PRISM
at JOHN JAY COLLEGE
PROGRAM FOR RESEARCH INITIATIVES IN SCIENCE AND MATH

Undergraduate Research CHRONICLE

2016

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engage

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examine

build connections

question

choose your future

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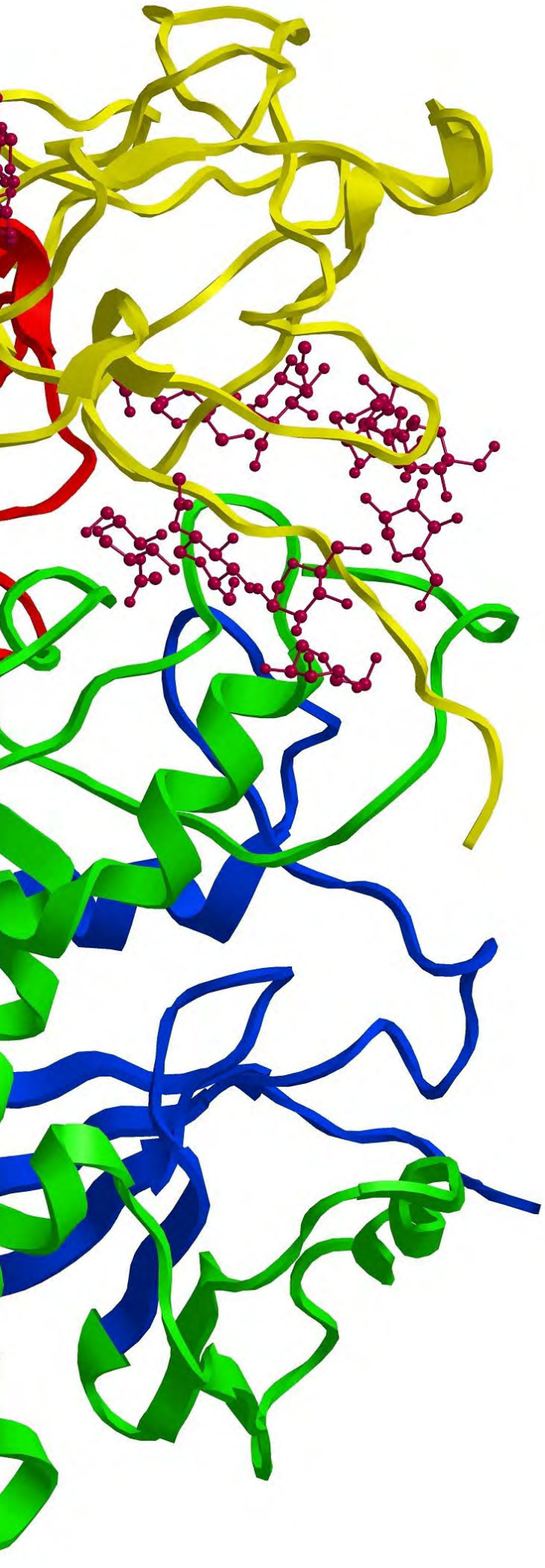

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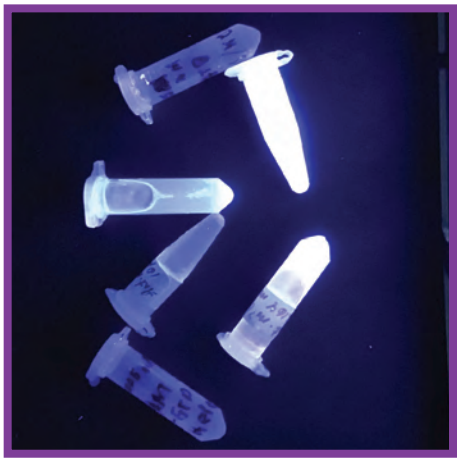
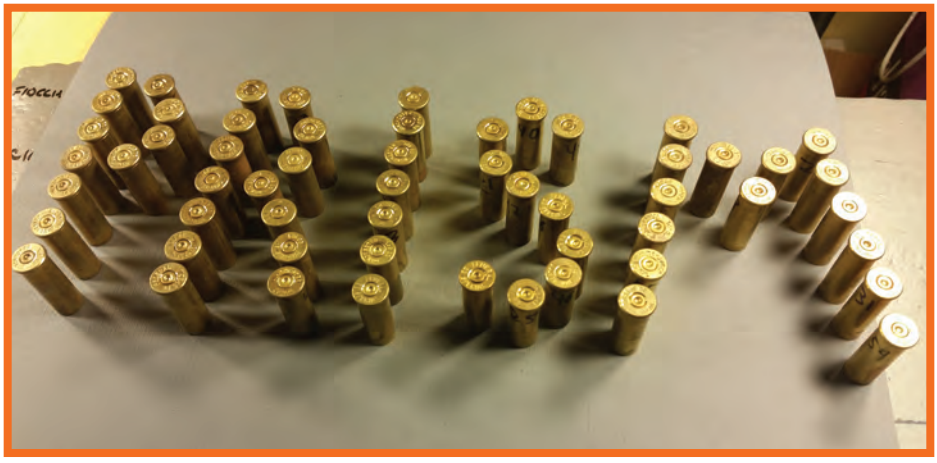
> “We are here to celebrate their success...as scientists, as mathematicians, and as individuals.”





ANTHONY CARPI
PRISM Director's Letter

"THE ROAD NOT TAKEN"

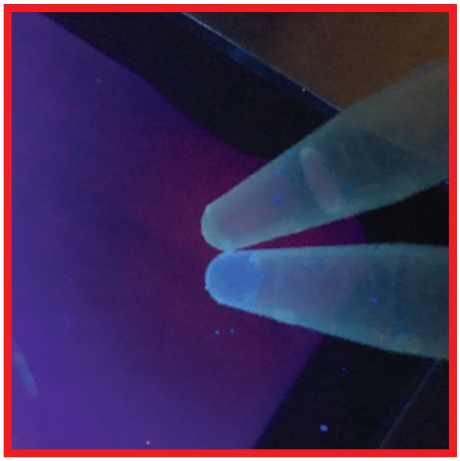
It was 100 years ago that Robert Frost penned the iconic lines:

> *Two roads diverged in a wood, and I—*
> *I took the one less traveled by,*
> *And that has made all the difference.*

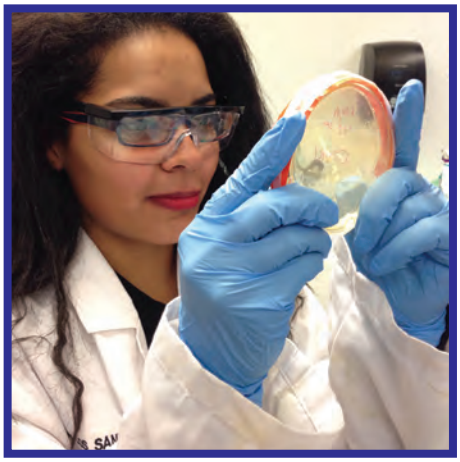
The poem has as much meaning today as then. Many of our students are first-generation college students, many work while attending college, a large number report speaking a language other than English at home, and quite a few are attending school while raising children or caring for family. These are not the traditional students we find in science and mathematics. They have persevered against significant odds and even prejudice. The road has been tangled in undergrowth, in the words of Frost. And yet we are here to celebrate their success—their success as scientists, as mathematicians, and as individuals.

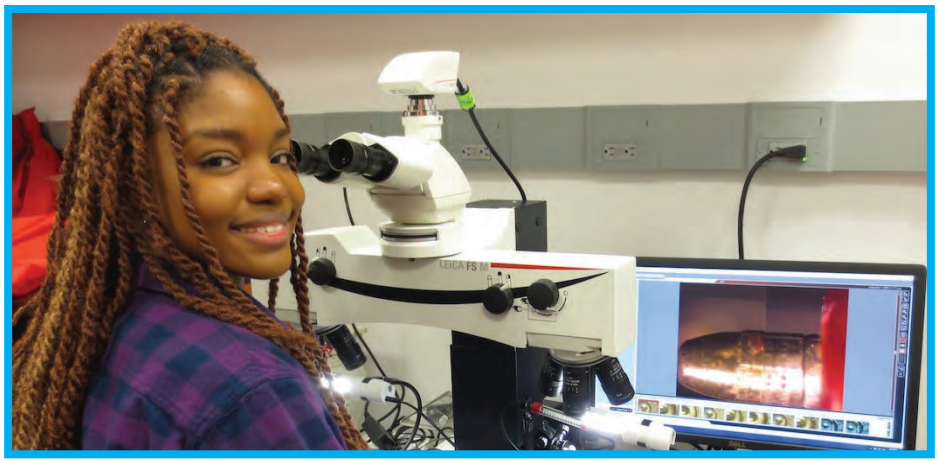
The studies presented in this *Chronicle* are a testament to the depth and breadth of their hard work. Whether it is research investigating anti-cancer drugs, examining evidence left at a crime scene, creating models to identify frog calls, or understanding cortical neurons, the work they are doing is impactful and ground breaking. And many are now preparing for the next stage in their journey. Students including Jiwon Seo, Porfirio Fernandez, Shanelle Shillingford, James Parziale (PRISM class of 2015) and Anna Stoll (PRISM Class of 2013) are deciding on offers from top-tier graduate programs such as those at Brown University, NYU, Yale, Columbia, Cornell and the Universities of Chicago, Michigan, and Stony Brook. They have taken the road less traveled, and are now making all the difference.

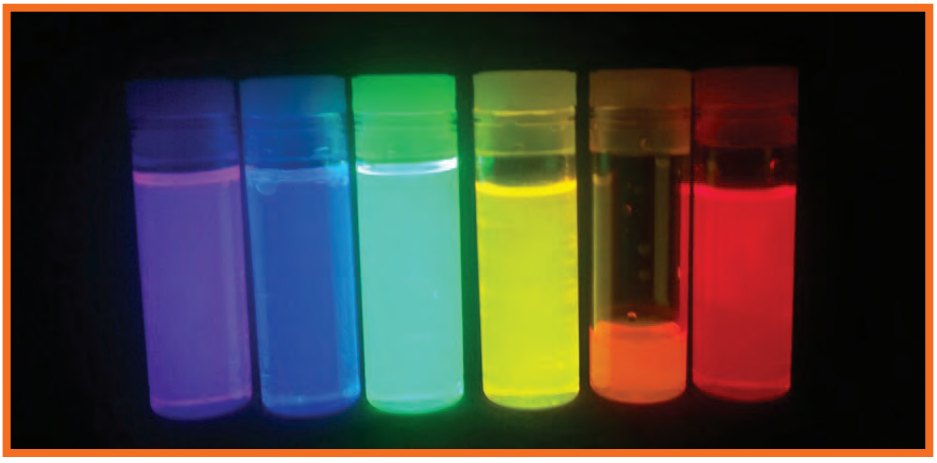
Congratulations to all of the students, and faculty mentors, featured in this *Chronicle*. May the road continue to lead to your success.



> “Science has always been intriguing to me because it never stays constant.”
>
> – Zenab Khan (page 18)







UNDERGRADUATE RESEARCHERS

William Aguilar

Science plays an important role in my life and has provided me with many opportunities to support myself and my family. I never knew I had such a passion for science until I took my very first college chemistry course. I am currently working on my BS in Forensic Science with a minor in computer science. Eventually I plan to apply to MD/PhD programs. My goal is to become a well-respected member of the scientific community. To achieve my goal, I actively participate in undergraduate research at JJC as part of the PRISM Undergraduate Research Program and plan to partake in many more events and opportunities.

Research Summary

My research focuses on two DNA alkylating agents: Mitomycin C and Decarbamoyl mitomycin C. The former is an anti-cancer drug and the latter a derivative a MC lacking a functional group. These agents modify DNA similarly and prevent DNA replication, causing cell death. However, cell death is activated via different pathways in each case. By understanding how the difference in DNA modifications caused by the two drugs provokes different cell deaths, we can potentially design drugs tailored to specific cancer cells and increase the efficiency of chemotherapeutic drugs.

Correlation of MC and DMC-adducts Structures with the Role of p21 in the Toxicity of the α-ICL and β-ICL (Dr. Champeil)

Mitomycin C (MC) is a DNA alkylating agent used to treat certain cancers. Its cytotoxicity is attributed to the formation of DNA-adducts, in particular the formation of interstrand cross-links (ICLs). Decarbamoyl Mitomycin C (DMC) is an MC derivative. When human cancer cells were treated with DMC and MC, it was found that DMC was more toxic than MC. Our goals are to synthesize MC and DMC DNA adducts and to determine the reasons for the stereoselectivity of DMC which forms beta, or cis adducts with DNA. Later, we will determine the mechanisms of MC and DMC DNA-adducts biological responses. To date, we have separated and identified the products resulting from the reaction of both MC and DMC with deoxyguanosine. In the case of the mono functional activation, the adducts formed by DMC were 66.7% alpha and 33.3% beta whereas the proportions were 63% alpha to 37% beta for MC in aqueous media. When DMSO was used as the solvent, the ratio was 87.5% alpha to 12.5% beta for MC and 88.6% alpha to 11.4% beta for DMC. These results clearly demonstrate that the mono functional activation favors the formation of alpha adducts with both drugs.

Valentina Aitbakieva

I was born and raised in Russia. Before coming to the United States I attended the University of Cinema and Television in St. Petersburg, majoring in electrical engineering. During my first few years living in America I dedicated most of my time to exploring American culture. Although I cannot remember exactly when and how I became interested in science, I can say with certainty that it is my future career path. Science is an open field, and molecular biology seems the most probable opportunity for me to make a difference while enjoying my work. Despite the fact that I am uncertain which specific career I wish to pursue permanently, I am confident that my participation in PRISM will lay a solid foundation for making that decision.

Research Summary

My research work is dedicated to comparing the antiviral activities of various forms of a protein produced by the common pokeweed plant. Identification of the most potent form may contribute to the development of treatments for various human diseases caused by viruses.

Isolation and Characterization of Different Isoforms of Pokeweed Antiviral Protein (PAP) from *Phytolacca americana* (Dr. Domashevskiy)

Ribosome inactivating proteins (RIPs) are widely distributed in plants. Their antiviral, antibacterial, and antifungal biological activities indicate that RIPs are major contributors to the plants defense mechanisms. RIPs prevent viral infections by inhibiting protein synthesis and inactivating host ribosomes. *Phytolacca americana* (common pokeweed plant), produces pokeweed antiviral protein (PAP), a type 1 RIP. PAP possesses high antiviral activity, yet exhibits lower toxicity toward eukaryotic cells, unlike type 2 RIPs (such as ricin from *Ricinus communis*). There are nine distinct isoforms of PAP, developing in different parts of the plant throughout its lifetime. Several isoforms exhibit stronger enzymatic activity than others (e.g., PAP-S isolated from seeds). The exact mechanism by which PAP selects its viral RNAs is not well understood, and is the interest of our research. The essence of my project is to isolate and characterize PAP isoforms, while comparing their enzymatic activities towards tobacco etch virus RNA. This research will contribute a greater understanding of how PAP exerts its antiviral activity, potentially finding several applications, including biomedical and agricultural. Our future goal is to investigate liposomal encapsulation of the most potent PAP isoform, to be used for the treatment of myriad human diseases caused by viruses, from influenza to HIV.

Maria Anaya

At eight years-old my mother bought me a children's anatomy book that completely fascinated me and sparked my interest in science. My mother's diagnosis with Multiple Sclerosis, a neurodegenerative disease, increased my motivation to pursue neuroscience research. As part of the CUNY Justice Academy, I had the privilege to join PRISM which funded my research. I am fortunate to be mentored by Dr. Tsimounis, who is a tremendous inspiration and taught me a valuable lesson: to be successful in science, one must have an infinite amount of dedication to your research project. Recently, I received a travel scholarship to the Annual Biomedical Research Conference for Minority Students (ABCRMS) and an award for my neuroscience poster presentation. My major is molecular biology, and plan to pursue a MD/PhD.

Research Summary

Our work focuses on understanding how neurons in the cerebral cortex (outer layer of the brain) connect to other regions of the brain. Our goal is to determine the structural characteristics that differentiate groups of neurons and their corresponding roles. To accomplish this, we are using fluorescent labeling of neurons together with computer software to classify neurons in the barrel cortex of mice.

Morphological Characterization of Supragranular Neurons in the Primary Somatosensory Cortex (Dr. Tsimounis, Queensborough Community College)

The cerebral cortex is the outer covering of gray matter in the mammalian brain. It is involved in higher order functions like touch sensation. We are conducting a morphological analysis of supragranular neurons in the mouse barrel cortex, which receives sensory input from the whiskers. Our purpose is to determine the morphological characteristics that differentiate groups of neurons and their corresponding roles. Tissue slices are processed with DiOlistics to reveal the morphology of individual neurons. *In vivo* injections of fluorescent beads in primary motor cortex (M1) label the neurons projecting from the barrel cortex. Computerized 3D reconstructions of neurons are generated, and morphological parameters measured. Principal component analysis and cluster analysis are applied to the measurements and six morphological classes have been identified: (1) largest neurons with the most extensive dendrites; (2) large neurons with high soma compactness; (3) medium sized dendritic trees; (4) small neurons with the lowest soma compactness and roundness; (5) small neurons with longer dendrites and higher basal length; (6) smallest neurons. Additional cells are being added to the database and the identification of neurons specific to the M1-barrel cortex circuit will be completed. Finally, sensory deprivation is being used to determine if neuronal activity affects neuronal morphology.

Brianna Bell

Ever since I can remember, I have always had an interest in science, especially chemistry. In high school, I fell in love with forensic science. After attending Long Island University (Post campus) for two years, I transferred to John Jay College. The toxicology track allows me to combine my love for forensic science and chemistry in a fun and interactive way. I am in my fourth semester at John Jay and very pleased with all of the opportunities available at this institution. Besides being a part of PRISM, I am a math and science peer tutor and involved in student organizations. My goal is to work as a forensic drug chemist with the Drug Enforcement Administration (DEA). I know that this will be achievable with all of the skills I am learning at John Jay College and through my research with Dr. Champeil.

Research Summary

My research focuses on the composition of Adderall, a highly abused drug of interest for athletes and college students. Determining the ratio of the two forms of the amphetamine drug found in Adderall will help in recognizing the difference between a prescribed form of Adderall and an "off the market" form.

Using Mixed Salt Preparation of Adderall to Detect the D- and L- Enantiomers of Amphetamine (Dr. Champeil)

Adderall is a central nervous system drug that is prescribed to individuals who are diagnosed with narcolepsy (a chronic sleeping disorder) and/or attention deficit hyperactivity disorder (ADHD). Adderall is composed of amphetamine salts, specifically a combination of d-amphetamine and l-amphetamine, which are enantiomers. Amphetamines are used to increase the release of norepinephrine and dopamine—which are neurotransmitters—in the brain, while also blocking reuptake. The drug increases the individual's ability to concentrate by restoring the balance of the aforementioned neurotransmitters. Due to its fast acting effects, Adderall is often abused for recreational purposes. Because the ratios of d- and l-enantiomers vary based on the drug's origin, a great way to recognize illegal production would be to develop a method to calculate the ratio of the 2 enantiomers. We hope to create such a technique to determine the difference between a prescribed form of Adderall and an "off the market" form using nuclear magnetic resonance (NMR) spectroscopy. Our hypothesis is that we will be able to determine the ratio of d- and l-amphetamine using NMR spectroscopy and the chiral shift reagent (S-PDTA) in an aqueous-based media.

Maria Alejandra Faure–Betancourt

I was born in Caracas, Venezuela and at the age of 10 moved to Brooklyn, NY with my family. I am 23 years-old and majoring in forensic science. This field has always fascinated me, even at a young age. After receiving my bachelor's degree, I hope to attend medical school and become a pathologist. In addition, I would like to open my own funeral home. People are usually intrigued by this choice, and my answer to them is that I pursue this for spiritual reasons. I practice Sukyo Mahikari, a Japanese religion that involves the transmission of light energy purifying the spiritual aspects of people and things. I strongly believe that by putting into practice my spiritual beliefs, I can somehow help souls reach a higher spiritual level and in some respect bring comfort to their loved ones.

Research Summary

The goal of my research is to chemically modify tea leaves so they can better absorb toxins in water. We are currently working with green, peppermint and chamomile tea. We believe this has the potential to be a low cost method to decrease the percentage of pollutants in contaminated waters.

Modifying Functional Groups in Spent Tea Leaves for Waste Processing Applications (Dr. Iyengar, Queensborough Community College)

Tea leaves are used in society for many purposes, including digestion, stress reduction, and anti-inflammation. Modern society has taken advantage of their health properties and manufactured bottled-tea drinks such as Arizona, Nestea, Brisk, and Snapple. These industries produce millions of bottles of tea and spent tea leaves (STL) as a side product. Spent tea leaves are mostly composed of various bio-polymers, including cellulose and fibers. Previous studies have reported that raw solid waste STL have a high affinity towards heavy metals and organic pollutants. These reports indicate that organic functional groups such as hydroxyl, carboxyl and amino are responsible for this adsorption. We are carrying out organic chemistry reactions to modify the cellulosic structure of tea leaves. Our hypothesis is that increasing functional groups will maximize the interaction between STL and pollutants by increasing its absorption properties. STL will be made by extracting organic materials from commercially available tea bags, simulating the solid wastes that are produced by tea-based companies. The process of extracting the tea leaves initially with water, followed by organic solvents will generate the cellulosic material needed for performing the chemical modification. These chemically-modified materials will be used in adsorption experiments.

Make-up Foundation

Ashley Brown

Science has always been a subject of great interest to me. As a child, I remember being fascinated watching the television show *Bill Nye the Science Guy*. I never missed a single episode; loving the short experiments he performed and feeling satisfied after truly understanding the concepts behind them. Long before high school I was interested in making visual and conceptual comparisons in science, and loved performing experiments. Despite this love of all things science, it was not until I was introduced to instrumentation and the concept of toxicology in organic chemistry that I began to consider a scientific career. While searching for a senior college, a friend mentioned John Jay. Soon I was attending John Jay. PRISM research has been a great way for me to delve into instrumentation and analyzing chemical fingerprints. My career goal is to pursue a career in toxicology mainly in chemical identification.

Research Summary

My research work focuses on identifying touch DNA on ATR instrumental analysis along with the most popular fabrics in clothing. This can help to identify the specific clothing and substances left behind in areal life (crime scene) situation.

Identification and Individualization of Cosmetics by ATR-FT/IR, and Ramen Spectroscopy (Dr. Kubic)

Fourier transform infrared spectroscopy (FT-IR) is an instrumental technique for chemical analysis that distinguishes an array of samples including cosmetic foundations. FT-IR measures the vibrational patterns of functional groups to correctly identify them. These vibrational patterns can be found in most samples known to man. Due to the powdery nature of foundations, it is easily transferred to other materials. Residue left behind from the make-up is usually a smudge or a smear. In the case of a crime, foundations can be analyzed by FT-IR analytical techniques. This analysis is further assisted by a spectral database to help forensic scientists, easily and efficiently detect the brand of foundation. The experiment is carried out by swabbing foundation and mixtures of foundations onto cloth then gently applying the sample onto a diamond ATR (Attenuated Total Reflection) crystal and collecting a spectrum. The material is then cleared from the spectral background solely leaving the cosmetics shown. The FT-IR readings are then compared to a spectral database resulting in matches compared to brand and line. Shade cannot be determined even by visual comparison. Analytical techniques used would aid scientists in efficiently determining brands of foundation that are currently on the market.

