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

Undergraduate Research CHRONICLE

2017

choose your future

challenge yourself

investigate

engage

PRISM

at JOHN JAY COLLEGE

PROGRAM FOR RESEARCH INITIATIVES IN SCIENCE AND MATH

network

inquire

examine

build connections

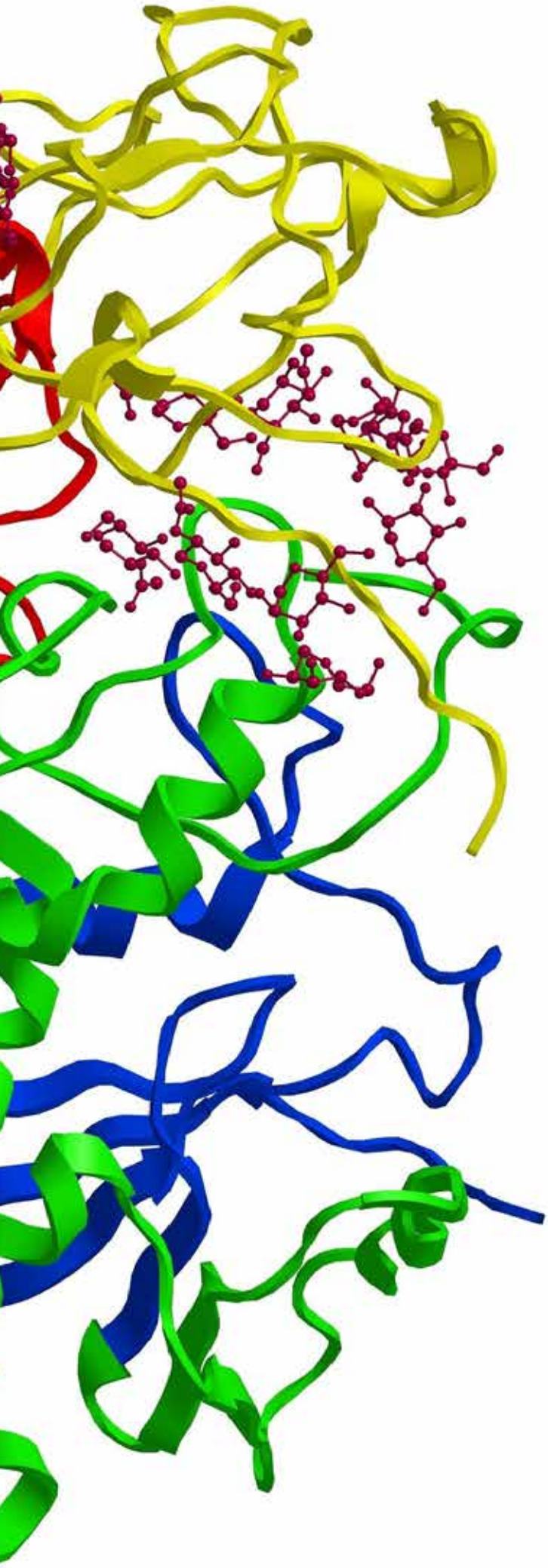
question

choose your future

Cover Shot:
Real fluorescence microscopic view of human skin cells in culture.
Nucleus are in red, actin filaments are in green, tubulin was labeled with blue.

JOHN JAY COLLEGE OF CRIMINAL JUSTICE

CUNY



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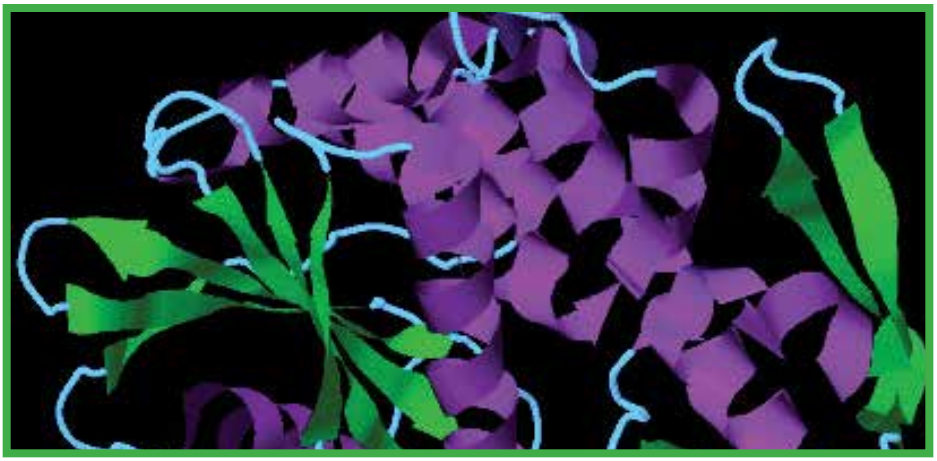
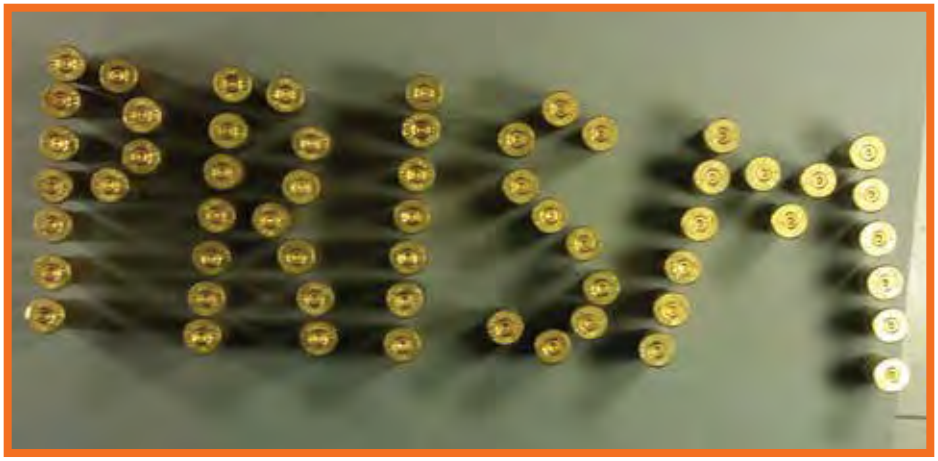


> **“PRISM provides the structure and support that allows John Jay students to do the things they are capable of doing and take their rightful place among the nation’s top graduate programs.”**



ANTHONY CARPI

PRISM Director's Letter

"Our 10th Anniversary"

Thomas Alva Edison once said "If we all did the things we are capable of doing, we would literally astound ourselves." And not just ourselves, but those around us as well.

We have been astounded by so many of our students and their capabilities. Like Ronal Peralta who will be moving on to a PhD program in Microbiology at the University of Pittsburgh in the fall, Victoria DePrimo who will be attending the University of New Haven to pursue a masters degree in Forensic Science; Khamattie Uzagir who will be attending the Arnold and Marie Schwartz College of Pharmacy at Long Island University, and Donovan Trinidad who is deciding between a suite of offers from prestigious PhD programs including Cornell and Princeton universities, among others.

This has been an outstanding year for PRISM. As we celebrate our tenth anniversary, we recently published findings from our long-term study of the impacts of this mentoring program on student success (JRST 4(2):169). The article reports on a decade and a half of data, countless student interviews and surveys, and involved many contributors working over the course of more than two years. And what did we learn? We learned that PRISM provides the structure and support that allows John Jay students to do the things they are capable of doing and take their rightful place among the nation's top graduate programs.

In the decade since its inception, PRISM has helped over two hundred students develop their talents in various ways. Many obtain professional jobs in science fields, while others continue their science training in graduate and professional schools. Some eighty PRISM graduates have now moved on to PhD and MD, and other postgraduate programs across the country, from Harvard University in the east to the University of California at Berkeley in the west, and the list of institutions our students attend grows yearly. PRISM alumni are incredibly successful in their careers as scientists and medical professionals and perform critical research like investigating the connection between child abuse and subsequent depression, developing methods for improved cancer screening, or developing new families of therapeutic agents to treat diseases like diabetes and obesity.

This year we launch the PRISM Alumni Network to help connect our many alumni working their way into leadership positions in various STEM fields. Our 2017 graduates will soon enter that network where the mentoring will continue, this time led by our impressive array of alumni throughout the country. PRISM is the enjoinment of cutting-edge science with personal relationships, and we look forward to developing a robust alumni network to extend those relationships to a national scale.

In this, our tenth year, help us celebrate not just the milestones of the program, but our students who are achieving their full capabilities and reaching their dreams.

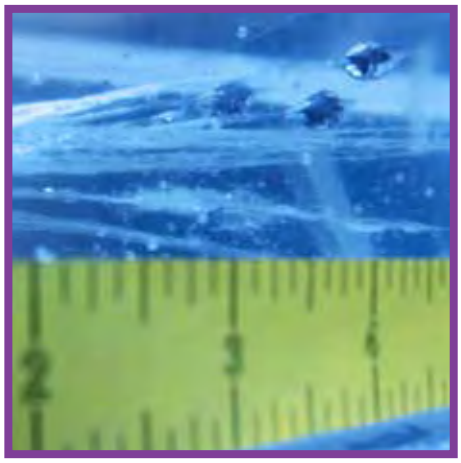
Congratulations,

"Forensic science was a way to combine a love of science with this passion for solving problems."

– Vincent Blandino (page 8)

"My passion in life is to pass my love of science to the next generation."

– Brianna Cingari (page 11)



"I am grateful for PRISM because of the real life exposure it provides beyond the school labs and classroom learning."

