Student Research Summaries

Karen Conrad

Mentor: Prof. Jason Rauceo

Phenotypic Characterization of HOT1 in *Candida albicans*

Abstract

Our lab studies the fungus *Candida albicans* the organism that causes vaginitis and diaper rash; however, in immunosuppressed individuals infections may lead to death. We aim to understand the molecular genetic control of genes that are active while this fungus is "infective". Our work has identified a set of genes that might be active in *Candida* during urinary infections. Our project uses molecular biology techniques to study the function of these genes and how does it contribute to "infectivity".

Stephania Guzman

Mentor: Prof. Nathan Lents

Analysis of the Human Microbiome on Living and Decomposing Bodies

Abstract

Our project is focused on the changes in the composition of bacterial populations in the skin of dead and live subjects. The aim for this research is to determine if these changes can be helpful in establishing time of death and other information in forensic investigations. Our preliminary analysis reveals a great amount of diversity in the bacterial communities from person to person and an even greater amount of diversity in the bacteria found in the cadaver samples. We also find common types of bacteria present in human skin as the subject decomposes. Next, we will

study more in depth the bacterial composition of these communities using High-throughput DNA sequencing.

Imani Hargett

Mentor: Prof. Lissette Delgado-Cruzata

Studying Perceived Educational Barriers, Coping Strategies, and Persistence of Minority Women in the Sciences at John Jay College

Abstract

While the number of minority women in the science undergraduate majors has increased in the last decade, the number of women in these ethnic groups who pursue a career in the sciences has not increased accordingly. Similarly, the fraction of minority women who continue to study sciences at the graduate level has marginally increased and overall remains very small. We want to explore the various barriers that may be attributed to these low numbers, the coping strategies that are being employed to overcome those barriers, and the overall effects both of these have on persistence within the STEM majors. We conducted an online questionnaire using the Perception of Barriers (POB) Scale, Coping with Educational Barriers (CWB) Scale, and Identification with Major Scale in students who are Forensic Science majors at John Jay College. We found that women displayed a higher perception of barriers concerning their future careers compared to their male counterparts and that perception of career-based barriers is lower for students whose mother had a higher education level. More importantly, we found that persistence in the major and the perception of educational barriers are inversely associated; students with a higher perception of educational barriers show lower persistence.

Richard Khusial

Mentor: Prof. Anthony Carpi

The Role of Temperature and UV Light in the Reduction of Mercury (II) Chloride to Elemental Mercury

Abstract

Mercury, a toxic element emitted from many industrial processes, moves into the vapor phase easily and is readily transported in the environment. Our research looks at the mechanisms of

mercury vaporization. We hypothesize that exposure to UV light and heat will cause the conformational changes in mercury compounds required for it to be released into the environment. Our preliminary results show that temperature may affect mercury emissions. Further analysis will include multiple samples run at the same temperature and at different temperatures.

Cristina Kinahan

Mentor: Prof. Gloria Proni

Separation and Spectroscopical Characterization Complemented with Computational Analysis of Methamidophos, N-methyl Methamidophos and Acephate

Abstract

Our lab studies the toxic effects that different forms of organic pesticides have. My work involves the development of new and more efficient ways to separate the components present in the pesticides N-methyl-methamidophos, methamidophos, and acephate, and test their individual toxicities. We aim to inform both the insecticide-manufacturing industry and consumers of the potential damage caused by some of the components of these types of pesticides.

Erica Klafehn

Mentor: Prof. Angelique Corthals

Post-Mortem Analysis of the Histomorphology of Trauma in Swine

Abstract

In the field of forensic science, and especially in forensic anthropology, human remains can be discovered days, even years after death occurred. As scientists and researchers, we are trying to determine if we can distinguish certain characteristics in deep tissue morphology that result after intact tissue undergoes a variety of types of trauma: ballistics (gun shot), sharp tool mark (knife wound) and blunt force. The objective of this ongoing project is to gather more information pertaining to specific types of trauma on decomposed tissue and be able to identify the type of trauma inflicted since the number of conducted, peer-review studies are sparse.

Anna Lerer

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Mentor: Prof. Nathan Lents

Zinc Reduces the Detection of Tetrahydrocannabinol by ELISA Urine Testing, While Copper May Cause a False-Positive Result

Abstract

In today's work place, many adulterants are used in an attempt to pass a routine drug test. Zinc sulfate has been observed to have such an adulterating effect on urine in acute marijuana smokers and may cause a false negative in a standard urine drug test. Zinc does not interfere with the integrity of the urine, possibly making it an effective adulterant. This study focuses on testing the effect of zinc sulfate on Tetrahydrocannabinol (THC, the active ingredient in marijuana) levels in urine obtained from human subjects. Zinc was observed to cause a false-negative result in a standard drug test. The higher concentrations of zinc in the urine samples were observed to have a stronger adulterating effect. Our next step is to refine our study, and to evaluate possible solutions that would eliminate the effect caused by zinc in THC testing.