Marissa Cofane

I am a second year undergraduate forensic science student who is a part of three programs including, the Honors Program, SSTEM, and most recently, PRISM. Prior to college, I was more interested in crime television shows than I was in the field of science. Those shows inspired me to take up the forensic science major in college. Needless to say, it is an intense major and is most certainly not as glamorous as the television portrays the field to be. However, after a few semesters I cannot see myself in any other field, and for lack of a better phrase have fallen in love with the sciences. I am now hungry for knowledge and cannot wait to delve into the world of criminalistics.

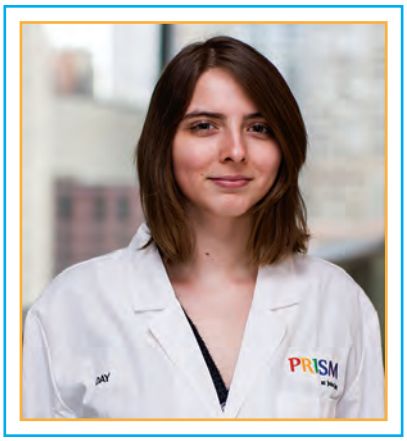
Research Summary

When a violent crime takes place in a home, it is common for blood to be spattered on the walls and for someone to try and conceal the bloodshed. A blood stain pattern created during an assault can be very informative in reconstructing the crime. My research focuses on finding the best photographic and chemical methods for detecting blood that has been concealed by latex-based paint.

Marissa Cofane *continued*

Detection and Restoration of Porcine Blood Under Latex-Based Paint (Dr. Diaczuk)

In an effort to conceal a violent crime, there have been cases where blood spatter has been hidden behind recently painted walls. In this experiment I want to discover the best method for detecting bloodstains under latex paint, along with finding the simplest way to remove the paint without chemically degrading the blood. I hypothesize that if a visible light source with a deep yellow filter is focused on the painted bloodstained wall, then the blood will show through the paint. As for the removal, I hypothesize that if a thin paint scraper is used, then the blood will not be compromised. I will be using a multi-wavelength light source along with an ultraviolet/infrared sensitive camera and chemical tests to confirm where the blood is under the paint. Multiple removal methods will be attempted including different types of brushes, scrapers, sand screens, and a latex-based paint remover.



Jeanine Day

I always wanted a career involved in the criminal justice system. When I was twelve, I wanted to study law; at fourteen my dream was to become a pathologist. After graduating from the Institute of Forensic Science and Criminology in high school, I initially entered John Jay as an international criminal justice major. But after listening to some friends talk about their chemistry and biology classes, I remembered how much I enjoyed science. I was interested in being challenged and exploring how crime scene investigators practically evaluate evidence. I returned my focus to forensic science and declared myself an aspiring criminalist. I joined PRISM and started a research project with Dr. Diaczuk in order to ultimately expand on the existing knowledge that a firearms investigator would have while testifying in a court of law.

Research Summary

The focus of my research is to determine if a mathematical equation used by blood-spatter analysts may be applicable when determining the angle at which a bullet was shot. If this equation is applicable, it will help firearms investigators to reconstruct the crime scene and draw conclusions about the evidence pertinent to the resolution of the case.

Determination of the Angle of a Fired Bullet Using a Trigonometric Analysis Method (Dr. Diaczuk)

The reconstruction of a shooting incident includes analyzing the trajectory of a projectile and provides forensic analysts with information regarding the nature of the crime scene that may allow them to ascertain crucial evidence that will be applied in a court of law. When determining the trajectory of a fired bullet, the angle at which it was shot is key evidence in locating the position of the shooter. It is speculated that the mathematical equation θ = arccosine (d/D) used by blood-spatter analysts may help determine the angle at which a bullet was fired. This is due to the similarity in shape between a blood droplet stain and a ricochet mark from a bullet that has been shot at a non-yielding substrate. The goal is to determine if this calculation can be applied to bullet trajectory analysis by measuring the major/minor diameters of ricochet marks of fired bullets. So far, seventy bullets have been shot at various angles of 10°, 15° and 20° at marble tiles and their major and minor diameters must be measured and applied to the blood spatter equation. In addition, one hundred and seventy ricochet marks from previous shooting experiments have been documented and analyzed.

Sabrina De Los Santos

I am a senior in the forensic science major, specializing in both toxicology and molecular biology, with a minor in biology. I acknowledge my lack of interest in courses that had no pertinence to either science or mathematics. Despite my grades prior to college, science has been the most fascinating aspect of my education; therefore it seemed the only logical decision would be to pursue a career in the field. My goal is a mixture of forensic pathologist and mortician.

Research Summary

Plants do not have an immune system; they use certain proteins to defend against viruses and parasites. Ricin and pokeweed antiviral protein (PAP) are two such defense proteins and have many similarities. Additionally, ricin is a well-known deadly poison. In this project we are investigating whether viral protein, VPg, which is known to inhibit PAP, will similarly inhibit ricin. If it does, it will serve as a potent antidote against ricin poisoning.

Analysis of the Effects of Turnip Mosaic Virus Genome-Linked Protein on Ricin A Chain Depurination of Eukaryotic Ribosomal RNA (Dr. Domashevskiy)

Ricin toxin from *Ricinus communis* seeds (castor bean plant) is a type 2 ribosome inactivating protein (RIP) that deactivates eukaryotic ribosomes, resulting in the termination of protein synthesis. RIPs are important in plants' defense mechanisms against foreign pathogens. Ricin A chain (catalytic peptide) exerts its cytotoxicity through the removal of a specific adenine in the conserved sarcin/ricin (S/R) loop of eukaryotic large rRNA. Pokeweed antiviral protein (PAP), originating from the leaves of *Phytolacca americana*, is a type 1 RIP, possessing potent antiviral properties. Previous studies show that a protein linked to turnip mosaic virus genome (VPg), inhibits both the antiviral and depurinating properties of PAP. VPg was identified as an effective counteractive protein against the defense mechanisms of plants. X-ray crystal structures of type 1 and 2 RIPs (such as ricin, PAP, and Shiga toxin) reveal great similarities in their active sites. Based on RTA and PAP similarities, and the ability of VPg to inhibit PAP's activity, we hypothesize that VPg will similarly inhibit the RTA activity. Steady state fluorescence is utilized to determine the binding affinity of proteins, and quantitative bioluminescent assays will allow us to determine the amount of purines released by RTA from eukaryotic rRNA in the presence of VPg.

Lisset A. Duran

I came to the United States from the Dominican Republic when I was nine. It is hard to pinpoint the exact moment when I came to love science. For me, it was a gradual process that began by watching *Bill Nye the Science Guy* and still continues today. In the future, I plan to pursue a PhD in biomedical sciences I want to be in a field where I can ask questions and find their answers, but more importantly I want those answers to impact people's life in a positive way. In the past I travelled to Morocco to conduct research, and it was an extraordinary experience. Currently, I am a sophomore and am conducting research on DNMT1 expression in breast cancer under the mentorship of Dr. Delgado-Cruzata.

Research Summary

My research focuses on the study of the molecular mechanisms of a cancer drug in breast cancer cells. By investigating how important genes in breast carcinogenesis are affected after exposure to this drug, we can gain information on whether it can be used in its treatment.

Lisset A. Duran *continued*

Studying the Loss of DNA Methyltransferase 1 (DNMT1) in BRCA1 Expression in Breast Cancer (Dr. Delgado-Cruzata)

Aberrant DNA methylation is a hallmark of many human cancers, such as breast, and it is characterized by global DNA hypomethylation and gene-specific hypermethylation of promoter sequences in tumor suppressor genes. Disrupted DNMT1, the protein that maintains methylation, function and amounts has been associated with aberrant DNA methylation levels. However, less is known about the downstream effect of the loss of DNMT1 in specific genes related to breast carcinogenesis. In this study, we investigate the effects of the loss of DNMT1 in the breast cancer cell line MCF-7. The goal of our research is to knockdown DNMT1 using an antisense oligonucleotide (ASO98), and determining DNA methylation and mRNA expression of BRCA1, a tumor suppressor, in MCF-7 cells. Our initial results indicate that a 24-hour treatment with 150nM ASO98 and 150nM ASO207 decreases DNMT1 mRNA levels by about 10%. ASO207 has been shown to decrease DNMT1 enzymatic activity at lower levels than ASO98; however, the decrease in expression we observed has not been previously reported. We also observed that a 24-hour ASO98 transfection a 4% decrease in the levels of BRCA1 at 150nM ASO98 concentration. In future experiments, we will validate our results and further investigate the extent of the effect knocking down DNMT1 has.

Laurie-Ann Edwards-Murdock

I am an international student hailing from the beautiful island of Jamaica. I have a passion for setting wrongs right. Mix that in with my great appreciation for science, and you have a drive best-suited for the wonderful world of forensics. I am currently a senior battling the final leg of John Jay's well-known undergraduate forensic science program with a concentration in molecular biology. My fire for forensic science only increases as I transition through each stage of this prestigious program. The opportunity to have hands on research experience, through the PRISM program, has definitely proven extremely beneficial to my journey to becoming a forensic scientist.

Research Summary

Most firearms impart microscopic marks on bullets as they pass through the barrel of the gun. Because these marks are unique to each gun, law enforcement can use them to match a bullet or casing to the firearm that shot it. Some gun makers, however, manufacturer firearms whose barrels do not impart these important microscopic marks. My research explores a simple and economic method to modify the barrels of these guns so they each create the unique marks necessary for a forensic examiner to associate an individual gun with the bullets it fires.

Individualization of Same-Model/Manufacture Polygonally Rifled Barrels by Introduction of Abrasive-Induced Striations (Dr. Diaczuk)

The identification of fired bullets by class and fingerprint-like rifling marks is a well-known and well-used technique. Generally, firearms manufactured using conventional rifling techniques give rise to rectangular grooves within a barrel. Grooves are the depressions cut away by the rifling cutter while the lands are the portions of the barrel not touched by the rifling cutter. These grooves and other tool marks are greatly beneficial to a criminalist's analysis as they give insight to make, model and barrel type, amongst other identifications of a firearm. These bring the examiner that much closer to linking the recovered fired projectile to its firearm or vice versa. However, as time progresses so has the advancement of firearm manufacture. These advancements have led to the introduction of the more recent technique of polygonal rifling. This method of rifling does not produce the usual transfer of tool marks from the hard barrel to the soft bullet. A firearm with these barrels do not possess the telltale rectangular land and groove striations associated with conventional rifled barrels. So far examination of ammunition fired from these firearms only provide connection between fired cartridge case with the breachface and firing pin. The lack of connective value, through the comparison of fired bullets generally leave this avenue of analysis unused or lacking in evidentiary contribution.

Porfirio Fernandez

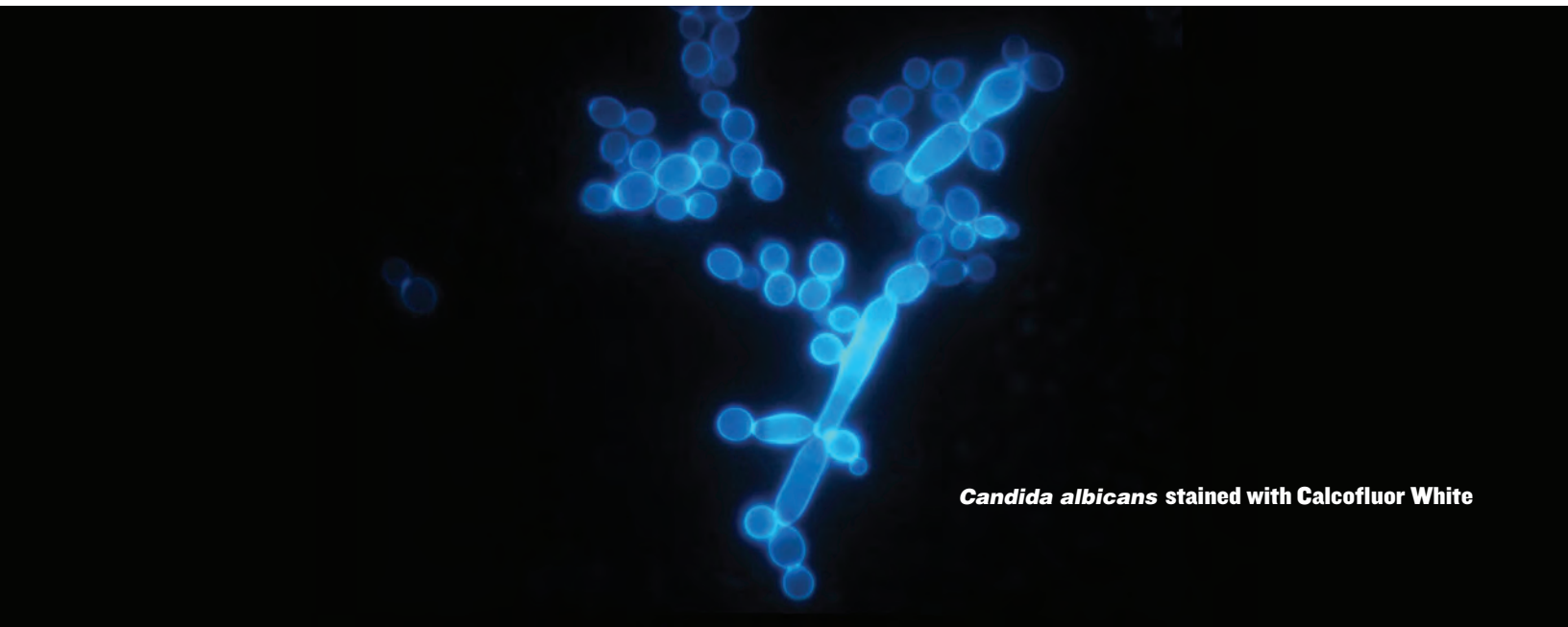
One morning I was awoken by a phone call and a plea to hurry to the hospital. My childhood best friend, Pete, had slipped into a coma. Less than 24 hours later, I sat helpless and grief-stricken as I heard the news that my friend would not survive. I needed to understand why. We later learned that a rare neurological disease led to his death, an event that challenged me to question my purpose in life and ultimately motivated my decision to pursue a degree in CMB. Shortly after my enrollment at John Jay, I met my mentor, Dr. Rauceo. Along with allowing me to work alongside him and an incredible research team, Professor Rauceo has helped me identify, plan, and pursue, a clear definitive purpose in the sciences. I am excited for my future as a research scientist as I look to apply to graduate school upon graduation.

Research Summary

Candida albicans is a fungus that can cause fatal infections in humans due to its ability to stick to surfaces. This 'stickiness' is mainly a property of proteins called Als which must travel through the cell to its surface. During the voyage though the cell, other proteins called chaperones help maintain the structure of Als, preventing it from unfolding before it reaches its final destination. Our research, which investigates whether the removal of a particular chaperone will cause the Als to lose its stickiness, could lead to the design of effective anti-fungal treatments for humans.

Characterization of Yeast Chaperones in Processing Cell Wall Amyloid-Forming Adhesins (Dr. Rauceo)

Candida albicans is the most common human fungal pathogen. The Agglutinin-like sequence (ALS) family of cell wall proteins mediates adhesion to human tissue and yeast cell-cell aggregation through the formation of amyloid domains. Amyloids are insoluble fibrous protein aggregates that are associated with human neurodegenerative diseases. We hypothesize that chaperones prevent premature amyloid formation of Als proteins during translation and trafficking through the endomembrane network. We screened 19 chaperone genes that were selected in part to their associated functions in trafficking throughout the endomembrane system. *Saccharomyces cerevisiae*, a non-pathogenic yeast, was used to test Als function. We transformed plasmids containing *ALS1/5* into *S. cerevisiae* strains containing mutations to chaperone genes. We performed binding assays with Als1/5-expressing cells to examine Als function, and we performed fluorescence assays to determine Als cell-surface localization. We found that most strains containing mutations to particular chaperones (11 of the 19 mutants) were statistically defective in yeast cell-cell aggregation. Our results confirmed the presence of Als5 on the cell wall for chaperone mutants Hsp104, Ssa4 and Sse1. Mutants Cct3, Gim4, Cpr7, Lhs1 and Hsp60 displayed a qualitative reduction in aggregation. This project will contribute to developing a network of chaperones involved in amyloid processing.



***Candida albicans* stained with Calcofluor White**

Erica Fontanes

I am a junior on the forensic science-criminalistics track at John Jay. I excelled in my earlier schooling and started college before my 17th birthday. I was born and raised in Queens and I love helping others. I teach swimming. I used to volunteer at the 9 /11 Memorial and Museum, and now I am the vice president of the Students in Action Club at John Jay. My friends often refer to me as "honest to a fault." I take this as a compliment because I am a truth-seeker. Being a truth-seeker is a big reason why I love science; it's all about figuring out what the right questions are, then finding a way to answer them and determining what can be accepted as the truth. It's all very fascinating to me, and I hope that my education will lead me to a career in a crime lab one day.

Research Summary

My research project is intrinsically related to the concept of chirality in insecticides. I work with sets of two molecules, which are mirror image of one another, mixed together. I separate the two molecules, and I analyze them using different physical chemical techniques. I determine the level of toxicity of the two molecules used as individual entities and in mixture. Effectively separating these compounds and determining toxicity can one day aid in the development and manufacture of pesticides that are safer for mass usage.

Separation and Spectroscopical Characterization of Methamidophos, and N-methyl Methamidophos (Dr. Proni)

Chiral organophosphates are commonly found in their racemic forms in insecticides and lethal chemical warfare agents. We hypothesize that different stereoisomers of organophosphate insecticides will have different levels of toxicity. The purpose of this work is to isolate different enantiomers of the organophosphate insecticide compound (methamidophos and n- methyl-methamidophos) to test their individual toxicity. These enantiomers are being isolated by HPLC chromatography and their absolute configuration will be determined through the concerted use of three different spectroscopic techniques: optical rotary dispersion (ORD), electronic circular dichroism (ECD), and vibrational circular dichroism (VCD), which more or less by work by passing a given type of light (different in three techniques) through an optically active medium and measuring absorption. Acephate has been successfully characterized in the laboratory, and further toxicity tests, ND50 (neurotoxicity) and enzymatic activity, will be conducted by a colleague of Dr. Proni's. The entire separation and characterization process needs to be repeated for the other two compounds: methamidophos and N-methylmethamidophos. The separation of methamidophos was obtained recently but more material needs to be prepared for the stereochemical analysis and the toxicological studies. The separation of N-mathylmethamidophos has not been optimized yet.

Akiema A. Forbes

I was born and raised in Brooklyn, NY. From a young age I was always fond of physical science. My favorite articles involved studies about environmental science, physics, and engineering. My first experience of being in laboratory was in Madison High School. I noticed the importance of lab was more than an academic requirement. Science helps people identify and relate to observations within daily life. Nevertheless, I grew interested with collecting data observations and evidence from laboratory investigations. While exploring opportunities in inquiry-based science I was more drawn into working independently to enhance my skills of communicating scientific reasoning and using proper laboratory techniques which obtains accurate quantitative and qualitative evidence. PRISM helps me gain experience in the laboratory to prepare me for real world research practices. In the future, I want to work in the research industry to prevent and reduce the diagnosis of various types of cancer.

Research Summary

Breast cancer is a disease that greatly affects the lives of many women. We have identified genetic indicators that can tell us who might develop the disease but those factors only account for a small proportion of women with breast cancer. My research focuses on identifying other compounds in the blood of women that can inform us about their chances of developing breast cancer.

Studying LINE-1 DNA methylation and Breast Cancer Risk Factors in Healthy Women (Dr. Delgado-Cruzata)

One type of epigenetic modifications is DNA methylation, where these levels in the cell regulate gene expression and are altered in cancer cells. Breast cancer is the most common cancer amongst women. Diseased breast cells are usually found at the mammary glands. DNA methylation can be measured by using Methylight quantitative PCR. This project will study the association between global DNA methylation and breast cancer risk factors such as family history in healthy individuals. We hypothesize that the data will show lower DNA methylation in women with a family history of breast cancer. We will recruit 100 women and survey their demographics, lifestyle and family history of breast cancer. The participants will also supply their saliva in a vial and we will extract DNA to determine levels of epigenetic markers which we will investigate in relation to breast cancer family history.

Imani Hargett

Science has always interested me. My mother is an ER nurse, so from an early age I was able to see medical practices at work. Before coming to John Jay, I attended Virginia State University where I majored in forensic chemistry, but due to financial issues had to leave. When presented with the opportunity to attend John Jay, I was elated to continue on my path of scientific exploration and jumped at the opportunity. Since joining PRISM and engaging in research, I have found many new facets that I had never explored before, which have changed my ultimate career aspirations. Upon graduating from John Jay, I intend to pursue an MD/PhD, combining my interests in pathology and cancer research.

Research Summary

My research focuses on understanding molecular processes important in hepatocellular carcinoma, a type of liver cancer. This is a very aggressive malignancy that has a very low rate of survival. I am researching the role of a family of proteins that processes modifications to the DNA. A better understanding of these mechanisms can aid in developing treatment strategies for liver cancer.

Understanding the Role of TET proteins in 5-Hydroxymethylation Levels in Hepatocellular Carcinoma (Dr. Delgado-Cruzata)

Ten-eleven translocation proteins (TET) are a family of α-ketoglutarate dependent dioxygenases that have been identified as participants in the demethylation process in mammalian cells, changing 5-methylcytosine (5mC) to 5-hydroxymethylcytosine (5hmC). Hepatocellular carcinoma (HCC) is one of the primary types of liver cancers, exhibiting high mortality rates with minimal options for treatment. It has been observed that global hypomethylation, decreased levels of 5mC, are observed in HCC, which is also common among other types of cancer. However, hypo hydroxymethylation, decreased levels of 5hmC, are also observed in HCC, which is unexpected. It is expected that low levels of 5mC would be counteracted with high levels of 5hmC due to the presence of TET proteins, but this is not seen in HCC and it is not understood. We will investigate how the absence of each TET protein affects the levels of 5hmC in the human liver hepatocarcinoma (HepG2) cell line. Using the HepG2 cell line, we will transfect the cells with siRNAs that will disrupt gene expression of one protein variant at a time; knockdown verification will be done using reverse transcription followed by real time PCR. To quantify the levels of 5hmC after each gene knockdown we will use a dot blot assay. We will compare the levels of 5hmC observed in each knockdown with normal cells that exhibit all three proteins, as well as, to the other knockdown samples (i.e. no TET1 vs no TET2 or no TET3). We will assess if an interaction between TET protein expression and 5hmC concentrations exists that are unique to HepG2 cells; an interaction may confer the ability for TET expression in tandem with 5hmC concentration as a way to differentiate between HCC and other cancers, as well as, an early detection method.

Zenab Khan

I am a junior in the toxicology track of the forensic science major, pursuing biology and mathematics minors. Science has always been intriguing to me because it never stays constant. In fact, it is always evolving based on new discoveries and the validation or refutation of existing theories. This major has been instrumental in preparing me for various occupations, allowing flexibility in my career choice. It has helped me realize and accept my love for math, along with science, thus influencing my choice to perform research pertaining to both biology and mathematics. I may choose to study bioinformatics after graduation as it combines both of my passions, while also breaking the stereotype that females are not good at math.