- Alexa DeJesus (page 13)

UNDERGRADUATE RESEARCHERS

Rageene Berry

India has always been big on science; everybody is either an engineer or a doctor. As I grew up there I saw a crime case unfold in front of me and realized that as big as we are on science, India is years behind in forensic science. Since I had always been interested in forensic science, I decided to study abroad and bring what I learned back to India. I also plan to pursue an MBA. I am unsure what my career goals are but I am sure my experience in PRISM's Undergraduate Research Program will help me.

My research focuses on the detection and quantification of illicit drugs used by a population by testing sewage water samples from the region of interest. The data obtained can then be used to identify major drugs being used in these areas, and can further help control the problem of drug use.

Wastewater-based Epidemiology of Tobacco and Illicit Drugs in New York City (Dr. Concheiro-Guisan)

Wastewater-based epidemiology is a relatively new scientific technique that helps detect the presence of substances such as drugs of abuse or certain medications by testing human excretion products (biomarkers) in wastewater. It is used to gather information about drug use in a community. The principle behind water-based epidemiology is that traces of compounds, which a population is exposed to or consume, are excreted unchanged or as metabolites in urine and/or feces, and ultimately end up in the sewer network. For the purpose of this project, wastewater samples were collected from wastewater treatment plants in Manhattan, Brooklyn, Queens, and the Bronx. The further research will involve introduction of internal standards in the samples and solid phase extractions. The extracted sample will then be analyzed using liquid chromatography tandem mass spectrometry to identify the drugs present in the sewage water and to calculate the amount of drugs used by the population.

Vincent Blandino

Science has always been a passion of mine, but even more pertinent was my curiosity for unanswered questions, and my ability to figure them out. I decided before college that forensic science was a way to combine a love of science with this passion for solving problems. I am certain that my time as a forensic science student and undergraduate researcher have improved problem-solving skills, adapting me to life beyond my education.

My research project focuses on determining the presence of drugs in saliva. The goal of this study is to develop an efficient and practical method that can accurately detect these compounds that can be used in forensic investigations.

Determination of Synthetic Cannabinoids in Oral Fluid by Liquid Chromatography Tandem Mass Spectrometry (Dr. Concheiro-Guisan)

A new class of compounds known as synthetic cannabinoids is becoming one of the most important drug-related health issues to date. These compounds are commonly found in herbal mixtures called Spice and K2. Synthetic cannabinoids possess several qualities, such as unregulated status and potency, which are extremely attractive for drug users. However, they cause many health problems, and the ease by which one can obtain these drugs is problematic for policymakers trying to ban them. There are many biological matrices from which one can detect synthetic cannabinoids, such as urine, blood, sweat, and oral fluid, but the collection of blood and urine are invasive methods. Collecting oral fluid, however, is quick, simple, and noninvasive, and is the focus of this research project. We hypothesize that if an individual has recently used synthetic cannabinoids, then these compounds can be found in their oral fluid. The analytical method for this study has been developed, employing supported liquid extraction (SLE) of the cannabinoids from oral fluid and analysis using liquid chromatography-tandem mass spectrometry (LC-MSMS). Currently, the method is being simultaneously validated and used to analyze 71 samples collected from individuals suspected of using synthetic cannabinoids.

Alorah Bliese

I decided to pursue science because I have an appreciation for life and want to understand how it is possible, how it works, and how it can be protected. Research has taught me that biology is intricately designed and can be undermined by small changes. While I had thought life was durable, studying disease has shown me that life is delicate and finding ways to improve quality of life is difficult. Although I have not chosen a career path, I plan to help preserve and protect life, whether that be humans, animals, or the environment.

In this project we are looking at how methylation, a process that modifies DNA, affects inflammation in rheumatoid arthritis (RA). We are testing this by exposing cells to reagents that cause these modifications. Understanding the underlying mechanism of RA will allow for improvements in the current treatments available to treat it.

DNA Methylation and the STAT3-IL6 Pathway in Rheumatoid Arthritis (Dr. Delgado-Cruzata)

Rheumatoid arthritis (RA) is an autoimmune disease that causes chronic inflammation in the joints. This inflammation is likely caused by elevated levels of the cytokine IL6 due to dysregulation of the STAT3-IL6 pathway. *DUSP22* is a known negative regulator of this pathway that works by dephosphorylating STAT3. *DUSP22* has also been reported to be hypermethylated in T-lymphocytes of RA patients, which could inhibit *DUSP22* expression. We hypothesize that the hypermethylation of *DUSP22* leads to the suppression of this gene's expression, which results in an increase in phosphorylated STAT3 levels. To determine this relationship, we will study DNA methylation in CD4+ T-lymphocytes and phosphorylated STAT3 levels before and after exposure to demethylating agents. Thus far, cells have been exposed to methotrexate and 5-aza- 2'-deoxycytidine and total RNA and DNA have been collected. Future methodologies will focus on detecting levels of STAT3 and studying DNA methylation levels at the *DUSP22* promoter region.

Tebah N. Browne

As a curious being, I always suffered from an unvanquished thirst for understanding, unconsciously seeking the hows and whys of life. As a remedy for my curiosity, I thought it would be fitting to become a scientist. Influenced by a program that focused on introducing forensic science and crime scene investigation to middle schoolers, I developed a desire to become a forensic scientist. I am currently majoring in forensic science - molecular biology track, and minoring in computer science at John Jay. After college, I plan to pursue an advanced degree like a master's or PhD.

The focus of my research is to determine if unknown body fluids relevant to forensic analyses can be detected using the analytical chemistry technique liquid chromatography tandem mass spectrometry. Our goal is to develop an accurate method that can be used in the field to solve crimes.

Signature Peptide Detection for Body Fluid Identification by Liquid Chromatography Tandem Mass Spectrometry (Dr. Prinz)

Body fluids such as saliva can be identified by functional peptides unique to that fluid. Detecting these protein markers can uncover the identity of an unknown body fluid. Some forensic crime labs do not implement peptide-based assays because these tests can be unspecific, expensive, and/or time-consuming. The adaptation of mass spectrometry for peptide analysis and advances in mass spectrometry instrumentation have made peptide-based assays more practical. However, the specialized instrumentation currently utilized in peptide body fluid assays, such as the matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS), is expensive and may be difficult for some crime labs to obtain. This financial barrier can be eliminated by utilizing liquid chromatography tandem mass spectrometers (LC-MS/MS), which are already used for toxicological analysis in most crime labs, for proteomic analyses. We believe that liquid chromatography tandem mass spectrometry can be used to detect the functional peptides of biological fluids such as whole blood, semen, saliva, menstrual blood, and vaginal secretions.

Bella Buvasheva

My fascination with science could not be called "love at first sight". As a child, I was intimidated by science, which resulted in my decision to pursue a degree in liberal arts. After moving to the United States from Russia, not only did I find the courage to change my major from political science to forensic science, but I also realized that it was easier for me to understand science than art. Choosing forensic science was a perfect way to immerse myself in STEM subjects and being in the PRISM Undergraduate Research Program helps me greatly in reaching my potential and laying out a good foundation to further my career in science.

My research focuses on determining how accurate forensic DNA testing is by looking at data from multiple past cases. This is important because these techniques are widely used in exonerating wrongfully convicted persons.

The Role of DNA Analysis in Exonerations of Wrongfully Convicted Individuals (Dr. Li)

DNA analysis is one of the forensic science techniques that have been in use since 1986. By the end of 1980s, DNA testing started to be used in post-conviction cases as well. Based on the literature review and the publicly available data, most exoneration cases are related to violent crimes such as homicides and sexual assaults. In this study, we hypothesize the importance of forensic DNA analysis in exonerations of wrongfully convicted individuals and project the usefulness of DNA databases in identification of true perpetrators. By using the Innocence Project, the FBI CODIS, and National Registry websites, all post-conviction DNA exonerations will be studied with the purpose of classifying them according to whether a true suspect was found or not, and the role of the DNA databases in such cases. Since the implementation of the post-conviction DNA testing and the effectiveness of the DNA databases, 428 people have been exonerated. With the improvement in forensic DNA testing, we expect to observe the decline in the number of wrongfully convicted individuals.

Junior M. Cadet

Coming out of high school, not knowing what I wanted to do or study, I bounced from major to major. I did not have a passion for science until I came to John Jay to study forensic science. I remember being fascinated by simple chemical reactions in general chemistry class. Yet, I always felt like what we learned in class was never enough, which is why I joined the PRISM Undergraduate Research Program. As a young, rising scientist, I want to be more knowledgeable in my field of studies and make a valuable contribution through my research.

My research focuses on developing a chemical reagent that will be used to detect fingerprints on paper with the naked eye. This reagent will allow forensic investigators to find fingerprints in documents without affecting anything printed or written on them.

Detection of Latent Print with the Naked Eye (Dr. Proni)

Not all fingerprints can be detected easily so a wide range of optical, physical and chemical techniques have been presented for the detection and enhancement of latent fingerprints. In particular, fingerprints on porous surfaces (cardboard, paper) demand a chemical development to be examined. It is known that each fingerprint contains an average of 250ng of amino acids. Research has focused on developing reagents that react with the amino acids in the print and produce colorful and/or luminescent compounds. 2-hydroxy-1,4-naphtoquinone, commonly called lawsone, was proposed in 2009 as a reagent to detect fingerprints. It is extracted from the leaves of *Lawsonia inermis*. This very promising reagent combines ease of application with a high sensitivity. The only disadvantage is its solubility; a high concentration of polar solvent is required to dissolve the molecule, which may cause an unfavorable ink-running on documents. The overall goal of the project is to obtain a derivative for fingerprint detection more active than the original molecule of lawsone. To do this we are preparing and characterizing, with different spectroscopic techniques, derivatives of lawsone. In addition, the compounds will be used to stain fingerprints. To measure their effectiveness, we will record the fluorescence light emitted by the stained fingerprint.

