and cumbersome one. Automation of this process will increase production efficiency and decrease risk of non-compliance. This project is accomplished by creating a Java program that uses the Quartz application programming interface.

## Mosley, Dontae

**Mentor:** Dr. Conner Sandefur, UNC Pembroke

### Digging for novel antibiotics in #BraveNation

This research focused on testing the antimicrobial properties of soil bacteria. Newly emerging antibiotic resistant bacteria – “Super bugs” – such as methicillin resistant *Staphylococcus aureus* are responsible for thousands of hospital-acquired infections. Therefore, it is imperative that we identify novel antibiotics to fight ‘super bugs’ and our soils are filled with uncharacterized bacteria, which may hold the key to emerging antibiotic resistant bacteria. For this research, two undergraduate research mentors and four BraveStart BIO 1000 students worked together to collect, isolate and test soil bacteria for growth inhibition properties against laboratory strains of *E. coli*, *S. aureus*, *P. aeruginosa*, and *K. pneumoniae*. Out of the microorganisms tested, six were able to inhibit the growth of *E. coli*. Four of the microorganisms were found in the Pembroke area and further testing of local soils could lead to more discoveries.

# Student Presentations

## Pointer, Jazlyn

**Mentor:** Dr. Erika Young, UNC Pembroke

### Macroinvertebrates as Bioindicators of the Eno River's Health

Bodies of water that are close to major and developing cities are susceptible to being polluted due to run off and sewage waste. While these bodies of water are often treated by chemical treatment facilities for human consumption, macroinvertebrate populations show that the rivers still experience substantial pollution.

## Royer, Fredejah

**Mentor:** Dr. Conner Sandefur, UNC Pembroke

### A systemic review of traditional medicinal plants

There are numerous traditionally used medicinal plants native to the US. These plants have been used for many different treatments as far as illnesses and diseases. As research has evolved, scientists have conducted experiments testing the medical properties of some of these plants. A subset of researchers are trying to isolate the compound(s) in plants that give them antimicrobial properties. There are multiple ways to test the plants and isolate the compounds including gas chromatography, cell cultures, essential oil enhancements, and many other strategies. In this systematic review, I have thoroughly read through multiple research papers that tested medicinal plants.

## Smith, Kaitlan

**Mentor:** Dr. Rong Li- National Institute of Environmental Health Sciences

### The Mechanism of FOXO1 Nuclear Translocation during Embryo Implantation

On average one in every four couples worldwide struggle with infertility. Dysregulation of the progesterone receptor (PGR) signal is associated with fertility defects. We found that overexpression of PGR isoforms, PGR-A or PGR-B, in the uterine epithelium resulted in severe subfertility due to failed embryo implantation in  $Wnt7a^{cre/+} PGRA^{LsL/+}$  ( $Wnt7aPRA$ ) and  $Wnt7a^{cre/+} PGRB^{LsL/+}$  ( $Wnt7aPRB$ ) mice. Further studies indicated that decreased FOXO1 nuclear expression in the uterine epithelium during embryo implantation could be one of the major causes of failed embryo implantation in these mice. It has been reported that in human endometrial stromal cells FOXO1 cellular localization is mainly regulated by its phosphorylation by protein kinase B (AKT) and serum and glucocorticoid-regulated kinase 1 (SGK1). The major purpose of this study is to explore the mechanism of FOXO1 nuclear translocation in uterine luminal epithelium during embryo implantation. In the animal models it was observed that nuclear FOXO1 is strongly expressed in the luminal and granular epithelium in the  $Wnt7a^{cre}$  mouse uterus at pseudopregnant (D4.5). However, a much weaker and mainly cytoplasmic staining of FOXO1 can be observed in the uterine epithelium of the  $Wnt7aPRA$  and  $Wnt7aPRB$  mice. In the HEC1A cell line when treated with either an AKT or SGK1 inhibitor, a time dependent FOXO1 nuclear translocation can be observed at each inhibitor's highest concentration. Future directions include testing these kinase inhibitors along with other candidate kinases *in vivo*.

## Smith, Phineas

**Mentor:** Dr. Joong-Lyul Lee, UNC Pembroke

### Performance Measurements and Analysis of the Interference of Things on 802.11 Networks

With the rise of mobile networks and the Internet of Things (IoT), wireless signals are increasingly causing interference for one another since there are only so many channels that these signals can travel on. This interference and data package interruption is often noticed by users on mobile devices by a delayed response, or "slowing down", of their internet. When data is received by a node on a network, it sends an acknowledgement message to the source. If an acknowledgement is not received, the same data is sent again. Using this premise, software simulations of data packet interference has been run in the past. However, the data produced by existing simulations fail to adequately reflect real life data interference.

