School of Natural Sciences and Mathematics

Undergraduate Research Presentations

Friday, July 12, 2024

9:00 a.m.

James S. Thomas Science Building, Room 226

Dr. Verlie A. Tisdale, Acting Dean

Program

Opening/Welcome.....Dr. Randall Harris
Associate Professor of Biology

9:15 a.m.....Daour Dieng

9:30 a.m.....Rori Goff

9:45 a.m.....Oluwademiladeayo Ashade
Ayanna Moultrie
Sterlin Carson

10:00 a.m.....Jy-Nese Spivey

10:15 a.m.....Aziana Moultrie
Sequoia Harris

10:30 a.m.....Closing Remarks

ABSTRACTS

Improving the bioavailability of potential active pharmaceutical ingredients

Researcher: Daour Vivenne Dieng

Research Mentor: Dr. Bijoy Dey

My research is about improving the bioavailability of potential active pharmaceutical ingredients (API). My focus is to create amorphous forms of drug by mixing the drug with a polymer. I use X-ray crystallographic spectra and infrared spectra to characterize the drugs. The research is ongoing and I have made some progress in understanding the field of research.

Understanding Radical Scavenging Mechanisms of Phenolic Compounds and it's Derivatives

Researcher: Rori Goff

Research Mentor: Dr. Bijoy Dey

Oxidative stress, a result of overproduction of free radicals in our body poses a high risk to human health. The counterpart, Antioxidant protection, is essential to minimize the harmful effects of oxidative stress. Phenoxy compounds and its derivatives are known to be one such potent antioxidant, and hence, it is important to understand the properties of and the modes of reaction (often called radical scavenging mechanism) of these antioxidant chemicals. There are three mechanisms proposed such as hydrogen Atom transfer (HAT), Radical adduct formation (RAF) and single electron transfer (SET). In this poster our focus is the HAT mechanism for the phenoxy compounds and a host of its derivatives in order to compare and contrast the antioxidant protection of these compounds. The results presented provide a thorough understanding of the HAT mechanism and the characteristics a compound must have to be a potent antioxidant agent. We have used density functional theory implemented in the Gaussian16 software widely used in computational chemistry community.

Antibiotic Production by Bacteria Isolated From Francis Beidler Forest Soil Samples

Researchers: Aziana Moultrie, Sequoia Harris, Ayana Moultrie

Research Mentor: Dr. Randall H. Harris

Antibiotics are critical for treating and preventing bacterial infections by either killing the bacteria or inhibiting their growth. However, bacteria are increasingly becoming resistant to antibiotics, with the World Health Organization predicting that by 2050, antibacterial drug-resistant infections will cause 10 million deaths annually worldwide. The growing need for new antibiotics has led to a renewed focus on natural products from underexplored environments as a source for antimicrobials. Francis Beidler Forest is an 1800 acre Audubon wildlife sanctuary that is relatively undisturbed, making it a potential source of environmental microbes that produce antibiotics. The

purpose of this project was to determine if bacteria cultured from Francis Beidler Forest soil samples produced an antibiotic and to identify them at the genus and species level. Twenty-four bacterial isolates were cultured on Luria Bertani (LB), Reasoner's 2A agar (R2A), or Brain Heart Infusion (BHI). The bacteria were then co-cultured with *Micrococcus luteus* and the ESKAPE pathogens (*Enterococcus faecalis, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa,* and *Enterobacter* species) to screen for antibiotic production. Sixteen bacterial isolates demonstrated zones of inhibition against *M. luteus* across all media. Of those, nine bacteria made a zone of inhibition against *S. aureus* on LB and BHI. In addition, one of those nine bacteria made a zone against *A. baumannii* on the same media. To further identify the bacteria, PCR and agarose gel electrophoresis of the 16S rRNA gene were conducted on colonies from the antibiotic-producing bacteria. The gel electrophoresis showed a band of 1500 bp for seven of the nine samples. The 16S rRNA gene sequence analysis revealed that five of the bacteria were *Pseudomonas chlororaphis* and two were *Pseudomonas paracarnis*. We have shown that soil samples from Francis Beidler Forest contain antibiotic producing bacteria. Selected isolates will have their genomes sequenced to examine them for biosynthetic gene clusters responsible for antibiotic production. The size of Francis Beidler Forest makes it an attractive site for further exploration.

The fight against antibacterial resistance using Bacteriophages therapy

Researchers: Ashade Oluwademiladeayo, Ayanna Moultrie, and Sterlin Carson

Research Mentor: Dr. Omar Bagasra

Bacteriophage therapy, better known as phage therapy, is the use of bacteriophages for the treatment of pathogenic bacterial infections. The sole purpose is to selectively target and kill bacteria that are multi- drug resistant bacteria to save a life from infections. With bacteria becoming stronger against antibiotics, scientist found that phage therapy has become a new and innovative way of kill multi-drug resistant bacteria, and due to an observed latency in the body, be available to fight future infection. The main concern is finding out what superbugs are, how are they become overexposed to other bacteria that may have the specific mutated gene that makes them antibiotics resistant, and how to gain approval from such organization as the Food & Drug Administration (FDA) and the World Health Organization (WHO) for the use of phage therapy to help impact human health and the longevity of life.

These “superbug” are strains of bacteria that are resistant to most antibiotics and other medications commonly used to treat the infections they caused. These superbugs are created from misuse of antibiotics. When theses antibiotics are overused or misused the bacteria becomes overexposed by taking genetic material from other bacteria that is resistance to the antibiotic and mutations to survive. Three main superbugs are *Carbapenem-resistance Enterobacteriaceae* (CRE), *Methicillin-resistance Staphylococcus aureus* (MRSA), and ESBL- *producing Enterobacteriaceae* (extended- spectrum β-lactamases).

During our research in Dr. Bagasra’s lab we learned how to isolate bacteriophages from MRSA at large scale and purify them using Maxi-Prep method.

Cervical fracture-detection Using CNN Approach

Researcher: Jy-Nese Spivey

Research Mentor: Dr. Shrikant Pawar

Cervical fracture-detection Using CNN Approach In a human's neck there are seven bones known as cervical vertebrae,they are listed as C1(Atlas/top bone)-C7(bottom bone). These bones are supporting and connected to your vertebral column , also referred to as your spine. The potential risk of paralysis or fatality rises if there is severe damage from the vertebral column that leads to damage of the cervical spinal cord and impair the central nervous systems connection between the brain and body. Older adults seem to have a high risk of fractures and are more likely prone to death from a cervical fracture. As a researcher my focus is to identify fractures using CT scans of the cervical spine at both the level of a single vertebrae and the entire patient. The aim of my study is employing Convolutional Neural Networks (CNNs) to predict the risk of cervical vertebra-related conditions from CT scans. These networks are efficient at image analysis , making them ideal for this task after programming them to independently learn and identify intricate patterns and features with visual data from the CT. With the development of my convolutional neural network (CNN) model will achieve impressive high results of validation and test accuracy. The AI model will help detect anomalies in bone structure, signs of degeneration, or other pathologies that contribute to increased risk of cervical spine conditions will be excelled with the use of CNNs processing the complex details of CT images. This is a crucial part for research because detecting and determining the location of any vertebral fractures is essential to prevent neurologic deterioration and paralysis after any trauma.