Hannah Chu

Growing up, I never imagined pursuing a career in science, but natural history and animals always interested me. After taking a class in forensic science, I took a leap of faith and chose to major in forensic science. Conducting research helped me decide that I would really like to have a career in science. Since I always had an interest in evolution and ecology, being able to research fly diversity and behavior has been an amazing experience. After graduating John Jay, I hope to complete a PhD in entomology.

My research focuses on studying the diversity of blow flies in Manhattan. Understanding fly diversity and distribution in a geographical region can help forensic entomologists improve the accuracy of determination of time of death in forensic investigations.

The Diversity of Forensically Important Blow Flies in Manhattan (Dr. Rosati)

Flies are often used to determine the time of death in forensic investigations. By identifying the diversity of flies that are forensically relevant in investigations, a database can be created for reference. We hypothesize that flies from urban areas are similar to those found in rural areas based on previous research done in Ontario, Canada which found habitat to have little effect on the blow fly community during decomposition. Our laboratory has collected flies from Central Park over the last three summers. This project focuses on a specific family of flies, Calliphoridae, which are commonly known as blow flies. In our future work, we aim to increase our collection of flies from different weather seasons and observe temporal diversity.

Brianna Cingari

As a child, science was my favorite subject. Because science was more hands on, I was able to understand it easier. It came naturally to me but simply learning about it from a textbook was never challenging enough. Science was also a passion that I was able to share with my dad who was disabled. Science projects became our way of bonding and eventually lead to the citywide finals in 6th grade. Research allows me to combine the different aspects of science that I enjoy, like solving a problem with my hands in real time, and it always presents me with a challenge. My passion in life is to pass my love of science to the next generation.

My research project takes a chemical component of an insecticide and separates it into its two forms (called R and S). These forms are then tested for their individual toxicities. Understanding the toxicity of either form will help manufacturers develop safer pesticides.

Separation and Spectroscopical Characterization of Ruelene (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 ruelene 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 works by passing a given type of light (different in three techniques) through an optically active medium and measuring absorption. In the future, toxicological data will be collected for the two enantiomers and their racemic mixture.

Marissa Cofane

Prior to college, I was more interested in crime television shows than in the field of science. Those shows inspired me to major in forensic science in college. Needless to say, it's an intense major and most certainly not as glamorous as the TV portrays the field to be. However, after a few semesters, I cannot see myself in any other field and have fallen in love with the sciences. I am hungry for knowledge and cannot wait to delve into the world of criminalistics.

Our project aims to develop a computer program that will show a 3-D animation that explains Galilean relativity. With it we aim to help students understand and apply these major principles of Physics.

Modeling Galilean Relativity Through 3-D Animation (Dr. Yaverbaum)

Galileo advanced a conjecture about the scope of physical law and the character of motion itself. This conjecture was presented as understanding that came before observed patterns or induced 'laws'. The conjecture has come to be foundational as intended and is now known as the Principle of Relativity. According to this principle, no statement can be made about the motion of one object without reference or comparison to another: speed, in this understanding, is necessarily a relation between two objects, not a property of one. According to this recognition of the character of motion, it is always possible, to determine how quickly one object is moving relative to the other, but such determination always applies equivalently in both directions.

This research takes that core principle and converts it into the virtual world using the Unreal Engine 4. This suite of software tools, or engine, is used to create games and animated videos. In this case, both functions of the engine were used. In this engine, objects can be moved around, and different reference frames can be established. The engine allows the users to view a reference frame of one object to be able to get a better understanding of the principles of relativity. Our future experiments will involve physical testing. The engine will provide a way that will help experiment with different methods before taking them out onto the field. The engine also will allow viewers to better understand the concepts of Galilean relativity.

Dee-Anne Adecia Cush

Before coming to John Jay, I found myself engaged in many activities, but never did I find any as intriguing as the advanced science courses I took. I was a science student in high school but at that point in my life my decision to pursue a science degree was influenced by my fellow classmates' decisions. My first two years at John Jay as a forensic science major helped me determine that a career in the health professions was what I wanted. Research with Dr. Corthals as a member of the PRISM Undergraduate Research Program has given me the guidance, support, and experience I require to pursue an MD in pathology.

My research projects seeks to determine if viruses—microorganisms that cannot survive outside a host—can be found on the remains of deceased farmed pigs after a long period of time. These findings could pave the way for novel methods used by scientists to determine the health history and the environmental conditions of a cadaver prior to death.

Detecting the Presence of Viral RNA and DNA Particles in the Bone Remains of Farmed Pigs Ten Weeks After Demise (Dr. Corthals)

Viruses are infectious non-living microorganisms that lack the ability to replicate unless they are within a suitable host. Their infectivity outside their hosts can vary from a few minutes to many decades depending on their genomic makeup and the environmental conditions in which they are found. Incorporating these two unique characteristics into its framework, this work seeks to explore the relationship, if any, between the bone remains of farmed pigs and four common viruses that affect them. If these viral residues can be detected in the swine's bones after death, then there lies a possibility that these results can be further used for health determination. Towards this goal, four common non-pathogenic viruses will be tested for in the remains of the pig bones. This will be achieved first through DNA extraction, PCR analysis and genome sequencing. These results can be compared to existing findings and subsequent expansion into the disciplines of forensics and medicine can be explored.

Jeanine Day

I always wanted a career involved in the criminal justice system. After graduating from the Institute of Forensic Science and Criminology at my high school I entered John Jay because I was interested in being challenged and exploring how crime scene investigators evaluated evidence. I joined the PRISM Undergraduate Research Program and started a research project to expand on the existing knowledge that a firearms investigator would have while testifying in a court of law.

The focus of my research is to determine if a mathematical equation used by bloodstain pattern analysts may be applicable when determining the angle at which a bullet was shot.

Estimation of the Angle of a Fired Bullet Using a Trigonometric Analysis Method (Prof. Rourke)

The reconstruction of a shooting incident includes analyzing the trajectory of a projectile. When determining the trajectory of a bullet, the angle at which it was shot may be key evidence in locating the position of the shooter. It is hypothesized that the mathematical calculation used by bloodstain pattern analysts to estimate the angle at which a blood droplet impacted a surface may help to estimate the angle at which a bullet was shot. Bloodstain pattern analysts use the equation $\sin\theta = (d/D)$ to estimate the angle at which the blood droplet impacted, where D and d are the major and minor diameters of the ellipse, respectively, and θ is the angle of incidence, in degrees.

Error analyses were conducted using R-Project in order to estimate how accurately the incidence angle could be predicted using the bloodstain pattern equation. By using A.N.C.O.V.A. analysis, factors such as the brand of cartridges, the type of impacted substrate and the actual known angle were taken into account in order to compare the predicted angle values to the actual angles. The standard deviations of the data sets indicated that the incidence angle can be estimated with an error of +/- 3.8 degrees.

Alexa DeJesus

I always disliked turning on the TV and seeing numerous crimes on the news. The anger I felt made me want to pursue a career focusing on justice. The need to contribute to the justice system, and my love for science led me to forensics. John Jay provides students with the skills necessary to become a proficient scientist. I am grateful for PRISM because of the real life exposure it provides beyond the school labs and classroom learning. Before becoming involved with the PRISM Undergraduate Research Program, my possibilities of even aspiring to a PhD were very remote. Instead, today I can envision a future where I will apply to graduate school.

My research focuses on synthesizing two compounds derived from henna dye and characterizing them to determine if they can be used to detect fingerprints. Our goal is to obtain a more functional henna derivative that can be used for fingerprint detection in forensic investigations.

Developments of New Reagents for the Detection of Latent Fingerprints on Porous Surfaces (Dr. Proni)

A wide range of optical, physical and chemical techniques have been presented in literature for the identification and intensification of latent (hidden) fingerprints. Specifically, fingerprints on porous surfaces demand a chemical development to be examined. Research has focused on developing reagents that react with the amino acid residues in fingerprints and produce colorful and/or luminescent compounds. 2-hydroxy-1,4-naphtoquinone, known as lawsone (henna), is extracted from the leaves of *Lawsonia inermis.* It is the most recent and promising reagent presenting both an intense coloration and high fluorescence after reacting with fingerprints and amino acid solutions. The only disadvantage is its solubility. When analyzing prints on documents, ink-running may occur due to the high concentration of polar solvent required to dissolve the molecule. This research project consists of preparing lawsone derivatives and characterizing them with different techniques, such as mass spectrometry and NMR spectroscopy. Furthermore, the compounds will be later used to stain fingerprints and the fluorescence light emitted by the stained fingerprint will be analyzed.

Victoria DePrimo

I first became interested in science through reading dinosaur and bug books as a child. My fascination with science grew when I received a science kit one Christmas and began to read stories about different forensics cases. My passion for forensics and justice kept me wanting more. These stories were the basis that led me to pursue forensic sciences at John Jay. Upon graduating, I will attend graduate school for forensics science. After completion of my master's degree, I plan to pursue a career as a criminalist with the FBI.

Due to the difference in bone density between children and adults, the width of a mark inflicted from a sharp tool, such as a knife, can be hypothesized to possess differences in their corresponding mark widths. Using 3D microscopy and imaging, my project aims to improve the identification of marks made by specific types of weapons on bones of juvenile or adult victims.