Herold M. Menier

Mentor: Prof. Peter Diaczuk

A Noninvasive Cleaning Method of Primer Impression Marks

Abstract

Every time a firearm is fired, it leaves behind a cartridge case that crime scene investigators must find before it can be used as incriminating evidence against a suspect(s). Unfortunately, cartridge cases are not always found after the initial investigation and as such, these incriminating piece(s) of evidence can be left buried for weeks to months at a time, allowing them to slowly corrode and be destroyed by environmental degradation. Our work measures how long it would take for environmental degradation effects to corrode the impression marks left on a cartridge case to the

point that it is no longer viable as evidence. To date, this research has shown that colder weather impedes the corrosion process, while warmer and moist weather accelerates it. We plan to further investigate the effects of the environment with respect to soil composition in different seasons, and different cartridge case types.

Jazlene Montes

Mentor: Prof. Shu-Yuan Cheng

The Effect of Manganese-Containing Dithiocarbamates on Activated Double-Stranded RNA Dependent Protein Kinase (PKR) and Mammalian Target of Rapamycin (MTOR) Signaling Pathways

Abstract

Environmental factors may play a critical role in the development of neurodegenerative diseases. Having low cognitive performance and previous pesticide exposure may increase the risk of developing Alzheimer's disease (AD). AD is a neurodegenerative disease, which is characterized by a progressive decline of memory. Preliminary work from our lab has showed that the manganese-containing pesticides dithiocarbamate, maneb (MB) and mancozeb (MZ), can increase the production of one of the proteins involved in the neurodegeneration suffered by AD patients. Using biochemical and molecular biology techniques, our work has shown that MB and MZ increase the activation of one of the genetic factors linked to development of AD. Our next step is to determine the molecular mechanisms behind the link between AD and exposure to pesticides.

Jae Hyuk Oh

Mentor: Prof. Hunter Johnson

Distinguishing a Frog Species Through a Mobile Application

Abstract

This research project is designed to aid biologists to identify existing frog species and to distinguish between existing and novel frog species by utilizing their unique voice spectra. The main goal of this work is to engineer an Android-based smartphone/mobile application to

recognize and distinguish frog species by using the built-in microphone available on common smartphone hardware to record their unique vocalizations and the "app" to then analyze them.

David J. Rodriguez

Mentor: Prof. Artem V. Domashevskiy

Studying Interactions Between Pokeweed Antiviral Protein (PAP) and Fluorescently Labeled Tobacco Etch Virus RNA

Abstract

Our lab studies the interactions between an antiviral protein discovered in pokeweed and viral nucleic acids. This interaction effectively inactivates various viruses (including several human viruses), inhibiting infection. Our work aims to develop a new method to study the interaction between viral nucleic acids and this pokeweed-derived antiviral protein. Our future plan is to develop ways to target this protein for human diseases, effectively creating new treatments for viral diseases like HIV and Hepatitis C.

Danielle Rouse

Mentor: Prof. Anthony Carpi

The Reduction Mechanism of Mercuric Oxide in the Environment

Abstract

The research our lab conducts focuses on examining the mechanisms of reduction of mercuric species like mercury(II) oxide to elemental mercury, and its flux from environmental surfaces like soil. In an effort to understand the mechanisms by which mercury (II) oxide can undergo reduction to elemental mercury, a series of laboratory experiments and molecular modeling studies will be conducted. We hypothesize that levels of elemental mercury emitted from mercury (II) oxide doped samples exposed to low energy light will be significantly higher than controls.

Shantoi S. Shaw
Mentor: Prof. Aftab Ahmad

Universal Interfaces for App Development

Abstract

Our research focuses on designing universal interfaces for software app development. With the help of such interfaces, future computer scientists can create new apps in a short period of time just by making a block diagram with arrows connecting the various blocks. As a start, our first application will be designed for Android Operating System (OS), because of its flexibility and open interfaces. Subsequently, we will research a set of code snippets for various atomic block diagrams that could be composed together into complex applications.

Derek Sokolowski
Mentor: Prof. Nathan Lents

DNA-Based Forensic Analysis of Plant Phylogenetic Identification Using Chloroplast DNA Derived from Plant Pollen and Plant Leaves

Abstract

Crime scene investigations utilize tools that are designed to connect suspects to crime scenes and/or the victim's body. However, physical evidence derived from plants (pollen, for example) is easily mismatched to its host specimenied using current methods, such as microscopy. The use of molecular genetics to identify plant pollen and plant leaves found on the human body will go beyond the work of microscopes and advance the accuracy of identification. By extracting DNA from both plant pollen and leaves and creating specialized markers for sequences of an individual species, we hope to be able to connect victims, suspects, crime scenes, and other past locations and activities. These tools will offer considerable value to forensic investigations.