Research Summary

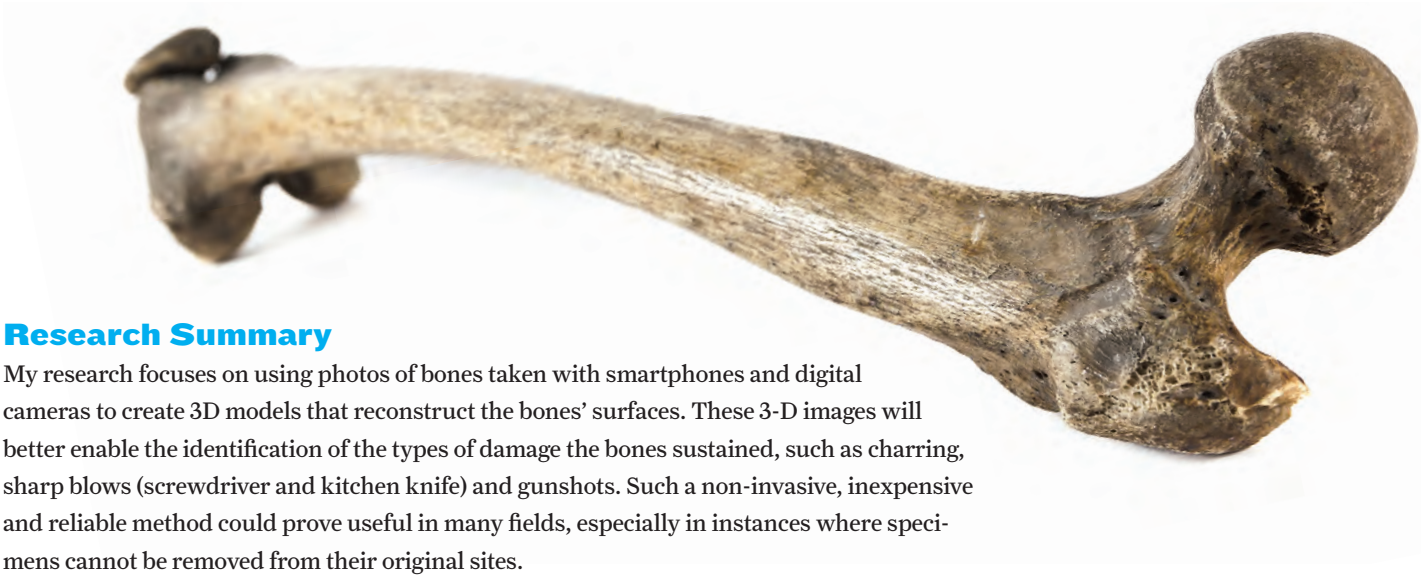
The focus of my research is to determine if bacteria found on the bodies of deceased individuals can play a role in deducing the time of death, and if so, writing an algorithm for it. Such an algorithm could help law enforcement officials determine time of death in a more accurate manner than is currently available.

Generating a Systematic Model to Approximate Time of Death by Examination of Taxonomic Differences over Time in the Human Microbiome of Decomposing Bodies (Dr. Lents)

Focusing on the microbiome of decomposing human cadavers, this project intends to detect and understand the changes that occur in the microbiome following death. Using that information, it may be possible to determine the postmortem interval more accurately. Bacterial communities of living and dead subjects have already been compared and it has been concluded that there are changes in the microbiome after death. Thereafter, samples of cadavers' ear and nasal cavities, collected from the Anthropology Research Facility at the University of Tennessee at Knoxville, were compared to analyze the influence of time on the microbiome. Having obtained the ear and nasal samples from four cadavers that have been sequenced using 16S metagenomic sequencing, this semester's focus will be to analyze that data obtained to produce a function that describes the relationship between the accumulated degree days and the relative abundance of each taxon, while also continuing sample collection. The analysis will incorporate attempts to produce a linear regression model from the data, as well as drawing trends from the sequencing results obtained for each individual taxon.

Erica L. Klafehn

I am a senior majoring in cell & molecular biology and minoring in psychology and anthropology. I moved to Manhattan in the fall of 2012 from Rochester, NY to pursue a degree in the field I am passionate about. It only took about a dozen broken Thanksgiving wishbones and an unhealthy obsession with Buffalo wings to realize that I have an interest in bones. This sparked my interest in forensic anthropology, and this year I am applying to PhD programs in biological and physical anthropology. I have thoroughly enjoyed my undergraduate research experience, under the guidance of my PRISM mentor Dr. Corthals and the additional support of the Ronald E. McNair Post-Baccalaureate Achievement Program. I am looking forward to my upcoming field work excavation experience in Luxor, Egypt, and I am excited to step towards my dream of becoming a forensic anthropologist. Live long and prosper!



Research Summary

My research focuses on using photos of bones taken with smartphones and digital cameras to create 3D models that reconstruct the bones' surfaces. These 3-D images will better enable the identification of the types of damage the bones sustained, such as charring, sharp blows (screwdriver and kitchen knife) and gunshots. Such a non-invasive, inexpensive and reliable method could prove useful in many fields, especially in instances where specimens cannot be removed from their original sites.

2D to 3D Rendering of Bones Samples in *Sus scrofa* (Dr. Corthals)

In the fields of forensic science, anthropology and archaeology, photographic images of remains, bones and artifacts have been taken to document evidence and help further their analyses. However, 2D photography is not always easy to work with or accurate because of colors and/or optical deformations. We propose a low cost method of data acquisition and image enhancing for forensic analyses, using digital cameras and smart phones. By importing easily acquired images into a newly developed computer machine-learning code, we will develop an open-source software that will create a three-dimensional image and reconstruct damaged surfaces. The samples used in this experiment include *Sus scrofa* bone samples that have either been charred, receive sharp (screwdriver and kitchen knife) and gunshot trauma. This reconstructed three-dimensional image will reveal morphological pathology features that will enable a better identification of the types of trauma present in the samples; such a non-invasive, cheap and reliable method could prove useful in many fields, especially in instances where specimens cannot be removed from their original sites.

Kathleen "Kate" Lopez

Whenever I am asked why I chose to be a scientist, I say it's because I loved solving puzzles as a child. It may sound like a simple answer, but my interest in puzzle-solving has guided many of the decisions I've made in my life. My initial interest in science, my choice of forensic toxicology and criminalistics as my major, and my decision to join PRISM all originate with my childhood fascination for problem-solving. As a young student, I found the sciences to be an "upgraded" version of the puzzles I once cherished. Pursuing forensics allows me to use those sciences as the pieces of much larger and more difficult puzzles, and conducting research amplifies those views. Post bachelors', I hope to channel my puzzle-solving skills in the pursuit of a PhD in environmental toxicology or forensic toxicology, and maybe even one day have a career that combines both fields.

Research Summary

My research involves analyzing the concentrations of cadmiumin in environmental water and sediment. Cadmium is a toxic heavy in metal that can stay in the body for long periods of time, and so by closely following the levels of cadmium in bodies of water, such as the Hudson River, we can make sure they do not rise to a harmful level.

Kathleen "Kate" Lopez *continued*

Determination of Trace Level Cadmium in Environmental Water and Sediment (Dr. He)

Cadmium, a toxic heavy metal that bio-accumulates, impacts the ecosystem and human health adversely even at low concentration. Monitoring cadmium in environmental water, therefore, is important to ensure the levels of cadmium do not rise to harmful levels. In this project, preservation of water samples through acidification and filtration and measurement using graphite furnace atomic absorption spectroscopy (GFAAS) and inductively-coupled mass spectrometry (ICPMS) were investigated. Superfund sites around New York City, including several sites from the lower Hudson River, Gowanus Canal, and Newtown Creek were used as sampling sites for cadmium determination. These bodies of water have historically known to be contaminated with various pollutants, including cadmium. Analysis results revealed that cadmium concentrations for the Hudson River sampling site (59th St) was 1.98 ppb, Gowanus Canal was 2.95 ppb, and Newtown Creek was 17.56 ppb. Acidification of the sample followed by filtration was found to be an ideal preservation method for this experiment.

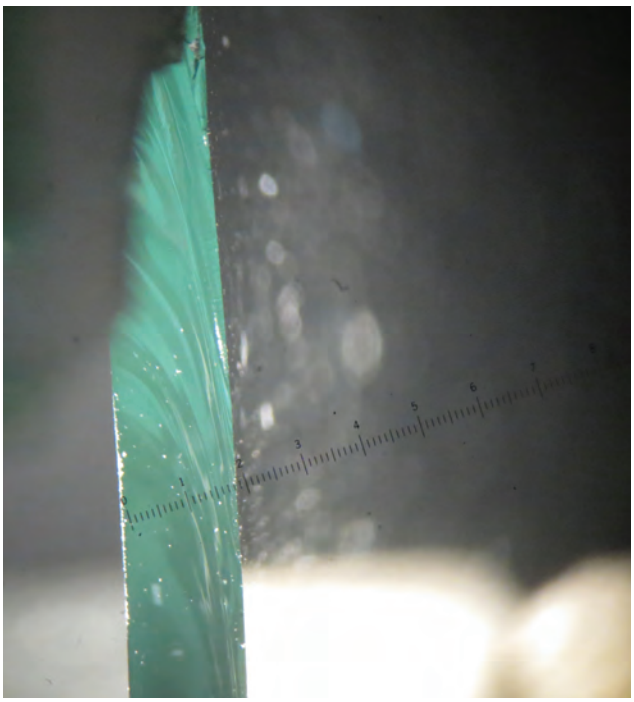
Glen Mahon

I am a fourth year student in the forensic science program, on the criminalistics track. I came to John Jay to become a crime scene investigator because TV shows like *Forensic Files* sparked my interest in forensic science in when I was in high school. At John Jay, I entered the PRISM program to gain research experience. I started my own research project studying the fracture patterns of glass under the mentorship of Dr. Diaczuk. My ultimate goal is to become a forensic scientist specializing in ballistics.

Research Summary

My research work focuses on how glass fracture patterns could be useful in determining the properties (caliber, velocity, ammunition type) of the type projectile that fractured it. Understanding the direction and angle of a bullet as it impacts glass has crime scene reconstruction implications.

Ballistics Examination of Rib Marks and Radial Fractures on Broken Glass (Dr. Diaczuk)



When glass breaks mechanically due to an applied force it breaks in a specific pattern. Radial fractures will occur that radiate out from where the force was applied and tangential fractures will occur in a circular pattern around where the force was applied. The glass will also develop markings called rib marks and these start perpendicular to the side where the force was applied and stop parallel on the opposite side of the glass. This experiment will investigate if indeed rib marks on glass can give more information about the force applied to the glass in terms of firearms. I hypothesize that changing pellet type will change the size of the rib marks. Three parameters will be tested initially using TLC plates as the glass source and an air rifle to see if they would change the rib marks and the parameters are; changing pellet caliber, changing speed of the pellet, and changing the thickness of the glass. If conclusive data is obtained then architectural grade glass will then be used and hopefully a firearm. It was determined that radial fractures are the first set of fractures that occur when a pellet or a bullet penetrates a glass plate.

Robert McLean

I am a New Yorker, born and raised, who is passionate about justice and science. The oldest child of a single parent, I have always worked hard to balance my education, work, and caring for my extended family. I enjoyed watching crime shows as a child and aspired to become a criminalist myself. Attending John Jay College and majoring in forensic science in the criminalistics track followed naturally. What I enjoy most about my studies and research is their real world applications to the justice system. My career goal is to ultimately get a job in a government laboratory as a criminalist.

Research Summary

Quantification of physical evidence is crucially needed in US courts. Microscopy is one of the most powerful tools at a criminalist's disposal to help accomplish this task. My research explores an optical/computational technique by which "scratch patterns" left by tool marks on physical evidence are collected with 3D microscopy and numerically analyzed for their similarities. We are using R and C++ programming languages to implement the technique of 2D cross-correlation into our suite of tool mark similarity analysis programs.

Using 3D Microscopy and RC++ for Enhanced Comparison of Tool Mark Evidence (Dr. Petraco)

Individualization of physical evidence is crucial to our adversarial justice system, and microscopical analysis is one of the most powerful tools at a criminalist's disposal. The proposed research explores a promising technique by which individualizing striation patterns on physical evidence can be collected using 3D microscopy and converted to numeric data that can be submitted to databases for enhanced efficiency in further analysis. We hypothesize that it is possible to use an interface between the R and C++ programming languages to compare two samples, and that such analysis would have a greater degree of accuracy than would normally be permitted by traditional comparison microscopy. If time permits, subsequent research will focus on determining the accuracy of matches made using the developed program(s).

Colleen McNamara

Science was never really my thing. I struggled with it throughout high school. Yet, behind the frustration, late nights, and troubleshooting, my perseverance (a.k.a. stubbornness) kept me going. What is science? How can it explain everything around me in a way different than I learned it before? That's the challenge in it! Science might not make sense to the average person. History compared chemistry to sorcery instead of proven fact. Even now that I've grown to understand science better, I see the challenge for others as I explain chemistry to my family and friends. They look at me like I've grown a second head! That's what's cool about science! Even as you learn it and practice it and perfect it, there will always be that challenge to understand, and make others understand, the world in a new light. Research gives me that opportunity and that's what makes it so enjoyable.

Research Summary

My research focuses on quantifying the amount of certain industrial pollutants in environmental water samples. Determining this abundance will help us understand the impact and harm the current watersources of New York City have on its inhabitants.

Colleen McNamara *continued*

Establishment of a SPE Method for Quantification of Polychlorinated Biphenyls (PCBs) in Environmental Water Samples Using Gas Chromatography-Mass Spectrometry (GC-MS) (Dr. He)

Cadmium, a toxic heavy metal that bio-accumulates, impacts the ecosystem and human health adversely even at low concentration. Monitoring Cd in environmental water, therefore, is important to ensure the levels of cadmium do not rise to harmful levels. In this project, preservation of water samples through acidification and filtration and measurement using graphite furnace atomic absorption spectroscopy (GFAAS) and inductively-coupled mass spectrometry (ICPMS) were investigated. Superfund sites around New York City, including several sites from the lower Hudson River, Gowanus Canal, and Newtown Creek were used as sampling sites for cadmium determination. These bodies of water have historically known to be contaminated with various pollutants, including cadmium. Analysis results revealed that cadmium concentrations for the Hudson River sampling site (59th St) was 1.98 ppb, Gowanus Canal was 2.95 ppb, and Newtown Creek was 17.56 ppb. Acidification of the sample followed by filtration was found to be an ideal preservation method for this experiment.

Victoria Mei

Growing up I saw the forensic science field portrayed in television shows, such as *NCIS, CSI,* and *Bones*, as well as in manga/anime (a Japanese-style of print and/or animated cartoons), such as *Detective Conan* and *Lupin III*. While watching these shows and also reading about solving mysteries from the Sherlock Holmes series by Sir Arthur Conan Doyle, trying to understand the crimes while using the evidence provided before it was explained was entertaining. Forensic science and PRISM provided me with the opportunity to pursue what I love through science and research. The research that I am conducting now involves determination of the lead and cadmium concentration in counterfeit cigarettes. Although I am not solving criminal cases, this research still brings out my love for science and math, and I am fascinated by it.

Research Summary

My research work has found higher concentrations of lead and cadmium in counterfeit cigarette samples. High levels of toxic elements are harmful to the health of everyone through exposure to first- and second-hand smoke. It is not difficult to understand that people who buy these cheaper, illegal cigarettes to save money are in fact putting their lives and those around them at greater risk.

Determination of Lead and Cadmium Concentrations in Counterfeit Cigarettes (Dr. He)

Counterfeit cigarettes are illegally manufactured cigarettes, found in many countries, which are more detrimental to human health than genuine cigarettes because of the higher levels of lead and cadmium concentration. Exposure to these metal elements, which are carcinogenic, leads to many health issues including toxicity, kidney damage, vomiting, fragile bones, and a decrease in intelligence quota (IQ). Our research focused on monitoring the concentrations of lead and cadmium in counterfeit cigarettes from various origins, which can vary based on the soil of which the tobacco was grown and the manufacturing method. The concentrations of the samples can be determined by generating a calibration curve of each element and comparing instrumental signals obtained from running cigarette samples. In our study, the samples went through dry-ash or microwave digestion process before analyzed by inductively coupled plasma-atomic emission spectroscopy (ICP-AES). Standard reference material (SRM) from National Institute of Standard and Technology (NIST) was used to validate the method and ensure the quality of analysis.

Annabell Mercado

Growing up, I developed the desire to make sense of the world around me, especially with regard to living organisms. My interest in the ways that life-forms function and their interaction with the world around them led me take specialized courses. These courses increased my interest and capabilities in the natural sciences. Today, I am a senior majoring in cell and molecular biology. Through hard work and persistence many opportunities have opened to me. Some of these opportunities have allowed me to conduct research with distinguished professors. My current aspiration is to attend graduate school and earn an advance degree in surgical pathology. This will allow me to become a pathologist assistant.

Research Summary

Liver cancer is an aggressive disease that accounts for a large number of deaths each year. In this study, we aim to understand the molecular mechanisms that are related to this disease, which can then help us find treatment options along with strategies to help prevent the disease.

Studying the Inhibition of TET Proteins in Liver Cancer Cells (Dr. Delgado-Cruzata)

One of the main mechanisms that we are studying in this research is DNA methylation. DNA methylation is one of the molecular mechanisms involved in liver carcinogenesis. The processing of DNA methylation by TET proteins in HCC is not completely understood. Therefore, we hypothesize that the inhibition of the ten- eleven translocation (TET) family of proteins will lead to a decrease in proliferation, invasion and migration of the HepG2, hepatocellular carcinoma cells.

Jazlene Montes

Starting in the second grade with solving math problems for fun, to reconstructing a rodent skeleton from owl pellets in the fourth grade, I have always had a passion for math and science. My fascination with these subjects only grew as I got older. While taking an introductory course in forensic science at Hunter College during my senior year of high school, I decided to pursue a degree in forensic science. Attending John Jay College allowed me to expand my knowledge and enhance my skill set. I seek to further my education by obtaining a PhD. Working with PRISM will assist in determining my specific field of study.

Research Summary

My research focuses on revealing how commonly used pesticides affect the human body. A deeper understanding of these effects can possibly lead to a much needed cure and a deeper comprehension of Alzheimer's disease.

Jazlene Montes *continued*

The Effects of Maneb and Mancozeb on Activated Double-stranded RNA Dependent Protein Kinase (PKR) and Mammalian Target of Rapamycin (mTOR) Signaling Pathways (Dr. Cheng)

Maneb (MB) and mancozeb (MZ) are widely used as fungicides. Environmental factors may play a critical role in the pathogenesis of neurodegenerative diseases. An association between past pesticide exposure and low cognitive performance may increase the risk of developing Alzheimer's disease (AD). AD is a neurodegenerative disease characterized by progressive decline of memory. The pathogenesis of AD is not fully understood. The neurodegeneration of AD brains has been linked to activated double-stranded RNA dependent protein kinase (PKR). Down regulation of mammalian target of rapamycin (mTOR) has been associated with the pathogenesis of AD. A molecular connection between PKR and mTOR was recently discovered, demonstrating that PKR is able to phosphorylate p53, which can then hinder activity of mTOR in response to amyloid β peptide 42 (Aβ42), a biomarker of AD. The focus of this study is to reveal whether MB and MZ can activate PKR and de-activate mTOR in human neuroblastoma cells (SH-SY5Y). The results have showed MB and MZ increased the activation of PKR by increasing the phosphorylation of PKR. PKR inhibitor (C16) was used to confirm the role of PKR in MB- and MZ-induced cytotoxicity. The status of mTOR will be studied in parallel by Western blot analysis.

Elmer Morales

I was born in Guatemala and came to the United States when I was about 10 years-old. I decided to pursue a degree in science when I started college, because I realized that a degree in science is very valuable in society. Science helped me understand the world around me, and this motivated me even more. In college I also read about Frederick Douglass and how he succeeded in life because he educated himself. Time has passed since this man was alive, but this idea got stuck in my mind. I think the only way to succeed in this life is with a strong education especially in the STEM fields. My goal is to earn a master's degree as a forensic toxicologist.

Research Summary

My research focuses on the investigation of detection methods of marihuana in hair from people who are regular users. Hair analysis is an interesting biological sample in forensic sciences because drugs can remain in hair for a long time and show past exposure.

Cannabis Determination in Hair by Liquid Chromatography Tandem Mass Spectrometry (Dr. Concheiro-Guisan)

Cannabis is the most commonly used illicit drug worldwide. According to the United Nations, 170 million people smoke at least once a year, and therefore, cannabis is involved in multitude of forensic investigations (driving impairment, custody). Hair is an alternative matrix in forensic toxicology that allows the detection of past drug exposure. Once drugs are deposited from blood into hair, they remain there for a long time (months). The objective of the present research is to develop an analytical method for the determination of cannabis active drug, delta-9-tetrahydrocannabinol (THC), and its metabolites, 11-Hydroxy-THC (THC-OH), 11-nor-9-THC-9-Carboxylic acid (THC-COOH) and 11-nor-9-THC-9-carboxylic acid glucuronide (THC-COOH-glucuronide) in hair samples. The instrumental analysis will be performed by liquid chromatography tandem mass spectrometry, due to the high sensitivity required (THC in ng/mg and THC-OH, THC-COOH, and THC-COOH-guluronide in pg/mg range). Our ultimate goal is to investigate if, besides THC, its metabolites are incorporated into hair. This information will help in forensic investigations, because THC can be incorporated into hair not only by active consumption but also by external contamination (smoke), but the metabolites are only incorporated into hair if the cannabis was actively consumed. THC metabolites detection will allow differentiation between external contamination and actual exposure.

Michael Muyalde

When I was young, my parents took my sister and me to the local nursing home where they worked so we could all be in one place. Over the years I have seen how scientific progress, such as new treatment methods and diagnostic tools, has impacted the quality of a patients' stay, which intrigued me regarding the future of science and its impact on human life. My interest in science piqued in high school, where I explored its applications in the fields of medicine and forensics. My motivation for coming to John Jay and applying to PRISM was to develop skills as a burgeoning scientist and apply my interest to some larger, positive context. As astrophysicist and cosmologist, Neil deGrasse Tyson states: "I am driven by two main philosophies: know more today about the world than I knew yesterday and lessen the suffering of others."

Research Summary

My research focuses on how breast cancer cells modify their genetic material as they reproduce. Understanding how this process works will help in finding ways to successfully "trick" these cells to stop modifying themselves. This, in turn, will reduce the cells' harmful influence on the body.

Cancer Cells

siRNA Knockdown of *DNMT1* in Breast Cancer Cells (Dr. Delgado-Cruzata)

Epigenetics is concerned with changes in gene function that are mitotically and/or meiotically heritable and that do not entail a change in DNA sequence. Some of these changes are external modifications of the DNA that affect gene expression, such as DNA methylation. In human DNA, hypermethylation in the promoter regions of tumor suppressing genes and hypomethylation of promoter regions oncogenes are indicators of carcinogenesis. This is true for human cancers such as breast, in which BRCA1, CDKN2A, and PTEN are methylated and have diminished expression. DNMT1 is a methyltransferase enzyme that adds a methyl groups to, or methylates, DNA. Previous work by Wang and colleagues have shown that the addition of siRNA to the c-myc oncogene in MCF-7 cells (breast cancer cells) reduced its expression up to 80% in resulting cells and decreased growth rate. Following that logic, we hypothesize that delivering siRNA targeting the DNMT1 gene in MCF-7 will lead to lower expression of this gene, allowing the study the regulation of DNA methylation.