Bone Density and its Effect on Mark Width (Dr. Corthals)

Bone density varies depending on the anatomical site. During the maturation process, the density of the same bone between children and adults changes. Research has previously been performed on different tools and its effect on mark width. However, bone density has not been tested to have an effect on mark width. My project aims to test different bone densities and its effect on mark width by using bones from the ribs and scapula, from a denser adult bone in relation to a less dense juvenile bone. Due to the difference in density, the mark width from a sharp tool such as a knife, can be hypothesized to possess differences in their corresponding mark width.

Lisset A. Duran

I came to the United States when I was nine years-old from the Dominican Republic. Thanks to a series of amazing science teachers and watching *Bill Nye, the Science Guy* on TV, I developed a passion for asking my own questions and finding my own answers. In the past I have conducted research at the National Institute of Aromatic and Medicinal Plants of Morocco and at Brown University in Rhode Island. Currently, I am a junior conducting breast cancer research in Dr. Delgado-Cruzata's lab. In the future, I will pursue a PhD in biomedical sciences. I hope to someday work for NASA and get the chance to go into space.

Our research focuses on understanding one of the mechanisms that regulates how genes involved in breast cancer are turned on. By understanding this process we can develop treatments that can better target breast cancer.

Investigating the Loss of DNMT1 and DNMT3B on Breast Cancer Gene and miRNA Expression (Dr. Delgado-Cruzata)

DNMT1 and DNMT3B are proteins that preform DNA methylation, whose aberrant function and amounts have been associated with many cancers. However, less is known about the downstream effect of the loss of DNMT1 and DNMT3B on breast cancer-related genes and miRNAs. DNMT1 and DNMT3B were knocked down in MCF-7 (breast cancer cells) and MCF10 (breast noncancerous cells) by mRNA targeting siRNA. In addition, both cell lines were treated with 5-aza-2'-deoxycytidine (5-Aza), a DNMT protein inhibitor. miRNA and mRNA were extracted from these treatments in order to determine changes in miRNA levels by microarray and changes in *DNMT1, DNMT3B,* and *BRCA1* gene expression levels by qPCR. Initial results show that 50nM siRNA knockdown decreased levels of *DNMT1* mRNA by 96.97% ffl 0.62, Accordingly, *BRCA1* mRNA levels decreased to 40.50% ffl 8.35 when transfected with 50nM siRNA. Currently we are working on knocking down DNMT3B and inhibiting expression through 5-Aza. In addition, we are also preforming microarray assays in order to investigate changing miRNA levels in response to changes in DNMTs. Understanding how changes in DNMT1 affect gene and miRNA expression could elucidate new mechanisms to better treat breast cancer.

Margaret Farmer

My interest in science and math has always been a part of who I am, but I took a different path before entering the forensic science program at John Jay by first graduating from art school. I joined the PRISM Undergraduate Research Program last year, and had the opportunity in Dr. Corthals' lab to apply my visual skills to develop my own digital photogrammetry project (photogrammetry is the science of making measurements from photographs). The project so far has been an experience in creative problem solving and learning computer science, which is new for me. After graduation, I hope to continue on to graduate school where I can pursue a degree in environmental science. The focus of my research is to develop a new technique to render 3-D images of human remains of pathological significance using consumer-grade cameras (such as the ones found on smart phones). If feasible, this technique will have a deep impact in forensic and archeological studies.

Structure from Motion 3D Rendering of Bone Traumas and Pathologies (Dr. Corthals)

Three-dimensional digital (3D) rendering from 2-dimensional images, also known as Structure from Motion (SfM), is an accurate and inexpensive alternative to 3D laser scanning or computed tomography. Incidents of trauma or disease can cause characteristic morphological landmarks in bone, distinguishable after death. If different bones subjected to the same type of trauma are analyzed with 2D to 3D documentation, it is hypothesized that these landmarks can be considered characteristic of that particular type of trauma within a statistical range. The software used to render the bones may also be useful as a measuring device if different sets of images of the same sample produce landmarks consistent in all renderings. Bone morphology that has been translated into a 3D digital image has the potential to be analyzed by machine-learning software, which, if incorporated into an application for smartphones/tablets, can lead to faster analysis that can take place on-site. Using both porcine bones that have been subjected to experimental trauma and human samples photographed on-site at the Theban Tomb Complex 29 in the Valley of the Nobles, Egypt, multiple renderings of similar types of trauma will be created in order to statistically analyze variation among features for future quantitative analysis.

Maria Alejandra Faure-Betancourt

I was born in Caracas, Venezuela, and at the age of ten I moved to Brooklyn, NY, with my family. I am 24 years old, and I am majoring in Forensic Science in the toxicology track. I am not sure when exactly my love for science started but what I know is that this field has always fascinated me, even at a young age. As the years passed, this love and fascination started to evolve as I realized the beauty of how our body works. For this reason I have decided to go to medical school and become a pathologist.

My research focuses on determining the exact location of drowned cadavers found in large bodies of water by utilizing molecular biology techniques.

Identification of Diatom Species in New York City Waters for Drowning Investigations (Dr. Li)

Diatoms are photoautotrophic eukaryotes that can be found in different aquatic environs such as rivers, lakes, oceans and marshes. Forensic scientists use diatoms to help them determine where victims drowned. Presence of diatoms in the blood stream of a drowning victim is indicative of drowning in an aquatic environment, while their absence can indicate that the person was dead before its body was found in the water. In this research we will analyze species of diatoms that are specific to the locations of the New York City waters. This will help us develop a technique to identify diatoms of different species as well as an opportunity to contribute to the forensic science field by limiting down the exact location and time frame the individual was drowned since water currents can convey the cadaver to a distinct site.

Erica M. Fontanes

I am a senior majoring in forensic science-criminalistics at John Jay. I am very excited to graduate this spring. This year has already proven to be a big year for me. Along with experiencing my final semester at John Jay, I celebrated the first birthday of my new puppy, Maxie, in March, and will celebrate my 21st birthday in October. Finding answers is why I love science. I've been a truth-seeker my whole life and working in the lab is where I feel most challenged and fascinated. I hope that my education will lead me to a career in a crime lab.

My project works with insecticides that are chiral, that is, sets of two identical molecules that are mirror images of one another. We separate the two molecules to determine the toxicity of each one independently to aid in the development and manufacture of pesticides that are safer for mass usage.

Separation and Spectroscopical Characterization of Ruelene (Dr. Proni)

Chiral organophosphates are commonly found in their racemic forms in insecticides. 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 ruelene by HPLC chromatography and then test their individual toxicity through the concerted use of three different spectroscopic techniques: optical rotary dispersion (ORD), electronic circular dichroism (ECD), and vibrational circular dichroism (VCD). In the future, toxicological data will be collected for the two enantiomers and their racemic mixture.

Joseph A. Fragale Jr.

Ever since I was young I have always loved animals. I never pictured myself doing research, but it has been extremely rewarding thus far. My research experience has given me the opportunity to work closely with insects and learn more about animal science. As a result, I hope to pursue a career in veterinary medicine after John Jay.

My research focuses on identifying how chemical signals stimulate blow flies to gather on a decomposing resource and lay eggs. The results from this experiment will help improve the methods used by forensic investigators that use flies to determine the time of death of cadavers.

Isolation of Resource and Oviposition Cues in Blow Flies (Dr. Rosati)

Lucilia sericata (Meigen) and *Phormia regina* (Meigen) are both blow flies belonging the to family Calliphoridae. Calliphoridae flies are forensically important because these specimens can arrive within minutes after death, making them a vital component when determining post mortem interval (PMI). It is currently unknown, but largely debated, what causes mass aggregation of a resource and oviposition of blow flies. The following experiment will expose chemical mixtures to the two species of bottle flies and observe their change in behavior to determine if chemical cues are responsible for aggregation to a resource and oviposition. Our hypothesis is that the aggregation to a source and oviposition cues are composed of chemicals observed by *L. sericata* and *P. regina* from their environment. This will be determined by exposing the flies to control and experimental petri dishes containing gelatin (control) or gelatin and chemicals (experimental). A null of the proposed hypothesis will result in no observable behavioral difference of the flies towards the control or experimental dish. Observations will include changes in fly behavior, probing, aggregation, and oviposition. Information obtained from this experiment can be used to determine cues in other forensically important flies and expand the knowledge of *L. sericata* and *P. regina* blow flies.

Josephine Guo

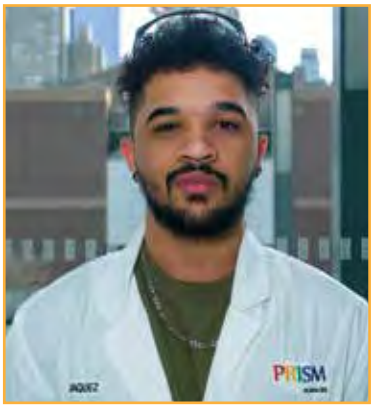
In high school, I decided to pursue forensic science after watching a TV show. I thought seeing others use science to solve crimes was very interesting. In my third year in college, I was introduced to research, but I was not sure if research was for me. When I joined Dr. Carpi's lab, I found that it was exciting to research unanswered questions and find the reason(s) behind the unknown. Discovering something was fun! I am still deciding my future plans because there are so many possibilities, but I do plan to continue research and work toward becoming a forensic toxicologist.

My research studies how mercury, a toxic metal, interacts with other chemicals in soil and then moves to the air. Understanding these interactions will help us understand how mercury moves in the environment, so we can try to minimize its toxic effects.