Fidelis Tan

Mentor: Prof. Yi He

Determination of Trace Level Cadmium in Hudson River Water Samples Using Graphite Furnace Atomic Absorption Spectrometry (GF-AAS) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Abstract

Cadmium (Cd) is a toxic metal ion that is found in the Hudson River, due to contamination caused by battery plant factories that manufactured cadmium-nickel batteries in Cold Spring, for military and commercial use from 1953-1962. Cd can be ingested and inhaled by humans, and as a result can travel through the bloodstream and deposit at various organs, especially the liver and kidney, causing permanent and serious damage to the body. The Hudson River was categorized as one of nation's longest and largest superfund sites (places where hazardous wastes are located), contaminated with severe hazardous wastes. We are developing new techniques to determine the levels of Cd in water samples collected from the Hudson River using state-of-the-art analytical chemistry tools. These techniques can detect toxic metals down to "part per billion (ppb)" concentrations. Our work will allow for better detection of Cd in the waters surrounding NYC and can help establish a better environmental monitoring system.

Carlos E. Texeira

Mentor: Prof. Anthony Carpi

Using Bird Feathers as Bio-Monitors of Mercury in the Environment

Abstract

Mercury is a naturally occurring element found in the environment in various forms. Organic mercury bio-accumulates in the food chain, reaching concentrations of biological significance in some animals and humans. The purpose of our research is to develop a standard reliable methodology that will produce replicable results of concentrations of mercury in bird feathers. We quantified merury in species of guinea fowls, zebra finches, tree swallows, red bill magpies and peacocks, which were collected from different areas in and around New York City as well as opportunistic samples found near a local zoo. Samples of bird feathers were also obtained from

the Bronx Zoo's Wildlife Conservation Society. Our data suggests that bird feathers have the potential as a bio-indicator of mercury in the environment as different feathers showed different levels of the metal. After determining a reproducible method, further research will be conducted to compare mercury intake of birds from the same species at different locations or to compare mercury intake from birds of different species.

Shawn Williams

Mentor: Prof. Artem V. Domashevskiy

Examination of the Effects of Translation Initiation Factors on PAP-RNA Interactions

Abstract

Pokeweed (*Phytolacca Americana),* a mildly poisonous weed prevalent throughout the State of New York, produces "Pokeweed antiviral protein" (PAP). PAP possesses broad spectrum antiviral properties by modifying the nucleic acids present in many viruses and thus lowering the infectivity of many plant viruses. Work from our lab has determined that PAP is also effective against animal viruses, suggesting it could be used in the treatment of many human diseases. Our work is trying to determine the regions in the viral nucleic acid that PAP binds, using biochemical techniques that employ steady state fluorescence. We found that PAP binds strongly to a conserved region of the several plant viruses and that this binding is influenced by the structure of the viral nucleic acids. Ultimately, we aim to develop PAP as an antiviral therapeutic agent.

Veronika Yakovishina

Mentor: Prof. Regina Sullivan at Queensborough Community College

Study of the Cytotoxic Effects of Carbon Nanotubes on Breast Cancer Cells

Abstract

Breast cancer is a major health concern in America today, with statistics showing that approximately 1 in 8 women in the U.S. will develop invasive breast cancer in her lifetime. It is critical to develop new and innovative methods to treat those with breast cancer without encountering the uncomfortable side effects that typically arise during current treatments. Single-

walled carbon nanotubes (SWNT), nanometer-scale tube-like structures, have been proposed as possible candidates for drug delivery vessels; however little is known about the cytotoxic effects of these particles. We will focus on studying the effects of single-walled carbon nanotubes on the mortality and proliferation as indicators of cytotoxicity of MDA MB 231 and MDA MB 468 cell lines. We found that breast cancer cells treated with SWNT have a higher percent of cell mortality as opposed to untreated cells. Our next step is to extend this work to different kinds of cancer tissue cells.

Shari Yarde

Mentor: Prof. Anthony Carpi

The Role of Water and pH in the Reduction of Mercury (II) Chloride to Elemental Mercury

Abstract

Mercury is a neurotoxin that has varying behavior in the environment depending on its chemical form. Elemental mercury (Hg°) is a toxic air pollutant that is volatile and deposits into terrestrial and aquatic systems after being oxidized in the atmosphere to divalent mercury (Hg^{2+}). Hg^{2+}can be reduced on environmental surfaces to Hg^{0} and released again to continue the cycle in the atmosphere. Variables such as moisture, UV radiation, temperature, and oxygen/oxide radicals have been proposed to affect the reduction of the metal on surfaces and the subsequent transport of mercury. Our research studies the mechanisms of the reduction of Hg^{2+} to Hg^{0}, specifically how the acidity of water and soil affects mercury reduction in soil.