Brooke Nielsen

Now that I am a senior at majoring in forensic science with a concentration in toxicology, I am amazed at how far I have come as a scientist. Joining Dr. Champeil's research laboratory has allowed me to experience working in the lab at a different setting. Instead of just following procedures in laboratory manuals, in research, thinking "outside the box" and brainstorming are keys to finding solutions to whatever obstacles cross your path. Participating in research through the PRISM program has made me more self-assured and confident that a career in forensic toxicology is an achievable goal.

Research Summary

The goal of my research is to create small strands of DNA that contain sites to which two different cancer drugs can bind. Understanding how the drugs bind to the human DNA and how cells respond to the DNA modifications will explain why these drugs effectively kill cancer cells.

Brooke Nielsen *continued*

Correlation of MC and DMC-adducts Structures with the Role of p21 in the Toxicity of the α-ICL and β-ICL (Dr. Champeil)

Mitomycin C (MC) is a drug that is currently used to treat certain types of cancers including stomach, anal, and lung cancers. A similar drug, decarbamoyl mitomycin C (DMC), shares similar properties to mitomycin C; one important similarity is that both molecules form similar interstrand crosslinks (ICL) on the DNA structure. We propose that the differences in mitomycin-α and mitomycin-β crosslinkages are the reason why the MC and DMC treated cells produce different chemical responses. In comparison to MC, when cancer cells were treated with DMC, there seemed to be a greater toxicity of the DMC treated human cancer cells that either expressed or lacked functioning p53 genes. Our goal is to synthesize short DNA strands containing the alpha or beta ICLs. These site-modified oligonucleotides will be used to treat cells with or without a functioning p53. The biochemical responses of the cells will be observed. We predict that with cells lacking a functioning p53, an alternative cell death pathway can be triggered upon exposure to the beta ICL.

Jae Hyuk Oh

I was born in Seoul, South Korea but spent most of my youth in New York City. I am currently majoring in computer science and information security and minoring in mathematics. I am also enlisted in US Army and planning to become an engineer officer. I am really interested in working as a white hacker or a cybersecurity analyst. Besides my school works, I am also a peer tutor at Math and Science Resource Center at John Jay College, and I occasionally develop an Android application or write a book.

Research Summary

The main goal of this research is to come up with Android based smartphone/mobile application that recognizes and distinguishes frog species using their unique voice calls. Scientists would record a frog sound. My application would distinguish the frog species by matching its voice/call against the sample voices/calls saved in a database. This approach is possible because a frog has its own distinctive and unique voice call.

Distinguishing a Frog Species through a Mobile Application (Dr. Johnson)

The main goal of this research is to come up with Android based smartphone/mobile application that recognizes and distinguishes frog species using their unique voice calls through the devices' built in microphone. The research is designed to support many biologists and scientists in terms of distinguishing and finding new frog species through the use of their unique voice spectrum.

Ronal Peralta

Growing up in the Dominican Republic and experiencing the undervaluing of the sciences, it would have been impossible to predict my future career path. I entered John Jay's Forensic Science program without ever taking a science class in my life. This proved to be extremely challenging. However, the difficulties I faced only made me more interested in science. I joined PRISM because I wanted to further test my interest for science, which since has only grown. Since joining PRISM, my vision for the future has become clearer. I hope to attend graduate school upon the completion of my bachelor's degree, where I will continue to develop as a research scientist.

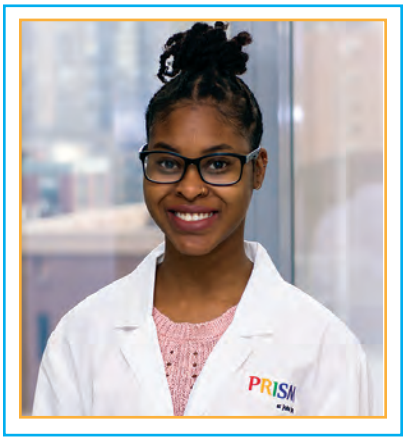
Research Summary

Mercury is a toxic heavy metal that can accumulate to hazardous concentrations in some environments. We tested the use of moss as an inexpensive alternative to airborne monitoring of mercury by exposing and analyzing 21 samples at various locations around a municipal sewage sludge incinerator in New Haven, Connecticut. Results show moss is an effective alternative to expensive air monitoring equipment, and that the sludge incinerator is a source of airborne mercury to the local environment.

Using Moss as a Biomonitor to Detect Atmospheric Sources of Mercury (Dr. Carpi)

Mercury is a global health concern because of its toxicity to the human brain. Coal fired plants and sewage sludge incinerators are sources of mercury emissions to the environment. Ambient air monitoring of these sources is expensive; however, mosses can be used as a passive biomonitor for airborne mercury due to their ability to absorb ions from the atmosphere. The purpose of this research was to study potential sources of mercury in New Haven, Connecticut using moss as a biomonitor of atmospheric mercury. We hypothesized that there would be a direct relationship between the distance of the moss to identified sources of mercury, and the concentration of mercury in the moss samples. Local sources and patterns of distribution were studied by placing 21 samples of moss in three transects around a sewage incinerator in New Haven and exposing them for three weeks. The samples closest to the incinerator showed mercury concentrations from 0.03 to 0.04 ppm, while moss placed further away had mercury concentrations from 0.02 to 0.03 ppm. This data suggests that the incinerator is a mercury source in the area.

Tonya Phoenix



I have always been interested in science and finding out how things work. As a girl growing up in Georgetown, Guyana, I found myself collecting little bugs and insects. I would inspect them and examine their parts, hoping to find out their functions. While I never followed through with this particular study, my next endeavor led to the discovery of my passion. As a sophomore in high school, my chemistry teacher opened my eyes to this exciting subject. I quickly grasped the concepts and fell in love with the complexity of their compositions. It was in that moment that I knew I would pursue a degree that involved chemistry. At John Jay College, I am a senior majoring in forensic science, with a concentration in toxicology, and I am a PRISM student working with Dr. Zhang. I graduate in 2017 and will unquestionably continue my education in toxicology or pharmacology.

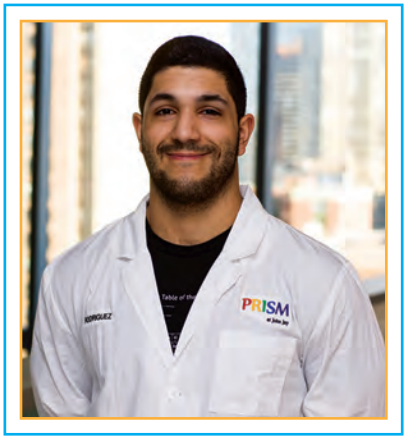
Research Summary

My research specifically focuses on the identification of toxic heavy metals, such as mercury, through the use of fluorescence technique. We are creating new chemical compounds that are designed to emit fluorescence and then exposing them to various toxic metals. If successful, changes in the intensity or color of the fluorescence could be used by chemistry, environmental and forensic researchers to identify the types and levels of toxic metals.

Tonya Phoenix *continued*

Flourescent Metal-Terpyrdine Complexes as Probes for Toxic Heavy Metals (Dr. Zhang)

Selective fluorescent recognition of toxic heavy metals such as Hg(II), Cd(II) or Pb(II) by using readily available chemical compounds is new and exciting for chemistry, biology and environmental researchers. Based on the traditional terpyridine structural unit, a new class of chelating ligand is designed for the formation of fluorescent metal complexes, thus, enabling selective detection of toxic metal ions by fluorescence spectrophotometric technique. Utilizing the classic Kröhnke condensation reaction for the ligand syntheses then making their complexes with CoII or CuII ions, allows for a structural characterization by spectroscopic techniques. In future studies, the formation of metal complexes will be continued. The primary goal is to specifically work with cobalt and copper metal salts to gather quantitative results for further analysis.



Christopher M. Rodriguez

Growing up I never would have believed that I'd find myself where I am today. Science wasn't something I had a specific passion for during elementary school nor my first few years of high school. I couldn't have been happier when the bell rang every day. That all changed when I sat down for the first day of chemistry class my junior year. I remember being captivated from the very beginning and eager to learn about all of the atoms and molecules that make up the world around me. From that very first day of class, chemistry and, science as a whole, became strong passions of mine. For me, science, more specifically chemistry, is a means to explain the universe that surrounds us and a way to answer all of the questions that I find myself asking.

Research Summary

Just as fingerprints are unique to an individual, so, too, is the combination of biomarkers. In this project, we are investigating whether the molecular composition of a person's sweat is unique to that individual as well as whether it can be used to identify the use of illicit drugs. Our research could lead to a new non-invasive method of identifying illicit drug use linked to specific individuals.

Determination and Quantification of Illicit Drugs from Fingerprint Residue (Dr. Roberts)

Just as every individual has a specific set of fingerprints, molecules have their own identifying markers. To identify these molecules we cannot simply observe them under a microscope as we would fingerprints. Instead, we must generate and observe their spectra, which can be revealed using very sensitive instrumentation. Sweat, is an aqueous solution excreted by various glands located close to the surface of human skin known as suboriferous glands. Sweat can be comprised from a multitude of analytes and molecules including water, lactic acid and urea, various salts, such as sodium chloride and potassium. Eccrine glands, which are predominately found on the inside of the palm, foot and forehead allow for noninvasive sample collection. We hypothesize that sweat from the eccrine glands, located on the hand, can be used to identify illicit drugs such as cocaine and may also identify an individual based on the composition and ratio of the analytes in the sweat collected. Utilizing Raman spectroscopy, spectra will be obtained from latent fingerprints and then analyzed to determine if illicit drugs can be detected and to determine if the known spectra can then be compared and matched with standard fingerprints obtained from the original source.

David J. Rodriguez

I am a senior at John Jay College of Criminal Justice, pursuing a degree in Forensic Science with concentrations in Toxicology and Molecular Biology, and a minor in Biology. Although during my beginning years at John Jay I was not always fully devoted, I have become very dedicated to both my academics and research. Due to the unbelievable support and guidance of the John Jay faculty and the opportunities offered by PRISM, I feel that I have really grown as a scientist. My experiences in research have given me a new understanding and appreciation of the hard work necessary for scientific discovery. In graduate school, I hope to continue my journey by mastering new techniques, expanding my knowledge, and discovering new things.

Research Summary

Pokeweed antiviral protein (PAP) is defense mechanism used by the Pokeweed plant to ward off viruses and parasites. RNA viruses infect plants. In this research we look at the interaction between these two molecules to understand how PAP stops the RNA from infecting the plant. The best way to monitor these interactions is to excite the RNA molecules so they glow in the dark, which is known as fluorescence. The study of these interactions may ultimately lead to the design of effective antiviral treatments.

Synthesis of Fluorescently-Labeled Tobacco Etch Virus (TEV) RNA and Its Interactions with Pokeweed Antiviral Protein (PAP) (Dr. Domashevskiy)

Fluorescence spectroscopy is an excellent tool to study macromolecular interactions. However, structural changes in the structure of nucleic acids may be difficult to monitor, because unlike proteins, nucleotides that comprise the structure of DNA and RNA have poor fluorescence. A method has been developed for synthesizing fluorescently labeled capped mRNA. The method incorporates a single fluorescent molecule as part of the 5'-mRNA or oligonucleotide cap site. The fluorescent molecule, Anthranioyl-(Ant)-m7GTP is specifically incorporated into the cap site to yield Ant-m7GpppG-capped mRNA. Efficient capping was observed with 60-100% of the RNA transcripts capped with the fluorescent molecule. The Ant-m7G derivative, which was previously shown to interact with the eukaryotic cap binding protein eIF4E, is shown to be a substrate for the *Vaccinia* virus capping enzyme. Further, the Ant-m7GTP-capped RNA is readily translated. This fluorescent RNA provides an important tool for monitoring capping reactions, translation, and biophysical studies. We have employed tobacco etch virus RNA for fluorescent labeling, and studied its interactions with a plant antiviral protein from *Phytolacca americana,* pokeweed antiviral protein (PAP). Studies between PAP and fluorescently labeled viral RNAs could prove to be an essential tool to study interactions between a myriad of viral RNAs and PAP.

Ronald Rodriguez

I never dreamed of becoming a scientist before I attended John Jay College. I decided to pursue an undergraduate degree in forensic science, mostly because mathematics was always my favorite subject and I assumed that I would find science fascinating. After several years in the forensic science program, I realized that I was correct in choosing science as a future career. I was interested in performing scientific research as an undergraduate student, so I joined PRISM in the summer of 2014. Under the mentorship of Dr. Jason Rauceo, I learned that science is so much more than just reciting information. It's about processing scientific information and learning how to apply it. My interest in science really developed when I joined Dr. Rauceo's laboratory. I enjoy performing research because it has significantly improved my critical thinking skills. This has encouraged me to pursue a PhD in biomedical research after I graduate.

Ronald Rodriguez *continued*

Research Summary

The goal of my research is to determine the role that one of the fungus' proteins plays when cells are exposed to high-salt environments such as kidneys. This gene can serve as a worthy target for the development of a new antifungal drug.

Characterization of Orf19.7296p in the *Candida albicans* Osmotic Stress Response (Dr. Rauceo)

The accumulation and storage of charged ions in yeast is critical for many processes that include energy production and transport. These cellular processes contribute to the growth and pathogenicity of *Candida albicans*, the major fungal pathogen of humans. Accumulating certain charged ions can cause cellular toxicity. As a result, *C. albicans* has developed mechanisms to transport and store ions efficiently to maintain homeostasis. My objective in this proposal is to determine the function of Orf19.7296 protein (Orf19.7296p) in the *C. albicans* osmotic stress response. A localization assay of an Orf19.796p-YFP fusion protein using fluorescence microscopy revealed that the protein produced a punctate focal pattern around the cell periphery following exposure to 1.0 M NaCl. The fluorescence intensity increased approximately 2.0 fold in the presence of salt when compared to untreated samples. Surprisingly, no fluorescence was detected in hyphal cells. Collectively, these results suggest that Orf19.7296p may associate with a protein complex during osmotic stress and its expression is specific to yeast cells only. However, the function of Orf19.7296p following exposure to salt stress remains uncharacterized. My hypothesis is that Orf19.7296p may be required for sodium transport. The function of Orf19.7296p will be determined through cation transport assays.

Danielle C. Rouse

I am a 22 year-old Barbadian currently enrolled at the John Jay College. As a Christian, I continue to make it known to all that the honor and glory belongs to God Almighty who continues to provide for my every need. My science journey started at Ellerslie Secondary School, where I pursued three sciences chemistry, biology and physics among others. I graduated from secondary school with 11 certificates awarded by the Caribbean Examination Council. With these qualifications I entered community college and pursued an Associate Degree in science majoring in chemistry, biology and mathematics. I graduated from the Barbados Community College with GPA of 3.20. These were all necessary to meet my ultimate goal—becoming a forensic toxicologist & blood spatter analyst.

Research Summary

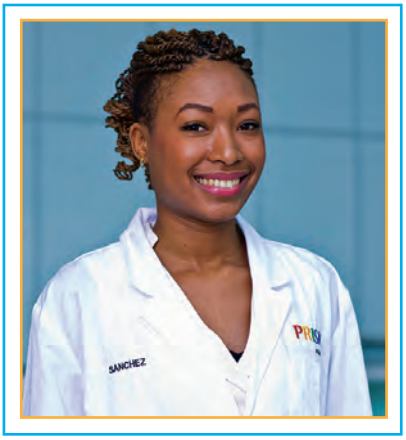
Mercury is a toxic metal that exists in the air, water and soil and which can build up in the bodies of animals and humans, causing harm. My research focuses on how mercuric oxide, a form of mercury that can be found in soils, changes to become elemental mercury, which is able to escape from soil to the atmosphere. Determining what environmental factors affect this change and specifically how it occurs in soil will help us understand the overall behavior of mercury in the environment and help us prevent toxic effects in humans as a result of mercury exposure.

The Reduction Mechanism of Mercuric Oxide in the Environment (Dr. Carpi)

Soils have shown to be a significant source of environmental mercury pollution via the reduction and emission of oxidized mercury, including mercury(II) oxide (mercuric oxide), to elemental mercury. 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. Previous work by Scarella et al. (2013) has shown that photolysis by low energy, long-wavelength light may drive the reduction of mercury(II) oxide to elemental mercury. Based on this observation, we hypothesize that of the emission of elemental mercury from samples doped with mercury(II) oxide exposed to low energy

light will be significantly higher than dark controls. To study this, we will examine the emission of mercury from samples doped with mercury(II) oxide and then exposed to: i) dark; ii) short and long wavelength light, and iii) other sources of low energy radiation. Through this research we hope to identify the mechanisms and driving forces behind mercury emissions from environmental soils.

Kelsha Sanchez



I am a senior at John Jay College with an expected graduation date of May 2016. Born and raised in Trinidad, I migrated to the United States in 2012 when I discovered that a bachelor's degree in forensic science is not attainable in the Caribbean. In 2014 I was selected to participate in PRISM. Since then I have been conducting research with mentor Dr. Li. His research focuses on the forensic analysis of biological evidence. After an extensive period of training and observing his graduate students, I am now involved in his human bone projects. After acquiring my Bachelor of Science in Forensic Science this year, I hope to enter into a forensic anthropology PhD program.

Research Summary

My research focuses on developing new methods to process bones in preparation for forensic DNA analysis. These methods are crucial to obtain DNA profiles from bone samples for victim identification, which can potentially make an original contribution to the field of forensic investigation of criminal cases.

Developing an Enzymatic Processing Method for the Forensic DNA Analysis of Bone Specimens (Dr. Li)

The forensic analysis of DNA from bones is a useful tool for identifying human remains. Bones are durable tissues that can be resistant to decomposition long after death. Bones have been found to contain detectable amounts of DNA decades, and even centuries, after the individual's death. The forensic DNA analysis of bone tissues can be applied to a variety of criminal investigations. However, bone samples recovered at crime scenes are usually not in pristine condition. Contamination from exogenous DNA can often be a problem when dealing with bone evidence. As a result, a mixture of endogenous and exogenous DNA can interfere with the identification of individuals. When attempting to analyze DNA from the bone evidence, the initial processing of bone samples is required to remove potential contaminants, in particular exogenous DNA and PCR inhibitors. New methods of preparing bones for DNA isolation are studied.

Jiwon Seo

Before I got involved with research, I used to teach an SAT prep course to local high school students. As an international student, research opportunities were rare at the time. When I heard about PRISM, I joined the program right away and transferred from Queensborough Community College to John Jay. Thanks to PRISM I've participated in a number of exciting research projects. I studied the effects of common fungicides maneb and mancozeb in Dr. Cheng's lab, and I was also involved in the mechanism study of chemotherapeutic agents MC and DMC in Dr. Champeil's lab. These research experiences fostered my interest in cellular mechanisms. I plan to pursue an advanced degree in biology and become a professor.

Research Summary

I am studying the effects of common pesticides on humans. These pesticides are advertised to be benign at low concentrations, but our research demonstrates some harmful effects to humans. Understanding these effects will shine a new light onto understanding the development of neurodegenerative diseases.

Jiwon Seo *continued*

Effects of Maneb and Mancozeb on PC12 (Dr. Cheng)

Maneb and mancozeb are common fungicides that could induce cell death. These compounds contain manganese, which is known to cause cell cycle arrest at GO/G1 phase and apoptosis. It is important to understand the effects these common fungicides on humans. We hypothesize that the low level exposure to the common fungicides, maneb and mancozeb, would induce cell cycle arrest at GO/G1 phase. PC12, rat pheochromocytoma cells, will be treated with various concentrations of maneb or mancozeb for 24 or 48 hours. The cell cycle analysis will be performed through flow cytometry. The preliminary data with SH-SY5Y, human neuroblastoma cells, showed that the compounds induce cell cycle arrest at GO/G1 phase. The finding of this research would strengthen the previous results by the use of the more traditional and therefore more comparable mammalian cell line in toxicology.

Shantoi Shaw

I am currently a senior at John Jay College of Criminal Justice, majoring in computer science. I am originally from the island of Jamaica, and I am the second in my immediate family to attend college. Throughout the four years of rigorous work in my major, I have never wavered in my interest in computer science. It is as appealing or exciting today as when I first started. As a result, my decision was final as I visualized my degree in computer science at graduation. In the future I hope to gain a PhD in computer science, mainly on the topic of cyber security; with something ground breaking. I am a bit of an optimist, but that is definitely a goal of mine.

Research Summary

The aim of this research is to examine how encryption methods can be improved to better protect packets as they traverse networks in order to prevent hackers from easily decrypting ciphered messages and stealing the personal data that the packets contain.

Mobile Device Safety via Encrypted Networks (Dr. Maras)

The creation of society's telecommunication inter-connectivity, has benefited the American society vastly, in a very swift period of time. While these technological advances have been beneficial, they pose serious threats to people around the globe, but specifically in America. Currently, there is a general lack of awareness about the potential threats posed due to the use and misuse of electronic communication devices, particularly mobile technology. Some of these threats are made possible by the "Packet-Switching" network. For example, data that traverses the "Packet-Switching" network can be intercepted by a hacker and later used to commit criminal activities, thus, making it a major concern for everyone living in the American society because the misuse of technology and illegal profiting from stolen data is costing too much money. The project seeks to examine the "Packet-Switching" network to see if security can be improved via better encryption protocols. The efforts of this project will help to mitigate financial damages to the American society, subsequently, making progress towards creating a more feasible solution for mobile security.

Shanelle Shillingford

I have always known that I wanted to pursue a career in science. Attending John Jay and majoring in forensic science, a major heavily based in chemistry, has sparked an interest in this physical science that I did not that know I had. PRISM has allowed me to pursue that interest and has provided me with hands-on experience in the field of chemistry, in particular, organic chemistry. I now have passion for the science that has pushed me towards obtaining a PhD in chemistry and one day becoming a chemist.

Research Summary

My research focuses on the separation of molecules known as enantiomers. The enantiomers of a particular compound are usually found mixed together and appear to be identical, but can each interact with enantiomers of other compounds in completely different ways. If these enantiomers can be separated, their individual interactions with other compounds can be observed. Effectively separating these compounds and determining toxicity can one day aid in the development and manufacture of pesticides that are safer for mass usage.

Separation and Spectroscopic Characterization of Organophosphorus Compounds: Methamidophos and N-methyl-methamidophos (Dr. Proni)

Chiral organophosphorus compounds are often used as insecticides in their racemic form for economic reasons. However, enantiomers are known to interact stereospecifically with biological systems and in many cases the exposure to the racemic mixture leads to selective microbial degradation of one of the two enantiomers. Moreover, two enantiomers may degrade or accumulate in the environment differently, or may have different levels of toxicity toward other species. The goal is to effectively separate these compounds into their enantiomers using chiral high performance liquid chromatography (HPLC) and to then determine their absolute configuration through the concerted use of spectroscopic techniques such as optical rotatory dispersion (ORD), electronic circular dichroism (ECD), and vibrational circular dichroism (VCD). To arrive at the definitive stereochemical assignment of the derivatives, both experimental and predicted ORD, ECD and VCD responses are to be considered. For all compounds, the biological activities of the racemic mixture and of the single enantiomers will be investigated using neurotoxicity and enzymatic activity in order to determine the toxicity level of each enantiomer. During the spring of 2015 the separation of Acephate has been concluded. Now, focus will be placed on developing effective HPLC methods for the separation of EPN, Methamidophos, and N-methyl-methamidophos.