The Effect of Substrate and Ozone Concentrations on Mercury Flux from Mercury (II) Chloride Spiked Samples (Dr. Carpi)

Mercury is an environmental concern because it is a toxin that can cycle between the atmosphere and terrestrial environments, and it has the ability to bioaccumulate in organisms and biomagnify in food chains. Previous research in our lab has suggested that an unknown variable is affecting the emission of mercury from sand and soil samples, resulting in unexplained variability in mercury flux behavior over time. Ozone has been found by others to influence mercury flux from both sand and soil, with higher ozone concentrations causing an increase in mercury emissions. Ozone is proposed to increase mercury flux by reacting with reduced sulfur groups, and possibly the substrate, to form reducing agents, which could then cause more Hg^{2+} to be reduced to Hg^{0}. We hypothesize that ozone may be affecting our flux measurements, causing the flux variability we have observed. Mercury flux was measured from $HgCl_2$ spiked sand samples and from $HgCl_2$ on an inert polymer substrate (PTFE sheet and PTFE powder), while simultaneously monitoring ozone concentrations. A positive relationship between ozone concentrations and mercury flux was shown in the sand substrate samples, while a similar relationship was not shown in the PTFE sheet samples. Future experiments will analyze $HgCl_2$ spiked PTFE powder samples to determine the relationship of substrate type, ozone concentrations, and mercury flux.

Enil Jaquez



Until college, I never truly knew that I loved science. In fact, I thought that I wanted to obtain an engineering degree. However, during my second semester in college, I took general chemistry as an elective, and my passion for science blossomed. I enjoyed the class so much that by the time I finished organic chemistry, I decided to radically change my studies. I decided that a forensic science degree is what I truly desire. My ultimate career goal is to become a forensic pathologist assistant.

My research project is to determine the molecular structure formed by a reagent developed by our lab when it reacts with fingerprint residues. Our findings will allow us to develop new fingerprint-detection reagents for forensic investigations.

Synthesis of New Lawsone's Derivatives (Dr. Proni)

Fingerprint comparison is still one of the most useful techniques for the identification of possible offenders. 2-hydroxy-1,4-naphtoquinone, commonly called lawsone, was proposed in 2009 as a reagent to detect fingerprints. It is a colorful reagent and presents fluorescent properties. The only drawback presented is its solubility: a high concentration of polar solvent is required to dissolve the molecule, and this can create de-inking problems in the documents analyzed. The overall goal of our project is to perform macroscale reactions of lawsone and amino acids and to isolate the compounds formed in these reactions and to subsequently determine their structures. NMR analysis will be performed to determine the overall chemical structure. As a second project, we will continue synthesizing derivatives of lawsone. Ideally, the synthesized compounds will be less polar than the original molecule of lawsone, thereby being more effective as fingerprint reagents.

Rabia Javed

I moved to the US four years ago to pursue a degree in biology. My love for biology began when I was in Iran, dissecting a frog for my ninth grade lab practical. Visualizing the intricacy of the species' internal system was quite intriguing. Currently, I am researching the effect of black cumin on pesticide-induced toxicity. I was inspired to take on this project after my recent internship in Morocco where I researched the properties of medicinal plants such as rosemary. My future goal is to pursue a PhD in neuroscience and to expand my research on the use of natural products derived from medicinal plants.

My research focuses on the medicinal role of the plant-derived compound thymoquinone on cells treated with pesticides. Understanding the role of thymoquinone in affected cells could lead us to develop future treatments for neurological diseases caused by exposure to pesticides.

Effect of Thymoquinone on Maneb and Mancozeb Induced Cytotoxicity (Dr. Cheng)

Maneb (MB) and mancozeb (MZ) are manganese-containing pesticides used to control various crop diseases such as the infamous potato blight. However, recent studies have linked these pesticides to neurodegenerative disease such as Parkinson's. MB and MZ lead to the production of reactive oxygen species (ROS) causing oxidative stress. Antioxidant compounds can hinder the activity of ROS and can serve as therapeutic agents. Thymoquinone (TQ), the active ingredient present in black cumin, is known for its antioxidant and neuroprotective properties among many others. This study examines the effect of TQ on PC12 cells treated with MB and MZ. Neutral red uptake assays were performed to determine cell viability after treatment with TQ and pesticides. Preliminary results have shown a decrease in cell viability after MB and MZ treatment and an increase when followed with TQ pretreatment, especially when the pesticide used was MZ. This shows that TQ can act as a potential treatment agent.

Julia Kakhnovich

I was born and raised in Belarus. In high school I enjoyed chemistry and biology the most, but I did not think of majoring either in forensics or in any other scientific fields. After I moved to the US, I started to pursue a career in nursing. I recently decided to change my major to forensic science. Being part of the PRISM Undergraduate Research Program helped me reconsider my career goals and to understand what it truly means to be a scientist. When I look back at all the hurdles that I had to overcome in order to be exactly where I am today, I know it was worth it. My goal is to pursue a career in forensic toxicology.

The aim of my research project is to design synthetic DNA sequences for the fast and accurate identification of common household flowering plants and to determine whether this approach can be used for plant identification from trace pollen evidence and its applicability in forensic investigations.

Sequencing of *trnL-trnF* Can Serve as a Tool for the Identification of Plant Residue in Forensic Investigations (Dr. Lents)

Evidence from plants could be valuable in forensic investigations to connect a suspect or victim to a crime scene. Certain genes are known to contain species-specific differences that can be exploited for that purpose. DNA barcoding has the potential to provide accurate and fast species identifications for plant samples that cannot be distinguished morphologically. The method is a DNA-based recognition approach that utilizes the *trnL-trnF* intergenic spacer of the chloroplast genome. First, DNA is extracted from a suitable plant source material, the gene of interest is amplified by polymerase chain reaction (PCR), the PCR product is resolved using gel electrophoresis and purified, and finally, sequences are obtained in order to achieve specific primer design. The identification of appropriate DNA loci was successful for the design of universal trnL-trnF primers. Species-specific primers were successfully designed for 19 different species. These molecular biology identification techniques allow us to identify unique DNA sequences to successfully differentiate these species.

Zenab Khan

I have always found science intriguing because of its evolving nature. Such a field requires that a student must be rational and objective—a quality I find I have manifested both as a student and as a tutor for classes in this major. I enjoy the forensic science program because of the hands-on approach used to train students. I hope to pursue higher education in a medical or forensic profession.

The focus of my research is to determine if the DNA of bacteria found on the bodies of deceased individuals can play a role in deducing time of death, and if so, writing a computer program that could help law enforcement determine time of death using DNA sequencing data.

A Machine Learning Approach for Using the Postmortem Skin Microbiome to Estimate the Postmortem Interval (Dr. Lents)

This research explores postmortem changes in the skin microbiome to accurately determine the postmortem interval, and thus, the approximate time of death. The bacterial communities on living and deceased subjects were compared to determine whether we could identify consistent differences among microbial communities. The focus then shifted to the cadavers and how the microbiome changes through decomposition. Swab samples were collected from the nostrils and external ear canals of four cadavers at the Anthropology Research Facility at the University of Tennessee at Knoxville over four to six weeks of decomposition. DNA was extracted from the samples and subsequently underwent 16S metagenomic sequencing using the miSeq platform from Illumina to quantitatively identify all bacterial species present in each sample. The data was normalized and graphed against the corresponding accumulated degree days (ADD), after which a curated list of data was manually selected. The curated list and non-curated list were analyzed via several regression techniques. Analysis indicated that microbial diversity decreased as ADD increased for the ear data; comparatively, the nose microbial community showed a less distinct positive correlation. Regression of the ear and nose data combined proved to be more useful than comparing the data sets individually. The model produced from the combined data, using K-neighbors regression, had a mean absolute error of 55 ADD, or roughly two days of decomposition.

April Kosakowski

My love for science developed in high school, when I first took a forensic science class. It exposed me to the world of forensics, showing me how these techniques could assist in enforcing justice, and how I could combine my passion for law and science; I was captivated. While conducting research in Dr. Carpi's lab, I discovered the joy of research, and working toward uncovering something new. In the future, I hope to work in a forensic science lab alongside law enforcement, and later in life, as a mortician.

Mercury is an environmental pollutant that can change form and move from soil to air. Gases like ozone, that are naturally present in the atmosphere, can increase this movement. My experiments study the molecular mechanism by which ozone causes this increase.

The Effect of Substrate and Ozone Concentration on Mercury Flux from Mercury (II) Chloride Spiked Samples (Dr. Carpi)

Mercury is a known toxic environmental pollutant that can cycle between the atmosphere and aquatic or terrestrial environments. Previous experiments that have been performed in the lab have shown variability in mercury flux from sand, which are not the result of our controlled experimental conditions. Studies have shown that ozone can influence mercury flux from sand, with higher ozone concentrations resulting in greater flux. It has been proposed that ozone may influence mercury flux by interacting with reduced sulfur groups and/or the sand itself to produce reducing agents, which could react with mercury in the sample, causing greater production of volatile elemental mercury. We hypothesized that the variability we observed in past experiments is the result of a reaction with atmospheric ozone, and that this reaction requires the presence of sand. To test our hypothesis, we replaced our normal sand substrate with Teflon® powder, an inert polymer, and added mercury. We monitored the flux of mercury from samples in the dark, and with light applied, while monitoring ozone concentrations. Data was then analyzed to evaluate the possible relationships between ozone concentration and the flux of mercury from samples with the Teflon powder substrate.