# Student Presentations

## **Spencer, Victoria**

**Mentor:** Dr. Erika Young, UNC Pembroke

### **Constructing an EPT/Biotic index for the Lumber River to assess stream health**

Poor quality bodies of water lack certain abundant groups of macroinvertebrates that are not tolerant to high levels of pollution. By collecting population samples of benthic invertebrates, one can conclude the overall health of a stream. The purpose of this study is to assess parts of the Lumber River in North Carolina, to determine whether or not pollution exists in specific areas based on the presence of EPT indicator species and overall invertebrates found in each sample.

## **Stumbling Bear, Nicole**

**Mentor:** Dr. Ben Bahr, UNC Pembroke

### **Developing Positive Lysosomal Modulators for Treating Alzheimer's and Parkinson's Disease**

Alzheimer's disease (AD) and Parkinson's disease (PD) are protein accumulation disorders of amyloid beta plaques ( $A\beta$ ) and hyperphosphorylated Tau protein that can lead to synaptotoxicity. These protein aggregates can cause irreversible loss of intellectual abilities, such as memory acquisition and language skills, which can affect the normal social and occupational lives of sufferers. Currently there are many therapeutic treatments undergoing investigation in search for successful methods to prevent or slow these neurodegenerative disorders. One treatment being researched is Z-Phe-Ala-Diazomethylketone (PADK) a compound that positively modulates the lysosomal pathway and increases lysosomal activity. To test the effects of PADK, transgenic mouse models went through behavior testing. Behavior testing can include open field test, nestlet scores, and spontaneous alternation behaviors to test the mice cognitive ability. Through testing we can see a transgenic effect which shows the positive lysosomal modulation due to treatment. PADK is also a weak inhibitor of the active form of cathepsin B (Cat B), an enzyme that degrades amyloid beta plaques ( $A\beta$ ). Explorations of newly designed compounds that have less inhibitory effects upon Cat B are being conducted.

## **Thomas, Marica**

**Mentor:** Jessica McCarty, Miami University

### **Ecology in Plants, Pollinators and Landscapes: Scoping Assessment of Bee Tourism Development for Oxford, Ohio**

Pollinators, in particular bees are in great decline due to heavily developed landscapes, loss of habitats and lack of plant biodiversity. Bees are central to the human population in terms of economics, bringing in billions of dollars in crop productivity and honey production, also being responsible for providing great food biodiversity and maintaining ecosystems. Due to the decline of pollinators, the core goal of this project is to help improve pollinator populations by creating a "Bee Tourism Map" by proposing bee tourism sites/pollinator gardens in the city of Oxford, Ohio. Bee tourism is a form of tourism that deals with culture and rural communities that connects beekeeping, bee ecological niches and sustainable economic activities. The first step in getting this project approved for proposal was meeting with the mayor of Oxford, to expand the idea and prompt more discussion of the development of bee tourism. With these bee tourism sites being put into place, future works will include expanding bee tourism by establishing pollinator garden tours to invite the Oxford community and tourist from all over to learn about the historic apiculture of Oxford, Ohio.

# Student Presentations

**Thompson, Brianna Anastacia**

**Mentor:** Dr. Philip Bradford at North Carolina State University

## **Electrically Conductive Carbon Nano-Tube Films**

The development of flexible electronics will impact the future by creating a future where an individual can wear a watch, or a t-shirt, that can monitor chronic illness, or help prevent individuals from getting sick. Current approaches for flexible electronics are printing a silver film, engraving patterns, and the use of carbon nano-tube thin films. Carbon nano-tubes are grown through chemical vapor deposition, and have previously provided favorable results when tested for its mechanical properties, electric properties, and tensile properties. The thought process behind using carbon nano-tubes is that they are naturally slightly conductive and very ductile because they adhere to each other on the nano-scale. If carbon nano-tube films can be made more electrically conductive, there could be a practical application to the flexible electronics movement by acting as 'wiring' for devices connected to the flexible electronic to communicate with each other.

In this work, we have developed a method for permanently adhering carbon nanotube carbon nanotube sheets to knit fabric for use as electrical interconnects. Carbon nanotube sheets are naturally fairly conductive, and their conductivity changes when a binder is used to adhere them to a fabric. We studied how the electrical conductivity changed as a function of the amount of binder used. In addition, we employed a method of combining silver nanoparticles with the polyurethane binder to further increase the electrical conductivity. After determining the most conductive configuration, the conductivity was measured after it is adhered to fabric, and during mechanical stretching.



## THANK YOU!

The RISE Staff would like to thank and congratulate all of the students who participated in the 2018 summer research presentations.

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