O'Jay Stewart

I was born and raised on the beautiful island of Jamaica and immigrated to the U.S. four years ago. During the completion of my education in Jamaica, I became extremely interested in the field of forensic science, aspiring to achieve a degree upon arriving in America. During my first semester at John Jay, my instructors urged me to consider a path tailored towards medicine, as they had observed the passion I had for the medical field. As a result of their suggestions, and a period of self-reflection, I decided to embark upon the path towards medical school. I am specifically interested in a medical scientist training program (MSTP), from which I will obtain both my PhD and MD degrees. With the training and experience I obtain through the PRISM program, I hope to develop and nurture qualities that will enable me to optimally conduct basic scientific and translational research.

Research Summary

The aim of my research is to study the interactions between pokeweed antiviral protein (PAP) and a series of lipid molecules, establish favorable conditions for PAP encapsulation into lipid vesicles (liposomes), and investigate the modification of liposomes for targeted drug delivery to HIV infected cells.

O'Jay Stewart *continued*

Biophysical Studies of Liposomal Pokeweed Antiviral Protein (PAP) for IV Treatment (Dr. Domashevskiy)

Human Immunodeficiency Virus (HIV) attacks the human immune system, destroying the CD4 cells that help the body fight disease. HIV can severely damage the immune system, leading to Acquired Immunodeficiency Syndrome (AIDS). Currently there is no cure or effective vaccine for HIV. Therefore, the necessity to seek alternative, effective HIV/AIDS therapies is of pivotal importance. Pokeweed antiviral protein (PAP), isolated from the common pokeweed plant, *Phytolacca americana,* provides a new and promising direction in HIV/AIDS research. PAP is a ribosome inactivating protein (RIP) and RNA N-glycosidase. PAP possesses antiviral properties and reduces the infectivity of many plant and animal viruses, including HIV-1. Direct injection of PAP into the bloodstream would have detrimental effects, resulting in Vascular Leak Syndrome (VLS); however mechanisms utilizing liposomal encapsulated PAP have yet to be tested. The aims of this project are: 1) Characterize PAP-HIV RNA binding interactions, and determine the extent of viral RNA depurination; 2) Determine the structural differences in lipids having the highest binding affinity to PAP; and 3) Identify the optimal conditions for liposomal preparation, manipulation, and processing. Attaining these goals may potentially lead to the development of an inexpensive, yet profoundly effective treatment for HIV/AIDS.

Fidelis Yin Ru Tan

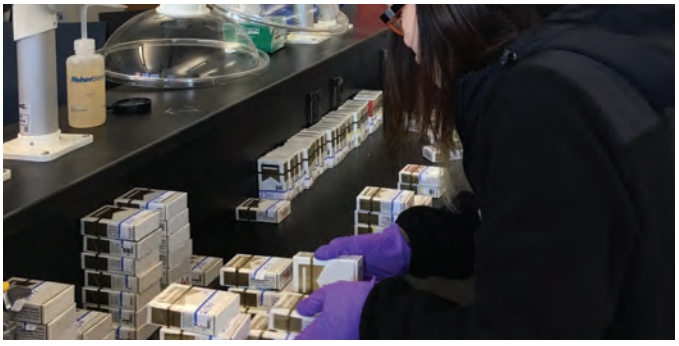
As a student in my native country of Malaysia, biology labs in high school were very memorable. They piqued my curiosity and sparked my interest in science. They made me realize how dynamic science is, and how science is an ongoing quest to find answers to mysteries. My passion to become a scientist has grown stronger every year. I want to shed light into solving problems that remain unanswered. I chose to study forensic toxicology and molecular biology at John Jay College because it is holistic in a sense that all sciences are applied, and yet it is a problem-solving field with ever changing scenarios. Although it's a challenging field, it hasn't prevented me from pursuing a scientific career. My future goal is to earn a doctoral degree in pharmacology and to find possible cures for neurodegenerative diseases like Parkinson's or Alzheimer's.

Research Summary

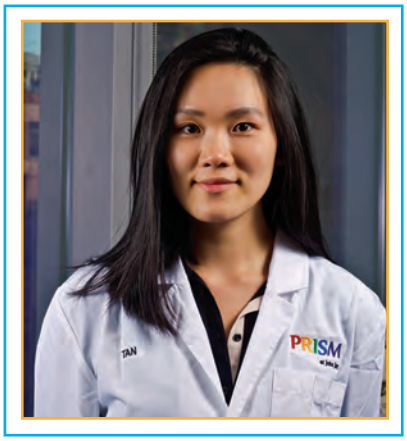
My research mainly focuses on investigation of counterfeit cigarettes sold on the black market. Our studies have shown that these illegal cigarettes have elevated levels of toxic metals like cadmium and lead compared to genuine cigarettes manufactured by regulated companies. Toxic metals found in these cheaper, illicit cigarettes may lead to liver damage and other health problems in first- and second-hand smokers. Young children are especially vulnerable when exposed to second-hand smoke.

Determination of Trace Level Lead and Cadmium in Counterfeit Cigarettes (Dr. He)

Counterfeit cigarettes are illegally manufactured and imported cigarettes, which were revealed to contain significantly higher levels of toxic metals, specifically Cd and Pb. Exposure to both Cd and Pb pose serious damage to the respiratory, cardiovascular, renal and central nervous systems. Therefore, determination of Cd and Pb in counterfeit cigarette is an important safety precaution as consumers may purchase these cigarettes without knowing the possible health risks. Both Cd and Pb can be determined by using the inductively coupled plasma mass spectrometry (ICP-MS) or inductively coupled plasma optical emission spectrometry (ICP-OES). In present study, counterfeit cigarette samples provided by law enforcement agents were studied. Two different digestion methods, acid digestion and microwave digestion, were evaluated and compared. Both methods showed acceptable results, however, microwave method offered higher recoveries.



Jia Wen (Joanne) Tan



I was born in China, and moved to the US with my family at a young age. My interest in science didn't start until high school, when I was exposed to the many fields of the natural sciences as well as hands-on scientific research. Afterwards, I knew for certain that I wanted to pursue a career in the sciences. Physics, chemistry, and biology help us understand the world around us. I am currently pursuing a bachelor's degree in forensic science. This field combines the two things in which I am most interested—science and investigating/solving problems. My career goal is to become a forensic toxicologist.

Research Summary

For my research project, I am creating a series of new chemical complexes (made from metals and organic materials) that John Jay biologists are testing on cancer cells. If these new metal compounds kill the cancer cells, they could lead to breakthroughs in new anticancer drug discovery.

Transition Metal Complexes of Novel Thiourea-containing Ligands for Cytotoxicity Studies (Dr. Zhang)

Metallic complexes are useful in many areas of biological and synthetic chemistry, mainly as catalysts in chemical reactions. Such compounds have allowed for breakthroughs in developing modern organic chemistry, much attention has been paid to the observations of novel, functional metallic complexes. However, bifunctional metal complexes based on a thiourea scaffold that implements hydrogen-bonding supramolecular interactions to a complex were little investigated. In this proposal, we aim to introduce a thiourea unit to various ligand backbones to generate a new class of organic ligands that can form novel metal complexes upon reaction to transition metal ions. New organic and metal-organic compounds will be characterized by spectroscopic techniques including UV, IR, NMR as well as X-ray crystallography. Further investigation on the cytotoxic properties of these metal complexes will be a part of collaborations with Prof. Shu-Yuan Cheng's group. This work will be a continuation to the ongoing research project in Dr. Zhang's group, where significant results have been obtained and published in peer-reviewed journals. Therefore, this proposed work is anticipated to drive the project forward and to gain new and interesting results that justify publication in peer-reviewed scientific journals in the fields of inorganic or bioinorganic chemistry.

Donovan Trinidad

I've always had an interest in science and math. While many of my peers dreaded the subjects, I practically ran toward them. When I arrived at John Jay I continued to excel in these areas academically, but did not go the extra mile immediately. For some reason, the idea of conducting research scared me. However, after hearing my peers discuss their research projects and seeing what they gained from participating, I got past that fear and applied to PRISM. Joining Dr. Lents' lab has allowed me to connect what I've learned in class to its actual applications and has offered me opportunities that have strengthened my interest in becoming a medical examiner.

Research Summary

The goal of my research is to determine whether or not we can use bacteria found on a body after death to figure out when a person died; if that is possible, we will create a model we can apply to case work. We are doing this by extracting DNA from swabs of four dead bodies taken over time, and identifying the types and amount of bacteria present.

Donovan Trinidad *continued*

Exploring Postmortem Changes in the Human Skin Micobiome (Dr. Lents)

In this project, we are exploring postmortem changes of the community of microbes that live in, on, and around the human body. One of our goals is to establish new tools for calculation of the postmortem interval (PMI) to aid death investigations. In the first phase of this project, we compared the bacterial communities on both living and deceased subjects to determine whether we could identify consistent differences among the microbial communities. We identified many microbial taxa that allow us to characterize a sample as having come from a decomposing body. In phase two, we are focused solely on dead subjects, and how the microbiome changes over time through the course of decomposition. We collected swab samples from the nostrils and external ear canals of four cadavers at the Anthropology Research Facility at the UTK over the course of several weeks. We extracted DNA from these samples and prepared them for 16S metagenomic sequencing. We are now focusing on the extraction and sequencing of DNA from the nostril samples, and analyzing the data collected from the sequencing of ear cavity DNA to highlight candidate taxa that prove most consistent and useful for establishing the PMI for deceased human subjects.

Khamattie Uzagir

I discovered my love for science when I was sitting in biology class learning how to translate DNA sequences. It was like a fun puzzle that I was trying to solve, and when I finally got the hang of it after MANY trials, I felt very accomplished. My interest in science skyrocketed from that day. I decided to major in forensic science and eventually became fascinated with chemistry because it challenged me. Though it has not been the easiest journey, being in a science intensive major is the most rewarding decision I have ever made. Working with Dr. Champeil has allowed me to apply my understanding of organic chemistry and use my critical thinking skills to solve scientific puzzles. I am thankful for the opportunities and support I received from PRISM throughout my journey at John Jay, and with PRISM's help, I will apply to pharmacy school upon graduation.

Research Summary

Amphetamine is a stimulant found in the prescription drug, Adderall. It is also manufactured illegally by undisclosed laboratories and then sold on the street. My research focuses on a pre-screening method that would differentiate the chemical structure of the prescription amphetamine from that of the illicit variety. Our method would allow forensic analysts to determine if the amphetamine found is legal or illegal, and it might provide law enforcement officials with clues about the synthetic route used to produce illegal amphetamines.

Detection of D- And L-Enantiomers Of Amphetamine In Mixed Salt Preparation of Adderall (Dr. Champeil)

Adderall is a drug often prescribed to treat individuals diagnosed with attention deficit hyperactivity disorder (ADHD) and narcolepsy, a sleeping disorder. This central nervous system stimulant contains amphetamine; which is used to increase the concentration of dopamine and norepinephrine in the brain. When monitored and used correctly, amphetamine can be useful to help reduce the symptoms of ADHD by increasing focus and concentration, while boosting self-esteem in individuals. However, because of its ability to induce quick therapeutic effects, amphetamine is often abused for recreational purposes. The need for the analysis of amphetamines is rising due to the rapid abuse of this drug. Nuclear Magnetic Resonance (NMR) Spectroscopy is a fast, conservative technique that can be used to identify the chemical structure of a sample. Amphetamine is a chiral substance which exists as a d or l enantiomer. Literature evidence demonstrates that chiral shift reagents in combination with NMR spectroscopy can be used to determine the ratio of dextroamphetamine and levoamphetamine in samples of Adderall. For this work, a chiral lanthanide shift reagent, Sm (dpta) will be prepared to help differentiate the enantiomers on an NMR spectrum of a racemic mixture of amphetamine. Once the chiral shift reagent is successfully synthesized, the ratios of enantiomers in several samples of Adderall will be determined.

Joseph R. Vandenburgh

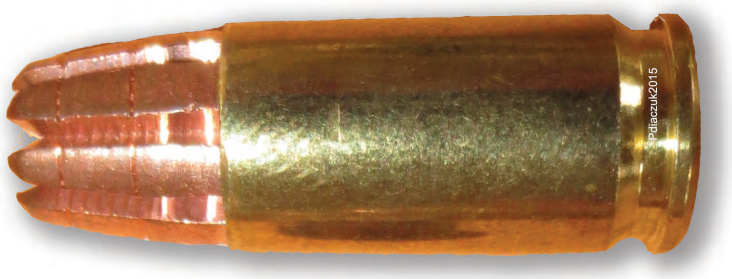
I am majoring in forensics science. The great thing about science is that it's always evolving. IBM's first computer (1956) was as big as two refrigerators and stored only 5MB of information, at a low price of $50,000. Now I am writing this biography on a 2TB computer with a price tag of $1,000. Last century printing was only done in 2-D. Now in 2015 printers can now print in 3-D. Finally, a man with no arm can now have a robotic one. These are a few examples of how science is constantly changing. By joining PRISM, I want to contribute to the ever changing world of science. Hopefully one day my research will make an impact, even the smallest impact will matter. John Jay was always my first choice of colleges to attend. Now that I am a member of PRISM, my research experience here will be that much more rewarding.

Research Summary

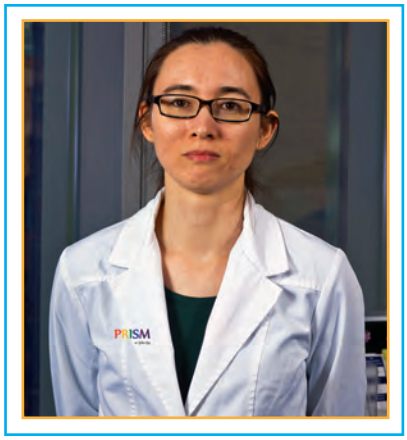
My research will determine the performance and effectiveness of a newly designed lead-free "radically invasive projectile" (R.I.P.) ammunition compared to more traditional lead-based standard hollow point ammunition.

Determining if RIP Ammunition Could be better for Law Enforcement than Other Ammunition (Dr. Diaczuk)

The RIP (Radically Invasive Projectile) is a bullet designed by G2 Research. Hollow point bullets are favored by the police department, because they have a greater tendency to stay inside the target. This feature lessens the danger to those who might get hit by the exiting bullet. Contrary to some beliefs, hollow point bullets do not explode on impact. Instead they expand, allowing greater kinetic energy transfer to the target. Is the RIP ammo a phase or an innovation that can change law enforcement doctrine on ammunition and shooting tactics? This is the driving question behind the research. The question will be addressed first with a laboratory analysis of the new bullet design, comparing and contrasting them with the current standard jacketed hollow point bullet. Later, the new bullets will be tested using the standard FBI ammunition test; the test used by the FBI to test their bullets prior to adoption for their agents. The laboratory analysis and subsequent field tests will determine if the newly developed RIP ammunition will outperform traditional jacketed hollow point service ammunition. The 9MM Speer Gold Dot cartridge and the 9MM Federal HST cartridge will provide the baseline to which the 9mm RIP cartridge will be compared.



Desiree Williams



Over the course of my studies I developed a curiosity for molecular biology and the tools we could use to manipulate genes to modify organisms. I hope to make a career out of research so I aim to pursue a graduate degree and work in biotech.

Research Summary

My research work focuses on creating tools to detect mislabeled fish. The species substitution of seafood inflates the price for consumers, increases health risks and jeopardizes sustainability. By creating tools to detect mislabeled fish, we can prevent fraudulent fish from getting to your table.

Desiree Williams *continued*

Species Identification of Mislabeled Red Snappers Found in New York City Fish Markets (Dr. Li)

Many markets have been known to sell mislabeled fish. One species that is constantly replaced by less expensive fish is the red snapper, or Lutjanus campechanus. Visually, it is nearly impossible to tell many of the substitute species from the actual red snapper. We aim to find a way to distinguish fraudulent species from actual red snappers by identifying single nucleotide polymorphisms within the cytochrome oxidase gene. Five samples were collected from random fish markets in New York City, DNA was extracted, and the samples were sequenced. After analyzing these sequences, we found that there may be positions that can differentiate between the Lutjanus genus. However, there is only one single nucleotide polymorphism (SNP) that differs for all the species we analyzed, which is at position 360. This finding may contribute to species identification by helping to closely analyze the exact position where one sequence differs from another. This will make identifying species that are closely related much easier. We aim to analyze more samples to provide a more statistically robust conclusion.

Tiffany Wong

"Life" was always a word which fascinated my mind as a child. This fascination stemmed from various sources related to the world in which we live. In childhood, I often enjoyed capturing wild insects and observing their daily lives in captivity, which flabbergasted my mother upon discovery of my captives. When I learned of the existence of science, I believed it to be the answer key to all my questions about why, who and what I am. This led to deeper questions over time. As my views evolved, I migrated toareas of study that strive to protect the planet.

Research Summary

My research project examines the current health of the waters of the lower Hudson River. This study specifically investigates the presence and quantities of carcinogenic and toxic water pollutants, such as PCBs and cadmium. My research also explores methods to improve the monitoring of pollution levels in the water.

Determination of Trace Level Organic Pollutants in Water at EPA Superfund Sites: Hudson River, Gowanus Canal, Newtown Creek (Dr. He)

Hudson River has been polluted by various inorganic and organic components in history and caused public health concerns. Currently, Hudson River is listed as an EPA Superfund site. Cleaning and remediation efforts have been made over the years. It is therefore important to monitor the major pollutants such as Polychlorinated Biphenyls (PCBs) in river water samples to have a better understanding of the cleanup efforts and obtain information for public awareness of this environmental health issue. In this study, PCBs were analyzed using gas chromatography-mass spectrometry (GC-MS). Solid phase microextraction (SPME), a solvent-free sample preparation method, was developed. Parameters affecting extraction efficiency such as stirring rate, extraction time, and desorption time were investigated and optimized. The method will be applied to analyze water collected from Superfund Sites in New York City.


Gowanus Canal

Michael Wu

A few years ago, Queens County Court sent a letter addressed to Michael Wu. Most people are dismayed to receive a letter for jury duty. It means that their lives will be interrupted because of this civic duty. I was excited to experience the full process of our legal system. I was juror number twelve, which meant I was the last person to be selected to serve. The most interesting aspect of jury duty was hearing expert testimony from scientists in the crime lab unit. It had a lasting impression and is one of the reasons that led me to attend John Jay College. I enjoy science because it gives me insight into how things work. Of all of my science classes, molecular biology holds my interest the most. I hope to continue my quest to understand microscopic biological interactions in living organisms through continuing education or in the field.

Research Summary

Pollen from flowering plants is often used as evidence at crime scenes. Currently, forensic botanists depend on pictures of flowers and pollen to determine the exact species of a plant. However, this is a subjective method of identification, especially since different plant pollen can have similar shapes. We are designing a plant DNA identification kit to distinguish plant species from each other at the genetic level. This objective method will eliminate the misidentification of plant species. At the same time, this method will allow for the rapid identification of flower type.

Genetic Characterization of Common Household Flower Species in Forensic Science (Dr. Lents)

Flowers are often used to decorate homes. In this work we want to determine if traces of flower pollen can be used as a component in a crime scene. Although every flowering plant has unique DNA, we hypothesize that, each genus has conserved sequences that could allow for discrimination from one genus to another. To explore this, plant DNA was extracted and specific genes were amplified for sequencing. Successful sequencing will allow us to identify unique DNA sequences which distinguish one species from another. To date, we amplified and sequenced the 18S ribosomal RNA gene from 13 plant species. We then designed both universal primers of conserved regions across all species and species-specific primers to amplify regions from each species based on unique polymorphisms.

Veronika Yakovishina

I was born in Tashkent, Uzbekistan. Science was always my favorite subject throughout middle and high school, and when I took my first chemistry course in Queensborough Community College (QCC), I knew that I wanted to work in the STEM fields. My favorite part of doing research at QCC is getting to do hands-on work and learn more about a topic that has always intrigued me. My time doing research has opened up a new world of opportunities to me and helped develop my goals into what they are today. I would like to get a bachelor's degree and then pursue a PhD in Toxicology. My career goal is to work in a laboratory full time, and contribute to the expanding pool of scientific discovery.

Research Summary

The goal of my research project is to identify novel methods of drug delivery to triple negative breast cancer cells, which are traditionally more difficult to treat than other types of breast cancer. Carbon nanotubes are cylindrical tubes of carbon which have been suggested as a possible drug delivery system for patients with this aggressive cancer. To determine the safety of such treatments, we are experimenting with different concentrations and ways to administer nanotube technology.

Veronika Yakovishina *continued*

Study of the Cytotoxic Effects of Carbon Nanotubes on Breast Cancer Cells (Dr. Sullivan, Queensborough Community College)

Breast cancer is a major health concern with statistics showing that 13% of women in the U.S. will develop invasive breast cancer in their lifetime. It is critical to develop innovative methods to treat metastatic breast cancer circumventing side effects common with current treatments. Biopsies from triple negative breast cancer (TNBC) patients display cells negative for the expression of estrogen receptor, progesterone receptor, and the HER-2/Neu gene, limiting the application of current treatments. Single-walled carbon nanotubes (SWNTs) have been proposed as candidates for drug delivery vessels, however little is known about the cytotoxic effects of these. We will focus on studying the cytotoxic effects of SWNTs on three breast cancer cell lines: MDA, MB-231, and MDA-MB-468. Fluorescence assays will determine if cell death is occurring via apoptosis. Current data suggests little to no correlation between treatment with SWNTs and mortality (concentration range: 2.5 - 200µg/ml) after 24 hours. However, MTT proliferation assays and fluorescence assays contradict these results, suggesting that cell viability decreases while apoptosis increases at concentrations as small as 2.5µg/ml. Once the mechanism of cell death is understood, other variables such as the effect of oxidized nanotubes, different cancer cell lines and possibly benign cells can be studied.

Yuan Zhuo Zhang

I developed an interest in forensic science at a young age, when I watched a series of TV shows related to the subject. But, for some reasons, I didn't choose it as my major. Until one day, when I saw the CUNY Justice Academy Program. It reminded me of my interest in forensic science. After I earned my associate degree of science for forensics from Kingsborough Community College (KCC), I continue my studies as a forensic science major in the toxicology track at John Jay. At KCC, I did research and had a chance to present my poster at the 18th Annual Green Chemistry & Engineering Conference. As a student who graduated from CUNY Justice Academy, I had the opportunity to get involved with PRISM and continue doing research. I am currently working with Dr. Zhang on synthesis of multinuclear non-precious metal complexes.

Research Summary

Chemical companies oxidize alcohol to create other chemicals. The traditional processes to do this involves the of use metals that are costly and dangerous to people and the environment. My research looks at an alternative process that uses copper—an abundant, safe and environmental friendly material.

Green Catalytic Oxidations using Multinuclear Non-Precious Metal Complexes (Dr. Zhang)

Multimetallic complexes are attractive catalyst candidates for a variety of organic reactions, and in particular a tetranuclear copper complex has proven to be efficient catalyst for the catalytic oxidation of alcohols recently. In previous work, one of the Copper complexes which was designed by using condensation of (R)-(-)-2-Phenylglycinol and 3-Formylsalicylic Acid Hydrate as preparation was synthesized successfully and the result for the X-ray measurement shown that the Copper complexes polymeric. Meanwhile, another Copper complex made by a di-aldehyde was synthesized and under testing. In this proposal, we are aiming to design more new multimetallic complexes based on non-precious metals, especially Copper, to carry out the catalytic aerobic oxidations of alcohols to carbonyl compounds in a "green" reaction media such as water. The facile one-pot metal-mediated condensation of aldehydes and amines will still be applied to prepare a range of multinuclear non-precious metal complexes. These metal complexes containing the di-aldehyde will be structurally characterized by spectroscopic techniques as well as X-ray crystallography. Catalytic reactions for alcohol oxidations will be performed using the newly synthesized multimetallic complexes, and the reaction will be preferably tested in water.