Glen Mahon

I am a fifth-year student in the forensic science program in 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 when I was in high school. At John Jay, I entered the PRISM Undergraduate Research program to gain research experience. I started my own research project studying the fracture patterns of glass under the mentorship of Dr. Diaczuk and Professor Rourke. My ultimate goal is to become a forensic scientist specializing in ballistics.

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

Ballistics Examination of Rib Marks and Radial Fractures on Broken Glass (Prof. Rourke)

When glass breaks mechanically due to an applied force, it breaks in a specific pattern. Radial fractures will 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 which are curved lines on the surface of the fractured edge, and they start perpendicular to the surface where the initial crack starts and end up parallel to the surface where the crack ends. 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 thin glass plates as the glass source and an air rifle to see if they will change the rib marks. These parameters are: pellet caliber, velocity of the pellet, and the thickness of the glass. Through a few successful trials a pattern was found in which the length of the rib marks, from the point of penetration to the widest point of the rib mark, was measured to be half of the thickness of the glass. The next steps are to use thicker glass samples and different caliber rounds to see if there are any differences in rib mark formations. If conclusive data is obtained, architectural grade glass will be tested with a firearm instead of an air rifle.

Darrien Maynard

My love for science began in my senior year of high school in the Caribbean island nation of St. Kitts and Nevis where I was raised. With my high school qualifications, I moved to New York to pursue my bachelor's degree in forensic science, with a toxicology emphasis, at John Jay College. I am currently a junior participating in the PRISM Undergraduate Research program. Through PRISM, I have gained knowledge and experience that I am confident will lay the foundation for my future scientific journey, and my pursuit of a graduate degree.

Our research focuses on understanding how one particular form of mercury—a toxic metal and environmental pollutant—changes in soil and moves to the atmosphere. This work could be used to help with planning better cleanup strategies for areas that have been historically contaminated with mercury.

Determining the Mechanism of Mercury (II) Oxide Reduction in Soil (Dr. Carpi)

Mercury is a toxic environmental pollutant that can cycle between the atmosphere and soil. It is known that reduction of mercury (II) species in soils occurs, and the result is the movement, or flux, of elemental mercury to the atmosphere. What is not known is the mechanism by which these mercury (II) species undergo reduction in soil. Since many different mercury (II) species can exist in soil, and the mechanisms of reaction vary from species to species, our research focuses on an individual mercury (II) species—mercury (II) oxide. Based on preliminary molecular modeling work, we hypothesized that a small amount of energy, such as could be provided by elevated temperatures, may be enough to allow mercury (II) oxide to be reduced to elemental mercury in soil. In order to investigate this hypothesis, we will use controlled laboratory experiments, using silica sand as a simpler stand-in for environmental soil, with a mercury (II) oxide addition. We will subject our mercury (II) oxide spiked sand to varying temperature and light conditions, and monitor how the flux of mercury from the sample changes in response to these parameters. The results of these experiments will further our understanding of how mercury behaves in environmental soils, which can be used to improve environmental mercury modeling, and could help with remediation of mercury contamination.

Veena Mehta

I have always loved science! I never thought I would enjoy research, but my research experience over the past two years has been extremely rewarding. It taught me how to work collaboratively, develop my lab skills, and think critically about my experiments. Although I initially wanted to pursue a career in forensic science, my experiences in the lab, along with my internship at Bellevue Hospital in New York City have inspired me to pursue a career in medicine and global health.

My research project attempts to identify a chemical or combination of chemicals that would be required to stimulate egg laying in blow flies. This will have a direct application to the field of forensic enthomology.

Isolation of Resource and Oviposition Cues in Blow Flies (Dr. Rosati)

Blow fly oviposition on decomposing matter forms the foundation for the use of insects in forensically related investigations. However, there is much debate over the particular cues that can attract blow flies to a particular resource or influence female oviposition behavior. Research has supported both the presence of a bacterial cue on the resource or a chemical volatile released from the resource itself, in addition to the presence of a visual cue on or near the resource. In this experiment, two forensically important blow fly species, *Lucilia sericata* (Meigen) and *Phormia regina* (Meigen), will be examined for behavioral effects when exposed to chemical and visually-based resource and oviposition cues. Cages containing 250 males and 500 female *L. sericata* and *P. regina* adult flies will be exposed to this specific mixture of chemicals for one hour, both with and without the presence of visual cues. The flies will be checked every 10 minutes during the exposure period, and any significant behavioral changes will be recorded. Pictures will be taken during the course of the trial to document the behavioral observations. Statistical analysis will be conducted to determine the significance of the results. This research will be used to further develop the hypothesis that oviposition in blow flies is stimulated by chemical cues, as opposed to bacterial cues.

Ana Mendoza

I was born in Colombia, and at the age of 18 my family moved to New York. I cannot remember exactly where my love for science started, nor how I first got involved with it, but I know I have been always fascinated by the way science allows us to explain physical phenomena. Currently, I am pursuing my bachelor's degree in forensic science. My future goal is to obtain a laboratory position and eventually attend graduate school.

Mercury is a pollutant that can cause serious health problems, and it is important to identify mercury pollution sources. My project tests moss to determine mercury levels in the air around a pollution source. Because it has the ability to absorb ions directly from the air, moss could provide a cheap, easy way to find mercury sources in the future.

Detecting an Atmospheric Mercury Pollution Source Using Moss as a Biomonitor (Dr. Carpi)

Mercury is a hazardous environmental pollutant and a human health risk because it can be a mutagen and a teratogen. Moss is useful as a biomonitor for mercury pollution in the atmosphere because it has the ability to absorb ions directly from the air. The purpose of my project is to study atmospheric mercury concentrations around a sewage sludge incinerator in New Haven, CT using moss as a biomonitor. It is hypothesized that moss is sensitive enough to detect a relatively small atmospheric mercury pollution point source (the incinerator). We expect moss samples would have greater mercury concentrations closer to the sewage sludge incinerator, which would show that moss is a useful monitor for atmospheric mercury pollution under these conditions. To test our hypothesis, moss samples were placed in duplicate at 19 sites in transects around the incinerator, and exposed to ambient conditions for three weeks in the summer of 2016. Linear regressions of the three transects (north, east and south) will be conducted to test the relationships between distance from the incinerator and the mercury concentrations measured in the moss.

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. Attending John Jay College has allowed me to expand my knowledge and enhance my skill set. Working in research has assisted in determining my specific field of study. I decided to pursue a degree in toxicology with an interest in public health. I seek to further my education by applying to post-baccaulareate programs and later pursue a PhD.

My research focuses on how commonly used pesticides affect the human body, specifically neurodegenerative diseases like Alzheimer's disease. A deeper understanding of these effects can possibly lead to a cure for this disease.

The Effect of Dithiocarbamate Pesticides on Mammalian Target of Rapamycin Downstream Effector p70S6 Kinase Expression (Dr. Cheng)

Environmental factors play a critical role in the pathogenesis of neurodegenerative disease. Alzheimer's disease (AD) is characterized by a progressive decline of memory. Past pesticide exposure and low cognitive performance may increase the risk of developing AD. The neurodegeneration of AD brains has been linked to activated double-stranded RNA dependent protein kinase (PKR) and down regulation of mammalian target of rapamycin (mTOR). Our project studies the effects of MB and MZ on PKR/mTOR/mTOR downstream effector p70S6K signaling pathway in human neuroblastoma cells (SH-SY5Y). Our results showed MB and MZ have 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. There was an overall decrease of cellular mitochondrial activity in response to MB and MZ, yet the decrease was stronger in cells treated with C16 one hour before being exposed to the pesticides. It is possible that PKR it not directly connected to cell death but is one of the many factors that play a role. MB and MZ have also increased total mTOR levels in SH-SY5Y. In this study, the level of the downstream effector of mTOR, p70S6 kinase, in SH-SY5Y cells will be monitored after MB and MZ exposures by using western blot analysis.

Elmer N. Morales

I was born in Guatemala and came to the United States when I was 10 years-old. Science helped me understand the world around me and this motivated me more. In college, I also read about Frederick Douglass and how he succeeded in life because he educated himself. This idea stuck with me. I am convinced that success in life can be found with a strong education, especially in the STEM fields. My career goal is to earn a master's degree in forensic toxicology.

My research focuses on the investigation of detection methods of marijuana in hair from people who are regular users. Hair analysis provides a good way to test how long drugs can remain in the body and show past exposure to these drugs.

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 cannabis at least once a year. 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 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-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. Our goal is to investigate if, besides THC, cannabis' metabolites are incorporated into hair, and if we can use THC-COOH-glucuronide as a biomarker in cannabis use. This information will help in forensic investigations because THC can be incorporated into hair not only by active consumption but also by external contamination (e.g., 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

As a child, I amused myself in the nursing home where my parents worked by identifying medical devices. Years later, I learned that bacteria also have their own "devices," which make them resilient to vaccines. As someone who still has much to learn about the science of treating, diagnosing, and preventing diseases, I feel that my continued participation in the PRISM Undergraduate Research Program will grant me the opportunity to strengthen necessary skills. Just as DNA dictates the features of an organism, so too do DNA modifications by proteins.

My research project focuses on specific protein-DNA and protein-protein interactions in breast cancer. We hope to determine if these interactions could serve as targets for cancer drug therapy.

