

SUMMER 2020 - SC INBRE / EPSCOR RET PROJECT DESCRIPTION FORM

Mentor's Name	Paul E Richardson
Institution	Coastal Carolina University
Department	Chemistry
Mailing Address	111 Chanticleer Drive east
Telephone	(843) 349-2598
Email	prichar@coastal.edu
Research Subject Area	Viruses – Drug design – Biomedical - environmental

A. Briefly describe overall research program at your laboratory.

<https://professorrichardsonresearch.wordpress.com/>

Humanity is besieged with the constant onslaught of bacteria and viruses on a daily basis, and we are slowly falling behind in this battle. Over the past few months outbreaks of salmonella have bedeviled our food supply, hospitals are constantly plagued with *Staphylococcus* infections that are resistant to antibiotics, and in one national park over 10,000 people were potentially infected by hantavirus. New weapons are needed in the fight to help inhibit and prevent these infections. Dr. Richardson's research is focused at looking at novel means to prevent/inhibit bacterial blooms in the environment or infections in people. Currently there are four research projects in his laboratory. The MRSA project is trying to isolate and identify naturally occurring bacteriophages in our community that could be used to treat bacterial skin infections. The oyster project wants to develop techniques to detect pathogen presence well before onset of disease into an aquatic environment. The environmental bacteriophage project wants to isolate and purify naturally occurring bacteriophages in our marine estuaries to study their ability to control bacterial blooms and ecological diversity. The Brookgreen project wants to study the diverse bacteriophage population in such a restrained environment like an aviary.

Environmental Bacteriophage

This project focuses on collecting water samples throughout Georgetown and Horry County looking for naturally occurring bacteriophages in our aquatic environments. Bacteriophages are an important part of our ecosystem that helps control and maintain proper bacterial populations. As bacterial populations increase so does the population of the bacteriophages. This project focuses on looking at the factors involved in the bacteriophage population in residential and commercial retention ponds in the area. Is there a difference in the bacteriophage population between these two ecosystems and what are those differences? What factors are responsible for these differences? This project will also collect and analyze these bacteriophages for their potential commercial value. Often, during the summer months, beaches are closed due to spikes in the bacterial population in the ocean. These blooms can be control using these naturally occurring bacteriophages and as such limit the time beaches must close due to bacterial blooms. These bacteriophages can be used to help use better manage and clean up our beaches when the conditions call for the beaches to be closed due to unsafe water conditions.

The MRSA Project

Staphylococcus aureus is a very common pathogenic bacterium in the human population. Recently some strains of methicillin resistant *Staphylococcus aureus* (MRSA). Have developed resistance to antibiotic drugs. It is imperative to human health that treatments are developed that can destroy the bacteria even after it mutates and bacteriophages

are a promising approach. Bacteriophages are viruses that only infect bacteria and are specific to the bacteria they infect. These bacteriophages are naturally occurring in the population and are harmless to the human host they populate, often being beneficial in their ability to control microbial populations. Unlike static drugs, bacteriophages can evolve with the bacteria to constantly keep up with the mutating pathogens. The purpose of this project is to address two questions about these naturally occurring bacteriophages; does the general population contain bacteriophages that are lytic against *Staphylococcus aureus* and can we isolate and identify these bacteriophages based on genomic fingerprinting and polymerase chain reaction?

The Arbovirus Project

Virus monitoring is a critical responsibility in understanding the threats to the human population from diseases that can pop up from seemingly nowhere. An arbovirus is a virus that is spread from insects. In 2016 DHEC reported 5 cases of Eastern Equine encephalitis, 2 case of West Nile virus and 1 case of Zika virus in Horry county. All of these viruses are spread from the bite of an infected mosquito. If we can detect and monitor these potential pathogens before they cause an epidemic we can provide critical health advice to keep our community safe. This project is about setting up a system to detect and monitor specific arboviruses in our community.

Step#1 is to design a mosquito trap.

Step#2 is to determine the factors necessary to catch Mosquitos.

Step#3 is to process mosquitos to get nucleic acids isolated and purified for testing.

Step#4 is to develop a PCR tests for mosquito DNA.

Step#5 is to develop a PCR tests for Human DNA.

Step#6 is to design primers for arboviruses of interest and the last step is to monitor the mosquito population using these PCR tests for arboviruses.

B. Briefly describe specific project(s) for your teacher

Any project listed above plus any techniques that our lab has experience with. Last year we developed an electrophoresis module with Dr. Daft.

C. Will any other people (post docs, grad students, undergraduate students, colleagues, etc.) be involved directly with your teacher?

Maybe, but it will mostly be me. You will also work with the students in my lab during the summer.

D. Will you require any advanced reading/preparation for the teacher? If yes, please briefly describe.

I have material for them. (lab procedures for our specific lab, literature) I will provide all material needed for training, techniques and literature.