PrIMER STUDENT RESEARCHERS

PrIMER Student Researchers (left to right): Natalia Fernandez, Hadler Alves da Silva, Crystal Kennedy, Annerys Guzman, Julia Diaz, Argenis Ramlogan, and Nyeisha Brathwaite. Missing: Stephanie Sanchez.

The Program to Inspire Minority Undergraduates in Environmental Health Science Research (PrIMER) is a joint program between John Jay College and the Mailman School of Columbia University's Environmental Health Science Department. The main goal of the program is to offer students at John Jay that have an interest in environmental health and are planning to attend graduate school after graduation, an opportunity to perform research with experts in this field. The program includes support for the graduate school application process, and close mentoring and advising by John Jay and Columbia University professors.

Nyeisha Brathwaite

I am in total awe of my latest scientific adventure. Research at Columbia University has given me an opportunity to develop skill sets utilizing a variety of molecular biology techniques. Since I enrolled into the forensic science major at John Jay, there have been many bumps along the way. However, I am glad that my passion and fire for science was not quenched but invigorated. I recommend students partake in research even if they are not sure, for they will quickly know if it is something they would like to seek in a career or not. After all, experience is priceless. I would like to thank Dr. Lissette Delgado-Cruzata and my research mentors Dr. Norman Kleiman and Dr. Greg Freyer for allowing me to assist in the development of an important public health based research project, revolutionizing noninvasive diagnosis.

Research Summary

In this research project we are analyzing saliva samples to detect compounds individuals release when they are under environmental stress, such as radiation. This method could provide a non-invasive way of measuring stress levels. This study has the potential to provide health care professionals with a simple tool for identifying individuals suffering from radiation exposure.

Non-Invasive Detection of Environmental Stress Using Translocator Protein (18 kDa) (TSPO)

Salivary glands undergo transcriptional changes in response to radiation exposure and psychological factors. Evidence suggests there is a dose-responsive increase in translocator protein 18 kDa (TSPO) mRNA expression and protein levels, in response to ionizing radiation (IR) exposure. Other studies have shown diminished TSPO expression among individuals suffering with psychiatric disorders. Measurable changes in TSPO expression that occur after either ionizing radiation exposure or psychological stress indicate TSPO may be a useful biomarker of environmental stress. High levels of TSPO exist in leukocytes and the major salivary glands. We hypothesize that changes in TSPO mRNA expression of saliva samples can be used as a non-invasive biomarker of certain stressors. Our proposed studies rely on reverse transcription coupled-PCR in combination with quantitative PCR (qPCR), to analyze changes in TSPO gene expression. We have identified primers suitable for TSPO expression in mouse and human white blood cells. The next steps require the optimization of a saliva-derived RNA isolation protocol, and we will compare and analyze TSPO expression in saliva and blood. This study has the potential to provide health care professionals with a simple non-invasive, quantitative tool for identifying individuals suffering from environmental or emotional stress.

Hadler Alves da Silva

My love for science began in my high school chemistry and AP Biology class. I loved learning about why things happened as they did in the world. I chose forensic science as a major because I believed that science could help in solving crimes. My three years at John Jay taught me how to look at the world with a different perspective as well as to think differently. I came to college trying to avoid doing research, but doing research this summer showed me that it isn't as bad as I thought it would be. I hope to use the skills I've learned in a forensic crime lab and to eventually get a PhD.

Research Summary

Children living in New York neighborhoods such as the South Bronx and Washington Heights have the highest asthma rates in the country. My research focuses on studying factors that might cause asthma, such as allergens, and my goal is to identify the allergens in the New York City subway trains to which people may be exposed on their journeys to work or school.

Allergen Exposure in NYC Subway Trains

Asthma is a chronic disease that causes the airways in the lungs to constrict making breathing difficult. Typical triggers of asthma attacks are allergens or usually harmless foreign substances the immune system has a reaction to like pet dander, dust mites, pollen, & mold. Since the New York Subway system is a primary means of transportation for those in NYC, exposure to these allergens may occur during an individual's commute. In this study, we want to identify and quantify the allergens that daily commuters are exposed to. We hypothesize that any allergen found in a home (Cat, dog, mouse) will be found in the subway train as they are transferable as well as cockroach, & dust mites which inhabit the subway. To prove this, we will collect air samples of the train and test the collections for the following allergens: Cat (fel d 1), dog (Can f 1), mice (Mus m 1), cockroach (Bla g 2), & Dust mites (Der f 1). Since we are in the early stages of the study, we are currently perfecting the methodology. As future work, we wish to focus on fungi exposure using this methodology.

Natalia Fernandez

Having witnessed crimes in the past, I always knew I would pursue a degree related to law. However, it was not until I decided to leave the Dominican Republic in 2010, and pursue a degree in forensic science that it all started. I applied to PRISM in 2013 and did research on bioremediation (using spent tea-bags as adsorbents of heavy metals) with Dr. Abel Navarro at the Borough of Manhattan Community College (BMCC). Later I worked with Dr. Gloria Proni at John Jay, synthesizing new fingerprint reagent derivatives. Currently, I work with Dr. Joseph Graziano at Columbia University, identifying the risk factors of lead exposure in children and adolescents in Bangladesh. It has been an honor for me to work with all of my PRISM mentors. Without them, I never would have discovered my passion for doing research or my desire to attend graduate school.

Research Summary

Lead is a metal that causes learning deficits and other health problems, especially in children. Children of Araihazar, Bangladesh have been identified as having high levels of lead in their blood, but the reasons that these levels are high is not clear. My research work focuses on identifying these factors. This will help us understand which strategies can be implemented to eliminate this exposure and improve the health of these children.

Risk Factors of Lead Exposure in Children and Adolescents in Bangladesh

For the past decades in Bangladesh, several health problems have been associated with exposure to arsenic. Naturally occurring arsenic in the ground contaminates many wells that have been used to provide water to villages in the community of Araihazar in Dhaka, Bangladesh. Ten-year-old and 6-year-old children in Araihazar were studied to determine the health effects of arsenic and manganese exposure. Furthermore, same children populations were exposed to lead as well in higher concentrations than the accepted values, but not from drinking water. In the past, 10 or more µg/dL of lead in blood was the level of concern in children. However, in 2012, Centers for Disease Control and Prevention (CDC) defined a reference level of 5 micrograms per deciliter (µg/dL) to identify children with elevated blood lead levels. Therefore, this study has the specific aim to identify and study the risk factors for the development of elevated blood lead concentrations among children previously and currently studied in Bangladesh.

Annerys M. Guzman

As a forensic toxicology and biology student, I am interested in the study of different environmental agents that have critical effects on human health, especially after an increase in exposure. Toxicology and biology allow me to make very clear distinctions between the different types of exogenous agents that can impact health and the physiological processes that can be affected by higher rates of exposure. My passion for learning about the type of chemicals which affect our health began when I was in middle school when people burned trash near my house in a rural section of the Dominican Republic. I became sick from this. My mother confronted and threatened to call the authorities. I wondered how things such as burning trash could affect human health. Now, I plan to apply to graduate school, continue my studies in toxicology and eventually work for the FDA or the EPA.

Research Summary

My research focuses on determining the effect lead has on changing the chemistry of the brain. Lead has been associated with diminished intellectual functions. The goal of my work is to determine whether different amounts of lead fed to rats right after birth affect the amounts of proteins involved in the signaling processes that take place in the brain.

Dopamine D1 Receptor Levels in the Striatum after Lead Exposure

Lead (Pb^{2+}) has been shown to affect processes such as cognition and behavior. Recent studies have provided evidence that there may be a relationship between chronic early life Pb^{2+} exposure and the neuropathology present in the schizophrenic brain. The current study aims to identify if striatal dopamine D1 receptors (D1R) are changed after chronic developmental exposure to Pb^{2+}. We hypothesize that the D1R will be affected by the level and duration of Pb^{2+} exposure. Striatal brain tissue was analyzed for whole cell D1R protein levels after developmental exposure to low (180 ppm) or high (1500 ppm) Pb^{2+} in male rats on postnatal (PN) day 14 (juvenile), 28 (early adolescence), and 50 (late adolescence) using western blotting. We show a mild percent increase in D1R protein levels in PN14 and PN28 rats exposed to 180 ppm (PN14: 11 ffl 0.86%, and PN28 16 ffl 0.5%), and 1500ppm (13 ffl 0.6 %) Pb^{2+}. Interestingly, in late adolescent rats (PN50), a percent decrease in D1R protein expression was observed in both 180 ppm (10 ffl 0.5%) and 1500 ppm (13 ffl 1.4%) Pb^{2+} exposed rats. By quantifying D1R protein levels, we could proceed to study the different effects that chronic Pb^{2+} exposure has on the biochemical pathways associated with the dopaminergic system.

Julia Diaz

I am a junior student in the forensic science program: toxicology. I am from New Jersey. In middle and high school, I realized I was always better prepared for subjects in the sciences rather than history or literature. During my junior year of high school, I took chemistry and that is when I knew I wanted to pursue a career in chemistry. My chemistry teacher was so passionate about teaching chemistry that it made me enjoy class and I actually understood the material very well. I remember her putting up CSI episodes every other Friday and I was astonished by how evidence was analyzed and processed. Now that I am actually in the program I realize it is not as simple but I continue to enjoy the lab work I do as I move further up in the major. After I graduate from John Jay, I plan to apply to medical school and pursue a long term career as a medical examiner.

Research Summary

Breast cancer is the fourth cause of death affecting women in the USA. My research work focuses on testing multiple compounds or markers that are present in different samples such as plasma, blood, or urine in women who have had breast cancer and others than have not. Testing for such biological markers allows us to determine whether they can use to detect the occurrence of breast cancer.

Nitrotyrosine Levels Among Relatives from Families Participating in The Breast Cancer Family Registry

In the last fifty years, oxidative stress has gained a considerable amount of attention. Many studies have been conducted and demonstrated that reactive oxygen species play a role in the aging process of several neurological diseases as well as different forms of cancer. Similarly, studies of reactive nitrogen species have demonstrated implications in multiple pathological diseases such as breast carcinogens. Nitric oxide (NO) and its byproducts can produce powerful oxidants that cause cellular damage by generating peroxynitrite. Levels of Nitric Oxide are difficult to measure since it is a fusible gas; as a result, biomarkers such as Nitrotyrosine are used to quantify levels of Nitric Oxide damage. The first aim of this study is to develop an Enzyme-Linked Immunosorbent Assay (ELISA) which can provide an accurate and efficient way of analyzing levels of Nitrotyrosine in plasma samples. The second is to test whether Nitrotyrosine can be used as a reliable bio-marker to predict cancer risk in women participating in The Breast Cancer Family Registry.

Crystal Kennedy

In 2011, I left St. Vincent and the Grenadines, a small country made up of a group of islands within the Caribbean archipelago, to pursue my dreams of becoming a forensic scientist. I have always wanted to see justice served, and I have always admired those that gather irrefutable evidence using scientifically proven and accurate methods for the greater good of society. This, along with my passion and knack for the sciences, led me to John Jay College's molecular biology track in the forensic science program. After gaining my bachelor of science here in May 2016, my goals are to advance to graduate studies within the field of molecular biology, and to begin my career as a scientist.

Research Summary

Outdoor air pollution has been linked to several respiratory diseases. Individuals exercising outside might breathe large amounts polluted air and this could increase their risk of respiratory illnesses. My research focuses on finding the amount of exposure to air pollution bikers have in New York City. We can ultimately use this information to identify the biking routes that have higher exposure and to advise bikers where it is safest to ride.

Estimating Minute Ventilation from Heart Rate in New York City Bicycle Riders

Particulate matter with an aerodynamic diameter of 2.5µL or less (PM 2.5) is a leading cause of morbidity and early mortality in urban cities such as New York City. A person exercising in such a city would be inhaling a larger dose of PM 2.5 than the average pedestrian. A pilot study is being conducted to determine the inhaled dose of PM 2.5 of the New York City cyclist, the potential effects of this dose on the cyclist's cardiovascular indicators, and routes throughout the city that may contain less PM 2.5 than others. Part of calculating the inhaled dose of PM 2.5 is measuring the minute ventilation (volume of air exchanged per minute) of the cyclist. If minute ventilation can be predicted from heart rate, we can simplify and lower the cost of the experimental protocol. We collected heart rate (HR) and minute ventilation (MV) data from 15 subjects and analyzed the correlation. 10 sets showed clear linearity between HR and MV with average slopes of 0.0012 bpm/mLmin-1. 4 appeared to require transformation in order to achieve linearity. 1 set resulted in erratic data points. Preliminary data indicates that there may be a direct relation that will allow us to calculate MV from HR data, however additional data is needed.

Argenis Ramlogan

I am a forensic science major focusing on the criminalistics track at John Jay. I have a passion for science especially chemistry. While my current career goal focuses on working in the field of forensic science, I like to keep my options open and experience other fields in science. A good example of this is my current internship at Columbia University which focuses on environmental health sciences. I want to further my education and live up to my full potential as a scientist.

Research Summary

My research focuses on how field equipment can be validated against laboratory gold standard measurements for heart rate, respiratory rate and minute ventilation in bicyclists. Through this validation process, field equipment can be efficiently used and accurate using a possible correction factor for determining the concentration of inhaled pollution bicyclists experience within large cities such as New York City.

Validation Study of Collected Parameters by the Hexoskin vs. Laboratory Standards in the Potential Inhaled Dose of Pollution Exposed to Bicyclists

This validation study was the first stage of a larger study focusing on the potential inhaled dose experienced by pollution-exposed bicyclists in New York City. Minute ventilation (VE) is used to take account of concentrations of pollution and volume of air inhaled to determine air pollution exposure. The equipment used in the study, Hexoskin shirt, was validated against laboratory equipment by comparing measurements made during a Cardio Pulmonary Exercise Test (CPET). Comparisons of parameters measured respiratory rate (RR), heart rate (HR) and VE were studied between the Hexoskin shirt and lab equipment at the same time using ten-second averages. All parameters correlated well across each subject. VE measurements were significantly different from the Hexoskin shirt and the lab equipment measurements. Preliminary results show that the concentration of inhaled dose of pollution using VE can be determined accurately using the Hexoskin shirt if a person-specific correction factor was applied.

Stephanie Sanchez

I am pursuing a degree in forensic science with a concentration in toxicology. Initially, I was a criminal justice major at Bronx Community College. However, I wasn't quite motivated. It wasn't until I took my first ever chemistry class that I gained, not only a renewed interest in school, but a growing curiosity in science. As of now, I look forward to PriMER research, affiliated with PRISM, where I can further expand or refine my knowledge and skillset.

Research Summary

Prostate cancer affects a large proportion of men each year. MEK5 is a protein that is found to be much more abundant in prostate cancer cells, as compared to healthy non-cancerous cells. The goal of my research is to inhibit the production of the MEK5 protein in cancer cells, making the cells more susceptible to radiation. Increasing the susceptibility of prostate cancer cells to radiation could improve the treatment for this disease and the quality of life of those suffering from it.

The Impact of MEK5 on Prostate Cancer Cell Survival

Ionizing radiation is commonly used to treat cancer. However, it is not always effective due to radioresistance that a tumor may exhibit, allowing it ultimately to prevail. We hypothesize that the mitogen-activated protein kinase kinase 5 (MAP2K5/MEK5) gene, which is involved in cell proliferation and survival, and is found to be overexpressed in prostate tumors as compared to healthy prostate cells, may also play a role in radiotherapy by promoting resistance to radiation. Our project elucidates the role of MEK5 by assessing the response of prostate cancer cells after the gene is silenced through the introduction of synthetic small interfering RNA (siRNA), with or without irradiation.

PUBLICATIONS AND PRESENTATIONS

IN ADDITION TO OUR Annual Symposium, PRISM students regularly present their research to their peers on CUNY campuses and at scientific conferences and professional events. Below are a few of the many professional accomplishments our student researchers achieved this past academic year (2014-2015).

Publications

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Presentations

2014 Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX

Fernandez*, P., Rauceo, J. "The Yeast Chaperone Sse1 Plays a Novel Role in Processing Cell Wall Amyloid-Forming Adhesins," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Guzman*, S., and Lents N.H. "Analysis of the Human Microbiome on Living and Decomposing Bodies," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Khusial*, R., Carpi, A. The Role of Temperature and UV Light in the Reduction of Mercury (II) Chloride to Elemental Mercury," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Kinahan*, C., Proni, G., Tami, K., Petrovic, A. G., Ben-Shabat, S. "Chiroptical characterization and biological evaluation of selected organophosphates," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX, November 12-15, 2014.

Lopez*, Y., Cheng, S. "Manganese-Containing Dithiocarbamate Pesticides Increase β-amyloid Precursor Protein and β-amyloid Peptide Expression in PC-12 Cells," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Montes*, J., Cheng, S. "Effect of Manganese-Containing Dithiocarbamates on Double-Stranded RNA Dependent Protein Kinase (PKR) Signaling Pathway," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Romero*, R., Roberts, M. "Surface Modification for the Detection of Illicit Biomarkers in Fingerprint Sweat," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Seo*, J., Cheng, S. "Mitomycin C and 10-Decarbamoyl Mitomycin A Activity Study on p53 Wild-type and Deficient Cancer Cells using Flow Cytometry," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Sokolowski*, D. and Lents N.H. "DNA-Based Forensic Analysis of Plant Phylogeny Identification using Chloroplast DNA," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX, November 12-15, 2014.

Texeira*, C., Carpi, A. "Using Bird Feathers as Bio-monitors of Mercury in the Environment," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Williams*, S., Domashevskiy, A. "Pokeweed Antiviral Protein Binds to Structures Present in the 3' Untranslated Regions of Viral mRNA," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

Yarde*, S., Carpi, A. "The Role of Water and pH in the Reduction of Mercury (II) Chloride to Elemental Mercury," Annual Biomedical Research Conference for Minority Students (ABRCMS), San Antonio, TX; November 12-15, 2014.

***denotes PRISM student**

Society of Toxicology Annual Conference, San Diego, California

Lerer*, A., Fonarova T., and Lents N.H., "Zinc Reduces the Detection of THC by ELISA Urine Testing, While Copper May Cause a False-Positive Result," 54th Society of Toxicology Annual Conference, San Diego, CA; March 22-26, 2015.

Lopez*, Y., Montes*, J., Cheng, S.Y., "Manganese-containing dithiocarbamates increase the expression of amyloid precursor protein and the level of phosphorylated PKR," 54th Society of Toxicology Annual Conference, San Diego, CA; March 22-26, 2015.

Seo*, J., Ta*, C., Cheng, S.Y., "Mancozeb induced cell cycle arrest and senescence via RTP801," 54th Society of Toxicology Annual Conference, San Diego, CA; March 22-26, 2015.

Experimental Biology 2015, Boston, Massachusetts

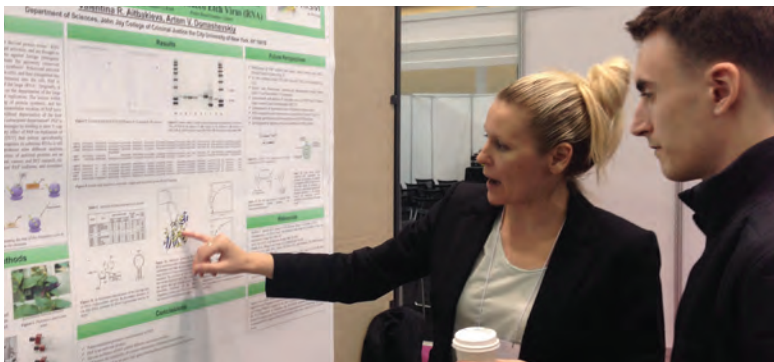
Aitbakieva*, V.R. and Domashevskiy, A.V. "Isolation, Purification and Characterization of Pokeweed Antiviral Protein (PAP) Isoforms, and Comparison of Their Enzymatic Activities Towards the Tobacco Etch Virus RNA," Experimental Biology 2015: American Society of Biochemistry and Molecular Biology, Boston, MA; March 27-April 1, 2015.

Rodriguez*, D.J. and Domashevskiy, A.V. "Synthesis of Fluorescently-Labeled Tobacco Etch Virus (TEV) RNA and Its Interactions with Pokeweed Antiviral Protein (PAP)," Experimental Biology 2015: American Society of Biochemistry and Molecular Biology, Boston, MA; March 27-April 1, 2015.

Other

Brathwaite*, N.; Zhang, G. "Nonprecious Metal Complexes Based on Multidentate Ligands for Catalysis and Fluorescence Sensors", 63rd Annual Undergraduate Research Symposium (URS) of the American Chemical Society, Queensborough Community College, New York, NY; May 9, 2015.

Chiu*, M., Tami, K., Kinahan*, C., Ng, A., Proni, G. "Stereochemical Determination of Methamidophos and Ruelene, Organophosphorus Compounds," 250th ACS National Meeting and Exposition, Boston, MA; August 16-20, 2015.



2016 PRISM SYMPOSIUM

ESTABLISHED FORMALLY IN 2006, but building on the foundations of a program that began as early as 2000, the Program for Research Initiatives in Science and Math (PRISM) strives to promote research achievement among John Jay students and prepare them for professional careers as scientists. By establishing and supporting close mentoring relationships between students and faculty, PRISM embraces the apprenticeship model of science.

The Program not only seeks to train students in the language of science, but to immerse them in its practice. Students participate in all aspects of scientific exploration, from the formation of research questions to the presentation and publication of new research studies. Along the way, they learn from their successes, and they learn to appreciate their failures. Exposed to the culture of the scientific community, many students find themselves irresistibly drawn to the profession. To date, more than 55 students have moved on from PRISM to post-graduate training in the sciences, a path that will lead to them becoming scientists themselves.

The Annual Research Symposium is a celebration of this year's student researchers and the work that they have accomplished over the past academic year.

2016 PRISM Keynote Speaker: Dr. Anastasiya Yermakova

I pursued a Bachelor of Science in Forensic Science with a concentration in molecular biology at John Jay College of Criminal Justice from 2004-2008 where I graduated Magna Cum Laude. Thanks to PRISM, I had the opportunity to perform research under the guidance of Dr. Margaret M. Wallace. I assisted a master's student in the determination of DNA profiles from flip-open cellular phones and deodorant sticks. While at John Jay I received a scholarship from the Department of Homeland Security that provided me with the opportunity to work as an intern for two summers at the US Army Medical Research Institute of Infectious Diseases. My research there focused on the development of nucleic acid-based detection assays for the Ciprofloxacin-resistant bioterror agents, *Bacillus anthracis* (anthrax) and *Yersinia pestis* (plague). Encouragement from both Dr. Wallace and Dr. Ron Pilette and my interest in biodefense and emerging infectious diseases inspired me to pursue a PhD in immunology and infectious diseases in the Department of Biomedical Sciences at University at Albany's School of Public Health and The New York State Department of Health's Wadsworth Center in Albany, NY.

Under the mentorship of Dr. Nicholas J. Mantis, my dissertation focused on the development of a subunit vaccine for ricin, a bioterror select toxin. After completion of my PhD in 2013, I began my postdoctoral fellowship in the laboratory of Dr. Jordan S. Orange at the Baylor College of Medicine and Texas Children's Hospital. My current research with Dr. Orange focuses on defining natural killer (NK) cell antibody-dependent cell-mediated cytotoxicity (ADCC). After my post-doc I plan to pursue therapeutics development in the biotech industry where I hope to make a positive contribution towards the development of new and efficacious therapies that have the power to restore health or even save lives of patients with unmet medical needs.