Measuring DNMT1 Activity in Breast Cancer Cells (Dr. Delgado-Cruzata)

Epigenetics is the study of "heritable changes in gene expression not attributed to DNA sequence," or as geneticist Adrian Bird described: "inheritance, but not as we know it." The epigenetic mechanism of DNA methylation, or the addition of a methyl groups to the promoter regions of genes, is mediated in humans by the DNMT1 enzyme. Abnormal methylation patterns influenced by DNMT1, can lead to carcinogenesis and cancer progression. This is especially true for breast cancer, a leading cause of death among women worldwide. However, the exact activities and functions of DNMT1 in breast cancer are not clearly understood. In this work, the activity and function of DNMT1 in the MCF-7 breast cancer cell line will be studied. We hypothesize that DNMT1 activity will be increased in MCF-7. To date, a transfection protocol for inhibiting the expression of DNMT1 in MCF-7 was designed. We are currently identifying methods of comparatively investigating DNMT1 activity in transfected and regular MCF-7 cells. One such method is an enzyme-linked immunosorbent assay (ELISA). In working towards implementing this method, a series of standard curves have been created to estimate the concentration of DNMT1 in transfected MCF-7 cells. For future work, we wish to clarify the role of DNMT1 in the progression of breast cancer and as a potential therapeutic target for treatment.

Yoselin Paucar

I have always been intrigued by science because it is filled with numerous unanswered questions and, thus, presents opportunities for research and for expanding my knowledge. Lat fall, I was privileged to begin conducting research with Dr. Rosati. It has been an incredible learning experience being introduced to forensic entomology and becoming comfortable with plenty of insects. I look forward to helping complete our current study and developing my own research project as I quench my thirst for knowledge.

My research focuses on identifying the species of preserved flies that were collected by our lab. This data pool will then be analyzed and published on a database that will help forensic entomologists understand how fly populations change through different habitats in Manhattan.

Diversity of Forensically Important Diptera in Manhattan (Dr. Rosati)

Given that they are among the first insects to arrive to colonize a decomposing resource shortly after death, blow flies (family Calliphoridae), are some of the most forensically important insects in the field of forensic entomology. As a result, blow flies are often considered to be key evidence used to determine the postmortem interval (PMI) in forensic cases where the time of death exceeds 72 hours. Due to changes in the distribution of insect species over a landscape or geographic region, a local database of forensically important insects should be created. The ongoing experiment will contribute to the creation of a database, which is lacking for the Manhattan and surrounding regions. To date, flies have been collected from wasp traps that were baited with pork liver and placed in Central Park during the summers of 2015 and 2016. Currently, preserved samples are being processed and sampled. Insect samples are identified to species and community indices will be determined, such as species richness (number of species), species diversity and species evenness. This database will provide information on the blow fly community that is present within the Manhattan region of New York City.

Ronal Peralta

When I began college, I had never taken a science class. My interest in science did not develop until my sophomore year after taking most of my introductory science courses. I joined the PRISM Undergraduate Research Program in my junior year, because I wanted to explore science outside of the traditional classroom setting. My experiences conducting research have motivated me to pursue a PhD in biomedical sciences, and currently, I am interviewing for PhD programs in microbiology and immunology.

We are testing the use of moss to monitor mercury, a toxic metal, in air. We placed moss at various locations and measured how much mercury this moss collected from the air. Because it has the ability to absorb ions directly from the air, moss could provide a cheaper way to find mercury contamination sources.

Using Moss as a Bio-monitor to Detect Atmospheric Sources of Mercury (Dr. Carpi)

Mercury is a global health concern because of its toxicity to the human brain. Sewage sludge incinerators are an anthropogenic source of mercury emissions; however, active air monitoring of such sources is expensive. Moss has been used as a cheaper passive biomonitor for airborne mercury due to its ability to absorb atmospheric ions. The purpose of this research was to determine whether measuring the mercury absorbed by moss is sensitive enough to detect a relatively small point source of atmospheric pollution. We hypothesized that there would be a direct relationship between the distance from identified sources of mercury, and the concentration of mercury in moss samples. Local sources and patterns of distribution were studied by placing 21 samples of moss in three transects around a sewage sludge incinerator in New Haven, CT and exposing them to ambient conditions for three weeks in July of 2015 and 2016. After collection, samples were analyzed and the patterns of mercury accumulation in the samples were correlated with distance from local sources. In 2015, moss samples closest to the incinerator showed mercury concentrations from 0.03–0.04 ppm, while moss placed further away had mercury concentrations from 0.02–0.03 ppm. Although 2016 analyses are still underway, preliminary data corroborates the 2015 findings. Our data suggests that this method is sensitive enough to reveal patterns in atmospheric mercury pollution even in a complex urban environment.

Tonya Phoenix

I always felt that I found my true calling in the scientific world. Organic chemistry is where I found new love for science, and this eventually provided a foundation for my pursuit of a bachelor's degree in forensic science. I have had extensive research training with my mentor Dr. Zhang, who has helped me strengthen my laboratory technique and publish articles in scientific journals. This experience helped me gain an internship with the Toxicology Department at the Office Of Chief Medical Examiner in New York City where I soon hope to start my career as a forensic analyst.

My research focuses on developing a new technique to detect heavy toxic metals such as mercury, lead and cadmium that are found in polluted environments and water. We are developing new molecules that fluoresce when combined with these metals, so that they can be detected in a cheaper and easier manner.

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

In recent years, readily available compounds have been discovered for selective fluorescent recognition of toxic heavy metals such as Hg(II), Cd(II) or Pb(II). A new class of chelating ligands has been designed based on the traditional terpyridine structural unit, 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 a variety of heavy metals, allows for a structural characterization by spectroscopic techniques. This experimental technique has shown good feasible results thus far prompting further analysis by x-ray crystallography. It is proposed that if the synthesis of affordable metal complexes could be made with a variety of heavy metals and target ligands, then structure crystallography of the complexes could be analyzed for further studies.

Daysi V. Proano

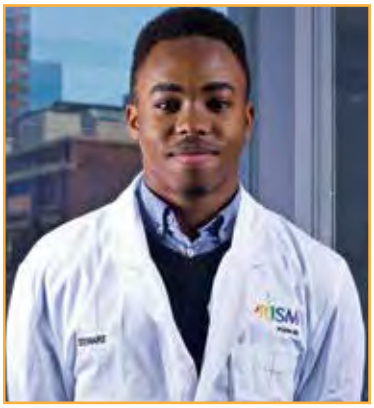
In college, I was fortunate to meet a diverse group of scientists who rekindled my interest in the STEM fields. Studying biology offered me an alternative perspective on how 'things' in the world work. I fell in love with the elegant experimental approaches that can help uncover details behind how the human body interacts with its environment. Research through the PRISM Undergraduate Research Program has not only helped me develop critical thinking skills, but it has also taught me to be more perseverant when presented with challenges. Upon obtaining my bachelor's degree in cell and molecular biology, I plan to pursue a medical degree in dentistry.

The main goal of this project is to determine the role of a protein involved in fungal infections and its response to drug treatment. Understanding the mechanism by which fungus survives could shed light on the development of new anti-fungal drugs and prevent fungal infections in humans.

Association of Transcription Factor Rlm1 in the *Candida albicans* Psk1-Sko1 Signaling Pathway (Dr. Rauceo)

Candida albicans is an opportunistic fungus that resides throughout the human body. The cell wall is critical for maintaining homeostasis, cell shape, and interaction with the environment. Our broad goal is to understand the mechanism of maintaining cell wall integrity upon anti-fungal drug treatment. The protein kinase Psk1 and transcription factor Sko1 maintains survival in response to the drug caspofungin. In order to fully characterize the mechanism of Psk1-Sko1 signaling, we propose to determine the role of transcription factor Rlm1. We previously showed that Rlm1 regulates *Sko1* transcription; however, it is unknown whether Psk1 regulates Rlm1. We hypothesize that Rlm1 is phosphorylated by Psk1 following caspofungin-induced cell wall damage. The goal of this project is to validate the expression of an Rlm1-V5-His6X fusion protein. We developed a cost-effective and rapid protein extraction protocol that involves mixing cells with glass beads and a commercially available detergent. Western blot results show that Rlm1-V5-His6X was sufficiently expressed. In addition, our growth tests validate that the addition of the V5-His6X epitope tag did not affect Rlm1 function. Future experiments will determine if Rml1 is phosphorylated by Psk1.

O'Jay Stewart



I was born and raised on the beautiful island of Jamaica where I became extremely interested in the field of forensic science. My professors and I recognized my passion for medicine, and I decided to embark upon the path towards a medical scientist training program from which I will obtain both PhD and MD degrees. With the training and experience I obtain through the PRISM Undergraduate Research program, I hope to develop and nurture qualities that will enable me to optimally conduct basic scientific and translational research.

My research focuses on the use of pokeweed antiviral protein (PAP) as a potential therapeutic for HIV. I am exploring ways to target this protein to HIV infected cells through modified liposomes.

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

Human Immunodeficiency Virus (HIV) attacks the human immune system destroying the CD4 cells, which aid in combating diseases. 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,* reduces the virulence of HIV and provides a new and promising direction in HIV/AIDS research. The aim of my research is to study the interactions between PAP and a series of lipid molecules, establish favorable conditions for PAP encapsulation into lipid vesicles and investigate the modification of liposomes for targeted drug delivery to HIV infected cells. The lipid composition for the ideal encapsulation of PAP has been determined as a 1/1 mixture of the DOPE and DOTAP lipids. PAP binds to the m7GTP cap of viral RNA with an affinity of 20nm. The affinity of PAP binding with the 5' UTR region of HIV viral RNA as well as the functionality of liposome encapsulated PAP is being examined. Effective targeting of liposomal encapsulated PAP to HIV infected cells can be developed as a therapeutic if promising results are obtained.