2016 PRISM Outstanding Undergraduate Researcher: David Rodriguez

This year Mr. David Rodriguez has been selected as PRISM's Outstanding Undergraduate Researcher. This award recognizes the progress and the level of commitment to research displayed by one of our students, and his/her development as a scientist.

David joined PRISM in the summer of 2014 under the mentorship of Dr. Artem Domashevskiy. His project focuses on how a protein found in pokeweed, a plant found throughout most of the U.S., could potentially be used as an antiviral drug. In his nomination letter, Dr. Domashevskiy wrote, "David harbors great potential and curiosity. He is highly responsible and takes the initiative upon himself to advance his knowledge and skills in the laboratory. Having grown into a confident, responsible scientist, Mr. Rodriguez now communicates with the ease of a seasoned researcher."

David's work focuses on studying the interaction of pokeweed antiviral protein (PAP) and viral RNA, an interaction that leads to the inactivation of the virus. To study this, he attaches fluorescent probes to the viral nucleic acids. After attaching the fluorescent cap, every time the viral nucleic acid interacts with PAP, the level of fluorescence changes, allowing him to identify and monitor the reactions leading to virus inactivation. Studying these interactions will allow us to study PAP's binding characteristics, and it might lead to its usage in eliminating viruses.

David is currently applying to NIH-funded Post Baccalaureate Research Education Programs (PREP) to broaden his experience in research after graduating from John Jay. He also plans to apply to PhD programs to fulfill his career goal to be an independent scientist.

The PRISM Outstanding Undergraduate Researcher Selection Committee evaluates nominees based on their research mentor's nomination letter as well as their current research proposal. Reaching a decision was not a simple task as all nominees demonstrated outstanding research skills. In addition, each mentor submitted a nomination letter that was not only impressive but also heartfelt, showcasing the close working relationship between mentor and student.

This year's selection committee was formed by Dr. Laina Freyer (Memorial Sloan Kettering Center), Dr. Jeremy Fagan (NYS Department of Health) and Dr. Angela Erazo (Ogilvy Commonwealth Worldwide).

Top row: *2015 Symposium - Dr. Anthony Carpi, PRISM Director; Dr. Daniel Cocris, Keynote Speaker, and Yessenia Lopez, PRISM Outstanding Undergraduate Researcher of the Year. Bottom row:* 2012 *Symposium - Roselynn Cordero, PRISM Outstanding Undergraduate Researcher of the Year and Dr. Damon Borg, Keynote Speaker.*

Former PRISM Symposium Speakers and Outstanding Undergraduate Researcher Award Recipients

2015
Keynote: Daniel Cocris, D.M.D (Rutgers School of Dental Medicine)
John Jay: Graduating Class of 2006
Award Recipient: Yessenia Lopez currently at Albert Einstein College of Medicine.

2014
Keynote: Alison Keenan, PhD (University of CA-Davis)
John Jay: Graduating Class of 2007
Award Recipient: Eugenia Salcedo, currently at University of CA-San Francisco

2013
Keynote: Lisa DeWald, PhD (Stony Brook University)
John Jay: Graduating Class of 2004
Award Recipient: Anna Stoll currently at CUNY Graduate Center

2012
Keynote: Damon Borg, PhD (St. John's University)
John Jay: Graduating Class of 2005
Award Recipient: Roselynn Cordero currently at Cornell University

2011
Keynote: Kimberly Papadantonakis, PhD (CA Inst. of Tech)
John Jay: Graduating Class of 2002
Award Recipient: Richard Piszczatowski currently at Albert Einstein College of Medicine

2010
Keynote: Julie Layshock, PhD (Oregon State University)
John Jay: Graduating Class of 2005
Award Recipient: Jason Quiñones currently at Stony Brook University

2009
Keynote: Bladimir Ovando, PhD (SUNY—Buffalo)
John Jay: Graduating Class of 2002
Award Recipient: Kana Noro

2008
Keynote: Marcel Roberts, PhD (Boston College)
John Jay: Graduating Class of 2002
Award Recipient: Nicole DeLuca

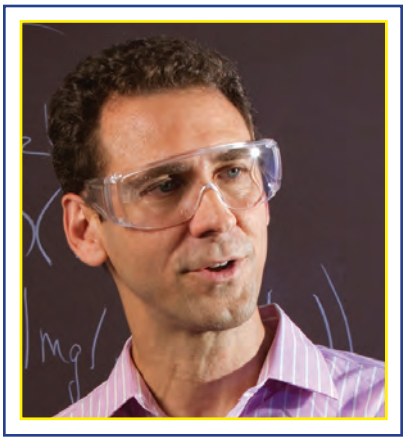
Aftab Ahmad, DSc (George Washington University)
Associate Professor

Areas of Expertise: Object-oriented programming, computer architecture and data communications and forensic security

I teach object-oriented programming, computer architecture, forensic security and advanced data structures. My current research projects include information flow inside a biological neuron, networking on demand (NoD) for network and application design. NoD is similar to software defined radios (SDR) with the difference that the NoD devices or applications can adapt to security and privacy demands by changing networking characteristics. At this time, I am working on applying this concept on networks of human-implantable devices for healthcare.

I have original work published in design of networks of implantable devices, assessment of network security, design of forensic capable mobile networks, and modeling of biological neuron signal. I've authored two books, *Data Communications Principles: For Fixed and Wireless Networks* (Springer-Verlag 2003) and *Wireless and Mobile Data Networks* (Wiley, 2005), and a book chapter "Chapter 7—Security Assessment of Networked Systems," Network Security, Administration and Management: Advancing Technologies and Practices, (IGI Global, 2011). My book chapter "Digital Body" will be published in Modeling Methodologies and Tools for Molecular and Nano-scale Communications, (Springer 2015).The chapter describes a view of the human body as a digital medium for networks of implantable sensors. My lab has projects on network signaling in biological neurons, reconfigurable networks for data privacy, and smart web app design.

Anthony Carpi, PhD (Cornell University)
Professor and Dean of Research



Areas of Expertise: Environmental chemistry and science education

In hindsight, I was incredibly lucky to have parents who tolerated me blowing out fuses with homemade electromagnets or setting off small explosions in the backyard with hydrogen balloons that were filled with a water electrolysis set-up I had in my bedroom. The freedom to explore ideas, even as far-fetched as running our lawn mower off of hydrogen power, has affected my approach to mentoring.

I try to provide students the guidance that they need to grow in the lab while allowing them room to make mistakes and learn from those errors. The key to becoming a good scientist is not memorizing a lot of facts, but learning how to think analytically and critically. In the lab we teach these aspects of science as well as creativity and independence. We learn how to frame a scientific question and then identify the methods to pursue it; we learn how to explain and present one's research so that people outside of our own lab will understand the significance.

My laboratory research focuses on understanding the chemistry and transport of environmental mercury pollution. Mercury is a major environmental pollutant, and once deposited into the environment the metal can be remobilized by various chemical reactions. We look at the specific mechanisms that drive these reactions—the molecular pathways that lead to mercury mobilization and how these pathways can be driven by environmental variables.

Anthony Carpi, PhD *continued*

We try to understand the effects that the transport of mercury will have on human populations and the environment. This is accomplished through a combination of molecular modeling studies, in-house laboratory analyses, and field research that has taken us to locations such as New Haven, CT and the Brazilian Amazon—good research should also be great fun.

Elise Champeil, PhD

(University of Ireland, Trinity College)

Associate Professor

Areas of Expertise: Synthetic chemistry and bioorganic chemistry

After a master's degree in chemical engineering (ENSCL, France), I decided to pursue a PhD in organic chemistry at Trinity College, Dublin. I further developed my synthetic skills in the labs of Prof. Lakshman and Tomasz (CUNY) where I developed an interest in the synthesis of modified DNA adducts. I am also particularly interested in the chemistry of the anti-cancer agent Mitomycin C.

My research is focused on the study of: (1) The synthesis of modified DNA adducts of Mitomycin C and decarbamoyl Mitomycin C, (2) the pharmacological mechanism of anticancer drugs mitomycin C and its analog on p53 proficient and deficient cells, and (3) the use of NMR spectroscopy in forensic science for the analysis of drugs of abuse and the discrimination of soils organic matter.

One of the greatest satisfactions of running a research group is to watch students develop into proficient scientists. I enjoy mentoring students and helping them develop their synthetic skills, data analysis abilities and critical thinking. Through regular meetings and one-on-one conversation, I guide them, encourage them and, hopefully, help them become better chemists.

Shu-Yuan Cheng, PhD (St. John's University)

Associate Professor

Areas of Expertise: Toxicology, pharmacology, molecular biology, and neuroscience

I began my career as a pharmacist. Understanding the toxicity of drugs is essential for a pharmacist. We all know that the right dose can make the difference between a poison and a remedy. Drug-drug interaction is always a big issue for a toxicologist. Due to these reasons, I became interested in divulging the toxic mechanism of drugs that can potentiate or synergize the toxic effect of other drugs. Moreover, being a John Jay forensic toxicology professor, I am also interested in using new analytical methods for the quantification of drugs in different types of biological specimens.

My research is focused on the study of: (1) the epidemiology of marijuana and prescribed opioids in waste water system of New York City by LC-MS/MS, (2) the extraction efficiency and matric effects of cathinones in various biological matrices by using LC/MS/MS, (3) the cellular toxic responses of pesticides (dithiocarbamates) on neuronal cells with emphasis on biochemical and molecular mechanisms associated with cell death (apoptosis, narcosis, senescence), and (4) the pharmacological mechanism of anticancer drugs mitomycin C and its analog on p53 proficient and deficient cells.

Being a research mentor, I love to encourage students to read, think and plan their research before they start. I constantly meet with them to discuss the background of their projects, the data, and the future experiments. I always recommend students to present their results at conferences, either at John Jay or national conferences to learn from others.

Marta Concheiro-Guisan, PhD

(University of Santiago de Compostela, Spain)

Assistant Professor

Areas of Expertise: Forensic and clinical toxicology

I studied pharmacy at the University of Santiago de Compostela, where I also earned my PhD in forensic toxicology. I worked in clinical and forensic toxicology at the National Institute on Drug Abuse (NIDA) in Baltimore, MD, first as a post-doc and later as a lab manager. I joined John Jay in 2015.

I really love forensic and clinical toxicology because, for me, they are the direct application of laboratory work to solve real-life problems.Both involve an "analytical chemistry" approach, to develop analytical methods for the determination of licit and illicit drugs in biological specimens, and a "pharmacology" and "toxicology" side, interpreting these analytical results, what they really mean and their biological implications and consequences.

My main research interests focuses on alternative biological matrices to detect drug exposure to cannabis and to novel psychoactive substances (NPS), and wastewater drug analysis. The alternative samples that we study are oral fluid, dried blood spots and hair. Among the heterogeneous and emerging group of the NPS, my interest is on the development of detection methods of synthetic cannabinoids and synthetic cathinones in biological matrices. Also, my research is focused on the screening and determination of different types of licit and illicit drugs in wastewater, to be able to estimate drug prevalence in a certain population.

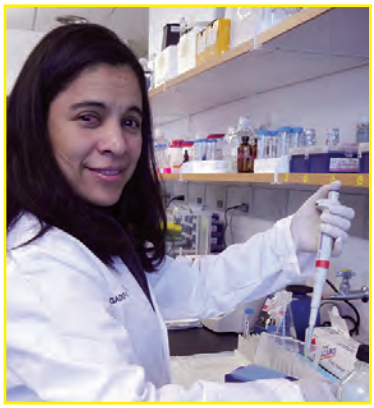
I enjoy working with the students and teaching them how to grow in research. The process is demanding but worthy and satisfying. I encourage my students to read scientific literature, and I directly supervise their lab work, discussing the research plan and troubleshooting the difficulties encountered. It is great to see how the students are becoming more independent and confident, step-by-step, learning from every experience in the lab.

Angelique Corthals, PhD (University of Oxford)

Assistant Professor

Areas of Expertise: Pathology, biomedical and physical anthropology, and archaeology

I have always been interested in archaeology. While studying at Oxford, my next door neighbor was a developmental biologist who was doing a study on the genetics of populations in the Nile Valley. She needed someone with expertise in Middle Eastern history and population genetics. As I began to help with her project, this led me to my doctoral work—looking at the relationship between art work styles of historical populations and changes in the genetic makeup of those populations. My current foci of research are the mechanisms of autoimmune diseases (specifically multiple sclerosis), the historical ecology of infectious diseases (specifically tuberculosis, malaria, the plague and HIV), and protocols of recovery of genetic information for ancient or damaged biospecimens. In addition to teaching at John Jay, I am the director of the BioBank and a research professor at the department of pathology at Stony Brook Medical School. I am also the forensic anthropologist-in-residence on the University of Brussels'TT29 excavation in the Valley of Nobles in Luxor, Egypt. I have appeared in several documentaries for National Geographic and Discovery Channel, as well as in a full-length feature IMAX movie called *Mummies: Secrets of the Pharaohs.*



Lissette Delgado-Cruzata, PhD, MPH

(Columbia University, Mailman School of Public Health)

Assistant Professor

Areas of Expertise: Epigenetics and cancer epidemiology

I have been in a lab for as long as I can remember; my parents are both chemists and when we were not in the lab, we were fermenting and distilling at home. Science always felt like a part of me. I studied biochemistry in Cuba, and fell in love with biotechnology and molecular biology. I earned my doctorate working in the intersection of molecular biology and public health. Being able to apply what I had learned in the lab to population studies was incredible. I developed markers that could be measured in biological tissues (biomarkers), such as blood, saliva and urine; and studied their association to disease. I enjoy observing the growth of our field and the many applications we have for molecular biology today. The interconnections of all the new areas of research are mind-blowing.

I run the first epigenetics lab at John Jay, where we investigate how DNA methylation is regulated in cells and what role it might have in early steps of cancer development. Part of these studies is carried on cell culture systems from breast and liver cancer cells. We look at expression of enzymes involved in DNA methylation maintenance (DNMTs) and those involved in processing of DNA methylation, TET family proteins. We investigate the role of these proteins by knocking them down or using chemicals that inhibit their function. Results from these studies can be very helpful in elucidating which other molecular events mediate these types of cancer and help us design better treatments for them.

Pete Diaczuk, PhD (City University of New York)

Lecturer

Areas of Expertise: Ricochet analysis and explosives

I got into science because I thought it would be good to know how not to blow myself up on the Fourth of July. During my senior year in Stuyvesant High School, I took out a book from the library entitled *Science Against Crime.* On the cover were two scientists in white lab coats. One was holding a side-by-side double barrel shotgun for test firing. I knew then that forensic science would be the direction of my application of science. John Jay College was in my hometown of New York, so off to Jay I went after graduating from Stuy. A couple degrees later and here I am working in the criminalistics laboratory, having earned a PhD in the process.

Not surprisingly, my interests are firearms and explosives.Firearm examination and comparison microscopy in particular have come under scrutiny in recent years. In the ballistics lab, we address the focus of these court challenges with new and ongoing research, while in separate projects we investigate new ammunition and bullet impact dynamics. Our goal is to contribute to the field of criminalistics, firearm and toolmark analysis by applications of microscopy. Potential researchers are encouraged to suggest a project that interests them, since I believe a personal interest will increase enthusiasm and dedication to the project.

Artem V. Domashevskiy, PhD

(CUNY Graduate Center and Hunter College)

Assistant Professor

Areas of Expertise: Biochemistry, biophysics, and molecular biology

Plants produce ribosome inactivating proteins (RIPs), important for defense mechanisms against foreign pathogenic invaders. Toxicity of RIPs has been explored by biologists to create transgenic plants resistant to viral and fungal infections, by cancer therapeutics to investigate immuno-conjugate therapeutics, by political and military groups to create biological weaponry, and by mystery writers to engage their readers. RIPs selectively modify ribosomes, rendering them unable to sustain protein synthesis. Examples of RIPs include ricin from castor bean, pokeweed antiviral protein from pokeweed plant, and saporin from common soapwort.

Our laboratory uses methods in molecular biology and biophysics to study structure, function, and properties of RIPs. We investigate eukaryotic and viral protein synthesis. Agriculture is an indispensable part of every person's life, ensuring that nutritious and inexpensive food is readily available. Agriculture continues to be confronted with epidemics, having devastating effects on economies and the plant sources essential for human and animal life. Eradication of disease agents is often expensive, potentially requiring the destruction vast areas of crops. We study antiviral properties of pokeweed antiviral protein (PAP), from *Phytolacca americana,* and are interested in understanding how PAP targets various viral RNAs for depurination. PAP encapsulated into a lipid vehicle is being investigated as an anticancer agent, and the toxin delivery is tested for efficiency.

Students receive training in enzymology, biophysical methods of analysis of protein-protein and protein-nucleic acid interactions, protein expression and purification. Active collaborations occur with laboratories specializing in NMR, X-ray crystallography, mass spectrometry, synthetic organic chemistry, phytopathology, virology, cancer and medicine.

Yi He, PhD (City University of New York)

Professor

Areas of Expertise: Analytical chemistry and environmental sciences

When I was growing up, I admired my parents and their scientific careers. My mother was a physician, and my father was an electrical engineer. Their love of science and technology significantly influenced my choice of a scientific career. I studied applied chemistry and applied electrical technology in my undergraduate years, and later on with a focus of environmental analytical chemistry. During my PhD study, I developed a field portable method to determine trace level arsenic in groundwater.

Currently, my research focuses on the development and application of solventless and solvent-minimized extraction procedures such as solid- and liquid-phase microextraction in sample preparation; and the development of methods for determination of trace multi-elements in samples of forensic interest by using atomic absorption spectroscopy or inductively-coupled plasma—mass spectrometry. As a research mentor, I encourage students to work independently, and I give them maximum support and flexibility. We have meetings to discuss project progress and always plan well before the actual experimental work starts. I strongly encourage students to attend professional meetings at various levels, from college-wide to national and international, so that they will expand their view and learn from both peers and experts.

Hunter Johnson, PhD

(University of Maryland—College Park)

Assistant Professor

Areas of Expertise: Mathematical logic

I earned a Bachelor of Science in computer science, math, and philosophy as an undergraduate. In graduate school I looked for a way to unify these interests and found myself specializing in logic while pursuing a PhD in mathematics. My logical research interests have to do with the idea that simple descriptions should describe simple things. Since coming to John Jay, I have made efforts to explore the more practical side of these ideas, using them to solve engineering problems with students.

I am interested in building machines to do things, basically applying some difficult theory in straightforward ways to accomplish a real life goal. A standard major in computer science is often very theoretical, taking place at the level of "pseudo-code" and leaving students unequipped to deal with real world problems. For this reason I like to aim my PRISM students at designing a program to do something difficult while using "out of the box" machine learning tools. This is usually more than sufficiently challenging and serves as a real growth experience for the student. The same approach can easily be taken for projects focusing on cryptography or some other topic related to computer security, rather than (or in combination with) applications of machine learning.

Collaboration with faculty makes students more employable and better prepared for graduate school, if they choose to apply. It is a widely acknowledged problem that many if not most graduates do not meet the bar where real abilities are concerned. PRISM is a great way to mitigate this. Additionally since graduate study, particularly at the doctoral level, is best suited to students who find pleasure in finding things out, PRISM research is a great way for students to test the waters in this respect.

Ekaterina Korobkova, PhD

(University of Chicago)

Assistant Professor

Areas of Expertise: Biochemistry, biophysics, physical chemistry

When I was 17 years old and I was a first-year undergraduate student, I became fascinated by chemistry while taking a physical chemistry class. I knew at that time chemistry would become my lifetime occupation. I enjoy the process of solving a chemical problem, experimental or theoretical, and enjoy struggling through it to find a solution. A substantial number of experimental evidence collected over the last decade supports the involvement of mitochondria in the key processes associated with cancer such as cellular apoptosis, growth, metabolism and energy supply. Oxidation-reduction reactions occurring in mitochondria and endoplasmic reticulum generate the flow of electrons. Leaking electrons may interfere with surrounding molecules, producing reactive oxygen species (ROS). ROS react with DNA, which results in the formation of covalent modifications on DNA bases. In our lab we study the dynamics of the expression of glycosylases, DNA damage repair proteins, in response to stress. We are also interested in the mechanisms of action of cytochrome c, a protein attached to the inner mitochondrial membrane. It has been known for a long time that this protein participates in electron transfer process, which ultimately leads to the synthesis of ATP. Recently cytochrome c was found to play a significant role in apoptosis. In the last ten years, extensive proteomic analysis has been performed on the mitochondria of various types of cancerous cells. One of the proteins found consistently overexpressed in the mitochondria of

cancerous cells as opposed to the normal cells is chaperone HSP60. This protein is located in the mitochondrial matrix and plays a significant role in protein folding, assembly, transport and degradation of damaged proteins as well as in the regulation of apoptosis. The identification of small molecules specifically targeting the interactions of HSP60 with other proteins is one of the ongoing projects in our lab.

Thomas Kubic, JD, PhD

(St. John's University, City University of New York)

Professor

Areas of Expertise: Light and electron microscopy, vibrational spectroscopy and image analysis to physical evidence examinations

I became involved in forensic science by serendipity and long before the advent of CSI television or the O.J. Simpson case. In the early 1970s, the research company for which I worked doing government defense research closed. I was in the habit of eating and sleeping in a warm and dry place (so was my wife), so I joined the Nassau County Police Department. I graduated from the police academy and spent a year on patrol duty. When the department realized that I had a MS in chemistry, I was transferred to the crime laboratory. I was promoted to detective and spent 23 years there before retiring in 1995. While in the crime laboratory, I became very interested in the analysis of micro-transfer evidence by light and electron microscopy and micro-spectrometry. The department was one of the first municipal laboratories to obtain a scanning electron microscope with X-ray analyzer (SEM-EDS) to perform GSR analysis. During this time, I also obtained my law degree from St. John's University and was admitted to the New York State Bar. After retiring from law enforcement, I spent three years as the forensic application specialist for a leading SEM Company. I then joined John Jay where I continued my interest in criminalistics. Along the way, I earned my PhD. At John Jay I teach classes in forensic instrumentation, advanced physical evidence, expert testimony and research ethics. I also teach chemical separations and analytical spectroscopy courses as part of the PhD Program in Chemistry at The CUNY Graduate Center.
In 1997, the criminalistics section of the American Academy of Forensic Sciences awarded me its highest honor—the Paul Kirk Award.

Nathan Lents, PhD

(St. Louis University Medical School)

Professor

Areas of Expertise: Cell biology, forensic biology, genetics, and bioinformatcs

Like our PRISM students, I started research as an undergraduate. First, I worked in an industrial microbiology lab trying to engineer bacteria to produce food additives. Then, I worked with soy beans and tried to understand how they try to protect themselves from their biggest parasite: nematodes. Next I went to graduate school at SLU Medical School and switched my research interests into the biomedical field, where I studied cell proliferation and cell signaling. This project and my postdoctoral work at NYU Medical Center focused on understanding cancer cells and how we might fight them. My laboratory currently has two projects. In one, we study how communities of bacteria that live on human skin change following the death of the human host. The goal is to determine if analyzing skin bacteria might help us establish time-of-death. In the other project, we study genetic diversity in household flowering plants. The goal of this research is to establish forensic tools to identify trace plant

Nathan Lents, PhD *continued*

material that may be picked up or transferred from a crime scene. For example, pollen from a specific flower that is inhaled by a victim or suspect could connect that person to a specific place. My mentoring style is very "hands off." My formation as a scientist was deeply affected by my first research experience. Three weeks after I started my boss suffered a heart attack and went on medical leave. It was up to me to figure out what to do, with only weekly phone calls for guidance. I was forced to plan my experiments and analyze their results independently. That's what I hope my students will learn how to do. Of course, I am always there to help...unless I have a heart attack.

Richard Li, PhD (University of Wisconsin–Madison)

Associate Professor

Areas of Expertise: Forensic DNA analysis, forensic molecular biology and forensic genetics

I first became interested in science through reading the detective story of Sherlock Holmes. Currently, my laboratory studies the forensic analysis of biological evidence. The research includes two aspects. The first aspect, the primary focus of my research, is the application of forensic DNA techniques for human identification. The second aspect of my research is forensic toxicology of postmortem samples. In particular, this study is working on the extraction methods of controlled substances from complex matrices, including biological fluids and solid tissue samples.

Erin Mann, PhD

(Memorial University of Newfoundland)

Postdoctoral Research Fellow

Areas of Expertise: Environmental chemistry and arctic research

Before I encountered science at school, I knew that I liked to take things apart and figure out what made them tick. As a kid, I could frequently be found off taking something apart, or putting it back together (with varying degrees of success), to the occasional consternation of my mom. As I got older, I realized that science, particularly chemistry, allowed me to continue with this fascination; I could take big complicated things down to their base components, and poke around to see what made them behave the way they did. As a research mentor, I strive to provide an environment where students are comfortable asking questions, either because they're unsure or just curious. I encourage students to chat about things that have been working, and those that haven't. Science doesn't always work the first time around. The "failures" are as important as the successes, and can be incredibly interesting (albeit somewhat frustrating at the time!) Our lab focuses on environmental mercury, which is a naturally occurring metal that can negatively affect the health of humans, and many other organisms. The basis of our research is determining how mercury behaves in the environment, and why. At present, we're working to determine the mechanisms by which mercury reacts and is lost from sand/soil; that is, determining the molecular pathway a specific mercury species takes to move from a form that stays in the soil, to one that can move back to the atmosphere. Determining how mercury will react in soil will give us a greater understanding of its overall environmental behaviour, and will provide valuable information for things like remediation of historically mercury contaminated sites (which still exist in the US).

Helen-Marie Maras, PhD

(DPhil in Law and an MPhil in Criminology and Criminal Justice from the University of Oxford)

Associate Professor

Areas of Expertise: Cybersecurity, surveillance, counterterrorism, and transnational security

I began my career in the U.S. Navy at the age of 17. At that age, I quickly learned the value of good mentors. Because of good mentorship and sound feedback on performance, I was able to quickly progress through the ranks and become one of three investigators on the base. I was also fortunate enough to have good mentors at my universities, which ultimately led to the completion of my undergraduate and graduate degrees in record time.

Due to these experiences, I have served as a mentor as often as I can. As a mentor, I encourage students to learn independently and I equip them with the necessary knowledge and skills to function well in their lives, both professionally and personally. My role is to serve as a guide, providing them with advice, sharing ideas, and giving them feedback on submitted work.

My research and publications have focused on digital forensics, cybersecurity, surveillance, counterterrorism, and transnational security issues (broadly defined). I examine these issues through a multidisciplinary lens, covering disciplines, such as criminology, sociology, law, psychology, political science, economics, computer science, and technology, in my work. I encourage students to read widely and incorporate literature and research from other disciplines into their own studies. Ultimately, this prepares students for employment in a variety of settings.

Gloria Proni, PhD (University of Bologna)

Associate Professor

Areas of Expertise: Supramolecular and molecular chirality, optical spectroscopy, synthesis and characterization of small molecules

All the students who work with me know about my deep passion for research and my interest in being a role model for everyone in their research efforts. I am most proud of my "above and beyond" mentoring efforts—establishing a personal connection with all my students. I am interested in making everyone who joins my lab an independent thinker and an accomplished researcher. My students will always have my unconditional support in their career choice, life decisions, etc.

The research method applied in my laboratory goes through several steps. First students will be exposed to a problem (for which we need an answer). Then they go through previous observations and literature in order to educate themselves about the problem under investigation. Next they design (with help) and conduct the necessary experiments in order to solve the problem. They also work on control experiments in order to build scientifically sound results. Based on these experiments and with my help, some conclusion will be formulated. When the problem under analysis is answered, the results will be organized in order to be presented to a larger public.

Currently in my laboratory, we are working on two major projects. The first one concerns stereochemical and spectroscopical characterization of organophosphates, compounds that are used as pesticides and as chemical warfare agents. This project requires students to learn chiral HPLC separation, UV-Vis and circular dichroism spectroscopies, and optical rotatory dispersion.

Gloria Proni, PhD *continued*

The second one explores the colorimetric and fluorescent properties of lawsone, the colorful component of henna tattoos, and derivatives. Lawsone and its derivatives, synthesized in the laboratory, detect latent fingerprints. Students engage in different synthetic and purification procedures, UV-Vis and fluorescent spectroscopies.

Jason Rauceo, PhD (City University of New York)

Associate Professor

Areas of Expertise: Molecular biology, molecular genetics, and mycology

I was a late bloomer in pursuing a science career. My microbiology and molecular biology courses introduced me to hidden and mysterious worlds, each containing the potential for novel and exciting discoveries. I decided to study the molecular mechanisms underlying clinically relevant diseases caused by microorganisms as CUNY doctoral student and as a postdoctoral researcher at Columbia University. Fungi have served as model organisms in which extraordinary biological processes have been elucidated. Thus, mycology lies at the core of my biomedical research career.

Our research focuses on the major human fungal pathogen *Candida albicans*. We are interested in the molecular mechanisms underlying various environmental stress responses. We are also interested in how cell-surface glycoproteins mediate attachment to host surfaces. Currently, we are exploring the role transcription factor Sko1 plays in the hyperosmotic and cell wall damage stress responses. We are also identifying the chaperone network that governs processing and localization of the Als cell-surface adhesins.

As a mentor, my main goal is to prepare students for graduate or professional school. I assign independent microbiological and molecular projects that allow students to design and troubleshoot experiments, develop oral presentation skills, utilize scientific databases, and polish their writing skills. Although I do not micromanage students, I regularly hold one-to-one meetings where experimental progress and plans are discussed and monthly lab meetings.

Ultimately, a simple unwritten code lies at the core of my mentoring: Selflessly foster the professional and personal development of the mentee. This endeavor extends far beyond conveying scholarly dogma, rather a mentor should be a role model, motivator, advisor, and friend. I consider it is a privilege to mentor the scientists of tomorrow.

Marcel Roberts, PhD (Boston College)

Assistant Professor

Areas of Expertise: Electrochemistry, spectroscopy and analytical chemistry

I initially got interested in science and performing well in science classes when I was about 11. I was hoping to impress a girl I had a crush on who was top of the class in both physics and chemistry. I never had a chance with her, but as I started paying more attention to the sciences, I found an endless source of fascination. The amazing complexity and elegance of the world viewed through scientific lenses has kept me interested since then.

My research interests focus on creating novel devices for identification but also the detection of drugs, explosives and contaminants. My specialty is chemical biology but I have a profound interest in toxicology and biomedical engineering. I am fascinated with creating devices that can have immediate and practical applications in border security,

forensic science, analytical chemistry and food safety.

I believe that the best scientists are well-rounded; therefore I encourage all my students to broaden their interests. I am a very hands-off advisor but if you join my lab you can expect to be tactfully quizzed on multiple subjects. My interest and love for science is linked to my love for science fiction and all things geeky and nerdy.

Jennifer Rosati, PhD (University of Windsor)

Assistant Professor

Areas of Expertise: Forensic entomology, biology, entomology, ecology, entomotoxicology, insect behaviour

The Rosati Lab conducts research in the field of forensic entomology. The carrion insect community is very diverse in the number and type of insect species that play a role during decomposition. Whether it is in the lab or out in the field, there are a multitude of ecological questions that need to be answered for many forensically related insects.

My research includes using fluorescent fingerprint powders as biomarkers to study species interactions and larval insect behavior, the importance of inter- and intra- specific interactions, the influence of biotic and abiotic factors and the effects on insect behavior or successional patterns during decomposition and entomotoxicology.

The world of insects is fascinating and I love being able to share my passion for research and entomology. I myself wasn't interested in insects until I encountered a few enthusiastic professors that were passionate about insects. They inspired me to become an entomologist, which may not have happened if I didn't have that interaction during my undergraduate experience.

I enjoy sharing my passion for entomology and I always welcome the opportunity to work with students. Being a mentor is important as it allows me to interact with and inspire students. As a mentor, it is important to guide students in conducting research and to allow them to ask interesting questions. Then it is important to take these questions and work together to design and implement a proper scientific experiment. My overall goal for a mentee is to enjoy the research experience, even though at times it may be demanding.

Paris Svoronos, PhD (Georgetown University)

Professor/Queensborough Community College

Areas of Expertise: Organic chemistry; analytical chemistry; science education

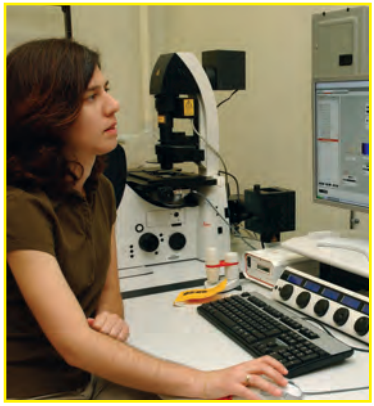
As a youngster I wanted to be a professor of history. It was only after a compromise with my engineer father that I followed a post-high school career in chemistry. I was fortunate to be awarded a graduate fellowship at Georgetown University and eventually an academic position at Queensborough (QCC). I chose QCC because, as an immigrant, I wanted to prepare the next generation of scientists.

At QCC, we have many immigrants who are strong in science but deficient in English. This fact governs my interaction with students. I understand that many of them have used a different alphabet most of their lives, but I also appreciate their belief that "the teacher is always right". I believe in undergraduate research that helps students use critical thinking to fix errors and learn how to fail. Presenting at conferences improves their English communication and personal confidence. Working with faculty creates a bond that can serve as a path to success upon graduation and transfer.

Paris Svoronos, PhD *continued*

I am extremely interactive in class and expect students to work and solve problems on the board on their own. I like to involve students in paid summer internships outside CUNY—and have been successful in this endeavor for years. Such experiences enhance the resume of students seeking to transfer to competitive programs and scholarships.

My laboratory research focuses on the determination of anti-oxidants in juices both spectrophotometrically and via high performance liquid chromatography (HPLC). The results are applicable to everyday life. The experimental conditions are simple, yet they require a great degree of data reproducibility. I am also involved in using freezing point depression measurements to determine the ionization constant of carboxylic acids at 0°C which are not reported in the literature.



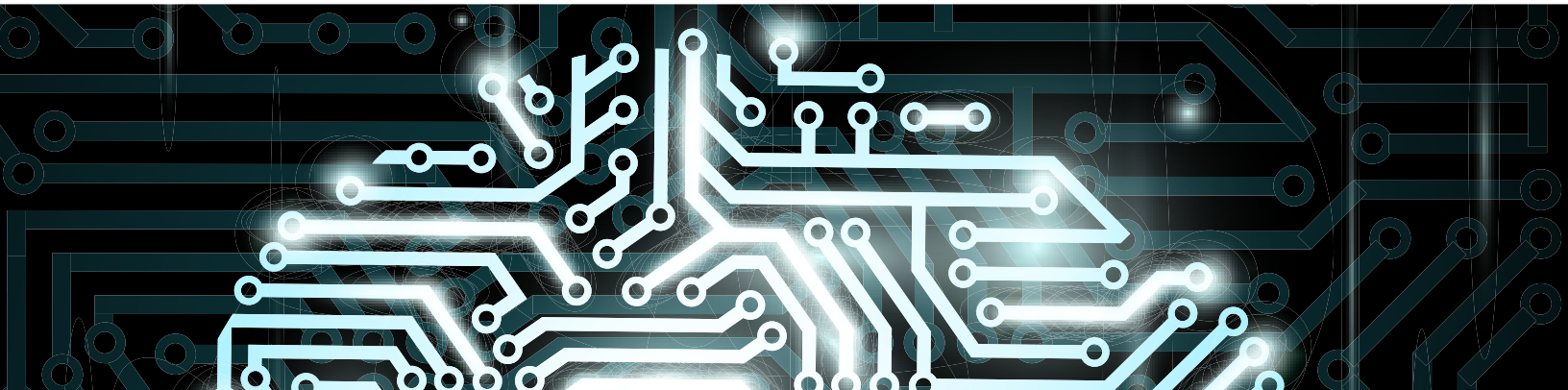
Areti Tsimounis, PhD (Columbia University)

Assistant Professor/Queensborough Community College

Areas of Expertise: Neurobiology, neuronal circuits, neuronal morphology

Science came naturally to me. As far back as I can remember, I have always been interested in figuring out how things work. For me, taking apart electronic games was much more fun than actually playing with them. However, biology has always been fascinating because it is natural, not man-made. The more I learned about it as I progressed through school, the more interested I became. The diversity of life is mind-boggling, and even more so are the countless interconnected molecular mechanisms that make organisms functional. My path in neurobiology began as a graduate student with what was meant to be a required rotation in a laboratory that studied cortical circuits; I never went back to molecular biology. The rotation ended up being my doctoral thesis.

My research interests continue to lie in neuronal circuits. My goal as an educator is to provide students involved in the project with a fulfilling research experience. After working for a few years as a director of a research core facility, I have been working with a group of mostly CUNY undergraduate students to characterize the morphologies of neurons involved in the circuits that process sensory information from the whiskers of mice. Whiskers are important sensory structures in many animals, similar to the fingertips of humans, and a network of neurons mediates this sensory input within the brain. Our aim is to identify the neuronal cell types and their connections that make up the particular network. In the lab, students are trained on the technical aspects of the particular project, such as specific laboratory protocols and data analysis methods. However, equally important are the skills that are transferable to other working environments, such as critical thinking, teamwork, and communication.



Daniel Yaverbaum, MS, MPhil

(Columbia University Teachers College)

Lecturer of Physics/City College of New York

Areas of Expertise: Physics education and cognition, Galilean and special relativity, and astronomy

In my lab we organize and analyze the data taken from the 70-odd students who participated in a project known as "Transforming Reference Frames". This project seeks to probe student mental models regarding Galileo's Principle of Relativity. We use a state-of-the-art eye-tracking device in order to collect optical data. We will thereby vastly deepen our investigation of student cognition as it applies to relative motion.

Asked whether I identify more with Edison or Einstein, I have to say that I identify more strongly with Einstein. I am fascinated with the mathematical and philosophical properties of electromagnetic radiation—particularly the notion of invariance under reference frame transformation—but could not convert a tungsten into a working bulb to save my light.

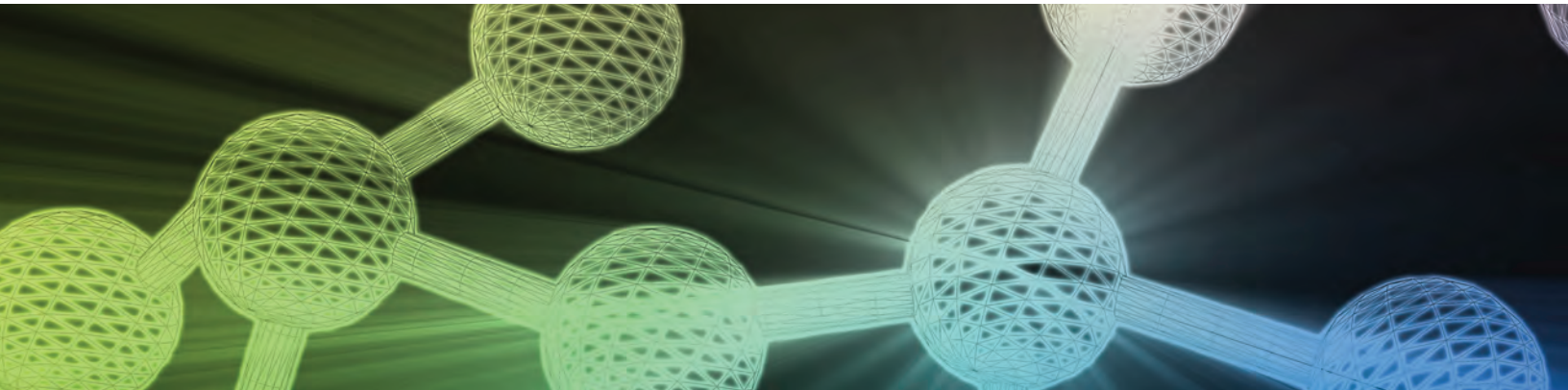
Guoqi Zhang, PhD (Chinese Academy of Sciences)

Assistant Professor

Areas of Expertise: Inorganic/organometallic chemistry, chemical catalysis, forensic chemistry and metallic anticancer drugs

I began to love chemistry when I was a middle school student. At that time I was so curious about what our world is made out of and what the things around us are. I believe it was this curiosity that made me learn chemistry well and eventually choose my career in chemistry. I started doing research with my first supervisor on the synthesis of a quinolone-based medicinal intermediate when I was a sophomore. I was able to complete the synthesis of this molecule during winter and summer breaks and then I performed my thesis work focusing on the physical chemistry of metal-organic hybrids. Moving to a graduate school was straightforward. The extensive research training I received in college prepared me well for cutting-edge research in many aspects of chemistry and analytic science during my PhD. I was further enriched with international research experiences at world-renowned institutions, before joining John Jay as an assistant professor of chemistry.

Currently, the research in our group is focused on the synthetic chemistry of novel metal-based compounds and their applications in catalysis, forensic analysis, toxicology and functional materials. Mentoring PRISM students has been a wonderful experience to me. Students in our group are encouraged to think and work independently while receiving excellent training in modern synthetic and analytical techniques. They are also offered great opportunities to present at local and national academic conferences. Research efforts involving many talented PRISM students in the past two years have enabled our group to flourish increasing productivity and visibility. Motivated science students are always welcome to join our exciting group.



PROGRAM INFORMATION AND STAFF

Edgardo Sanabria-Valentín, PhD
PRISM Research Coordinator
Pre-Professional Advisor
CSTEP Program Director

Raquel Castellanos, PhD
PRISM Outreach Coordinator

Ron Pilette, PhD
PRISM Resource Coordinator

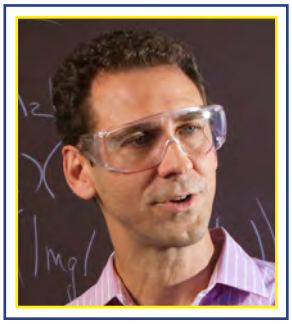
PRISM, THE PROGRAM FOR RESEARCH INITIATIVES IN SCIENCE AND MATH, was established in the Fall of 2006 by Drs. Anthony Carpi, Lawrence Kobilinsky and Ronald Pilette, to promote undergraduate research in science at John Jay College.

The Program was founded in the same year as the adoption of the course FOS 402: Undergraduate Research Internships, an expansion of the capstone offerings in the undergraduate forensic science major. These initiatives were part of a broader effort to encourage faculty-student research mentoring. PRISM was the outgrowth of a smaller undergraduate research initiative funded by the New York Education Department, CSTEP. CSTEP funding was critical to first establishing undergraduate research as an important component of the Department of Sciences. CSTEP along with the US Department of Education and National Science Foundation have been critical support mechanisms contributing to the growth of this initiative.

As PRISM expanded, the number of students served by it has grown commensurately. From its first year of operation with only a handful of students, PRISM has expanded to more than 40 students who actively participate in mentored research each year. In addition, several dozen additional students participate in program seminars and training activities annually. Since PRISM's inception, 175 students have participated in mentored research and received research stipends. PRISM has been highly successful in increasing the number of students moving on to post-graduate education and successful careers in science. More than 55 students have matriculated into professional degree programs in STEM, science education, and health.

For more information, contact us at PRISM@jjay.cuny.edu
Visit our website www.prismatjjay.org
'Like' our PRISM group on Facebook®
Follow us on Twitter @PRISMatJJAY

PRISM at JOHN JAY COLLEGE
PROGRAM FOR RESEARCH INITIATIVES IN SCIENCE AND MATH



Anthony Carpi, PhD
PRISM Director

Lawrence Kobilinsky, PhD
PRISM Co-Director

Nathan Lents, PhD
PRISM Co-Director

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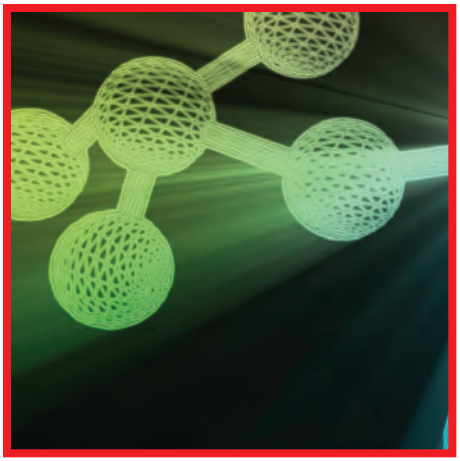
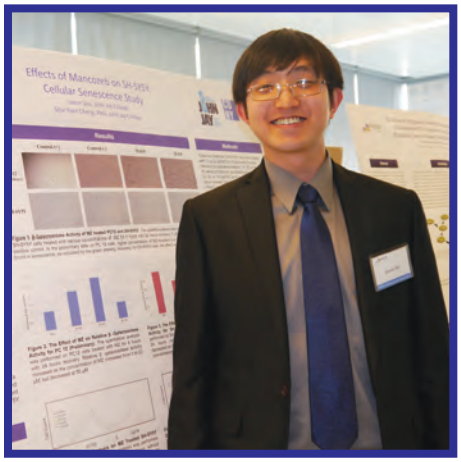


"I enjoy performing research because it has significantly improved my critical thinking skills."

– Ronald Rodriguez (page 29)

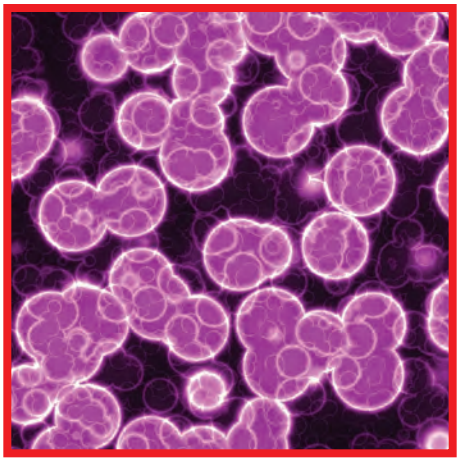
"Hopefully one day my research will make an impact, even the smallest impact will matter."

– Joseph R. Vandenburgh (page 37)



"Participating in research through the PRISM program has made me more self-assured and confident that a career in forensic toxicology is an achievable goal."

- Brooke Nielsen (page 25)



"My goal is to become a well-respected member of the scientific community."

– William Aguilar (page 7)

"Since joining PRISM, my vision for the future has become clearer."

– Ronal Peralta (page 27)

"...I am excited to step towards my dream of becoming a forensic anthropologist. Live long and prosper!"

– Erica Klafehn (page 18)

choose your future

challenge yourself

investigate

engage

network

inquire

examine

build connections

question

choose your future

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For information about the Program for Research Initiatives in Math and Science, please email the staff at PRISM@jjay.cuny.edu or visit **www.prismatjjay.org**.

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