Donovan Trinidad

I always had an interest in science and math. While many of my peers dreaded the subjects, I practically ran toward them. I continued to excel in these areas academically at John Jay, but did not immediately go the extra mile. 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 overcame my fear and applied to the PRISM Undergraduate Research Program. I have since been provided with opportunities that have sparked my interest in microbiology, and I hope to obtain my PhD in this field.

The goal of my research is to determine whether we can use bacteria found on a dead body to figure out when a person died. If we can, we will create a model to apply to forensic casework.

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

In this project, we explore 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 phase one 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 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 over the course of several weeks. We extracted DNA from these samples and prepared them for 16S metagenomic sequencing. We analyzed the data collected to highlight candidate taxa that proved most consistent and useful for establishing the PMI for deceased human subjects. Future work includes refining this model, testing it on more cadaver samples, collecting samples from different areas of the cadaver body, and field-testing our model in real forensic casework.

Kevin Urbano Molina

I was born in El Salvador, and when I was 11 my family moved to New York. My love for science grew throughout my high school career at the Manhattan Center for Science and Math. There teachers exposed me to different scientific disciplines. The natural processes that surround our existence captivated me. My research has allowed me to investigate mercury's global cycle, and its effect in the environment. Currently, I am pursuing a bachelor's degree in forensic science, and my future goal is to find a research-related job and later pursue an MD/PhD.

My research project focuses on understanding how mercury, a toxic metal, behaves and changes form when it is exposed to different conditions, like heating and adding light. This work will further our understanding of mercury behavior in soil, helping us identify a mechanism that reduces mercury in the environment.

Mercury Flux from Sand as a Way to Determine the Mechanism of Mercury Reduction in Soil (Dr. Carpi)

Mercury poses a danger to human and ecosystem health because of its toxic properties, its ability to accumulate in biological organisms over their lifetime and its increase in concentration as you move up trophic levels in a food chain. Mercury also has the ability to cycle, or flux, between the surface environment and the atmosphere, which allows mercury to be deposited to and react in soils. It is known that divalent mercury can be reduced to elemental mercury in soil; however, the mechanism by which this occurs is unknown. The purpose of my project is to investigate the reduction of an individual species of divalent mercury to elemental mercury. I will do this by monitoring the flux of elemental mercury from sand samples spiked with divalent mercury, and exposed to different environmental conditions. By looking at the relationship between mercury flux and the experimental conditions the sample was exposed to, the factors that influence mercury reduction in sand will be identified. This will lead us towards a better understanding of the mechanism of mercury reduction in the environment.

Joseph R. Vandenburgh

I am majoring in forensic science with a criminalistics specialization. The great thing about science is that it is always evolving. IBM's first computer (1956) was as big as two refrigerators, stored only 5 MB of information, and cost over $50,000. Now I am writing this biography on a 2 TB computer with a price tag of $1,000. Last century antibiotics were just being created. Now there are cures for many diseases and infections. These are a few examples of how science is constantly changing. Hopefully, one day my research will make an impact because even the smallest impact will matter.

My research explores the use of 3-D animated models to help students better understand complex physical laws that are hard to picture. This work will also help us design future on-field physics experiments.

Modeling Galilean Relativity through 3-D Animation (Dr. Yaverbaum)

Galileo advanced a conjecture about the scope of physical law and the character of motion itself. This conjecture (Galileo, 1632) was presented as understanding that came before observed patterns or induced 'laws'. The conjecture has come to be foundational as intended and is now known as the Principle of Relativity. According to this principle, no statement can be made about the motion of one object without reference or comparison to another: speed, in this understanding, is necessarily a relation between two objects, not a property of one. According to this recognition of the character of motion, it is always possible, to determine how quickly one object is moving relative to the other, but such determination always applies equivalently in both directions. This research takes that core principle and converts it into the virtual world using the Unreal Engine 4. This engine is used to create games and animated videos. In this case, both functions of the engine were used. In this engine, objects can be moved around, and different reference frames can be established. The engine allows the users to focus on a reference frame of one object to be able to get a better understanding of the principles of relativity. Our future experiments will involve physical testing. The engine will provide a way that will help experiment with different methods before taking them out onto the field. The engine also will allow viewers to better understand the experiment.

Veronika Yakovishina

I discovered my love for science when I took my first chemistry course at Queensborough Community College in Queens, NY. I was excited to get the opportunity to be a research intern in a biology lab where I studied a novel technique for the treatment of breast cancer. It was during that time that I realized my passion was science research. This motivated me to continue doing research once I transferred to John Jay in the field of toxicology, which I was always curious about. My time doing research has opened up a new world of opportunities for me and developed my goals for the future. My ultimate goal is to earn a PhD in toxicology.

My project studies the effects of the pesticides maneb and mancozeb on rat cells. By studying the response of cells to these toxins, we can understand the potential link between pesticides and the development of neurodegenerative disorders such as Parkinson's disease.

Delineating the Signaling Pathways Involved in Maneb and Mancozeb Induced Cytotoxicity in PC12 Cells (Dr. Cheng)

The widespread use of toxic compounds in agriculture poses a threat to the well-being of the general public. Fungicides such as maneb (MB) and mancozeb (MZ) are widely used and shown to potentiate parkinsonian toxin toxicity. Preliminary data from our lab showed that MB/MZ can prevent cells from progressing to S phase, causing early cell aging and cell cycle arrest. This phenomenon contributes to the development of debilitating neurodegenerative disorders such as Parkinson's and Alzheimer's diseases, which affect millions of people in the United States. Understanding the toxic mechanism of MB/MZ is crucial. The p53/p21-signaling pathway plays an important role in cell cycle regulation. Our data showed the activation of p53/p21 and the translocation of activated p21 to nuclei in rat pheochromocytoma (PC12) cells treated with MB and MZ for 24 hours. Activated p21 has been shown to involve in cell cycle arrest, which has been observed in PC12 cells treated with MB and MZ. PI3K/Akt (Phosphatidylinositol 3-Kinase/Protein Kinase B) can decrease p21 activity by phosphorylation. Further experiments will need to be done in order to explicate the interplay of PI3K/Akt/p21 in response to MB/MZ.

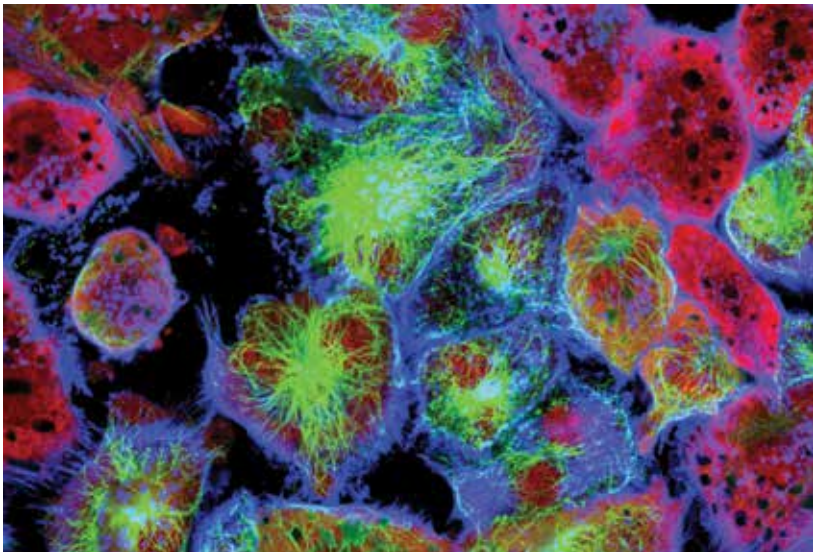
Owen Zacarias

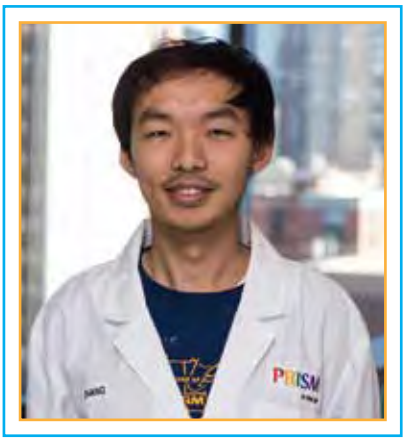
I have taken great interest in scientific research because of my curiosity and desire to learn about drugs and their involvement in the body. I first thought I would love to work for the FBI or DEA but I have gained valuable insight about graduate school, and I envision myself pursuing a master's or a PhD degree. I believe that researchers are the future for any advancement in science and with all our combined endeavors we can make great contributions to our society.

Our research explores the effects of two anti-cancer drugs. Both drugs work by making small changes to the genetic make-up of cancer cells. These subtle changes cause cells to be killed more efficiently, and we are trying to figure out why in order to find better anti-cancer drugs.

Synthesis of β-Monoadducts Using Oligonucleotides (Dr. Champeil)

The drug Mitomycin C (MC) is currently used to treat stomach, anal, and lung cancer. In the presence of DNA, it is known to form one stereoisomeric interstrand crosslink (ICL) known as α-ICL. Another drug, 10-decarbamoyl Mitomycin C has been found to form the same adduct as MC in the presence as DNA as well as a second stereoisomeric adduct known as β-ICL. DMC has been found to induce apoptosis more efficiently than MC, and we believe that the different biochemical responses exhibited by the two drugs are due to the opposite stereochemistry of the α- and β-ICLs. Our work aims to develop an efficient method of producing the β adduct and to determine the cell death pathway triggered by the α- and β-ICLs.





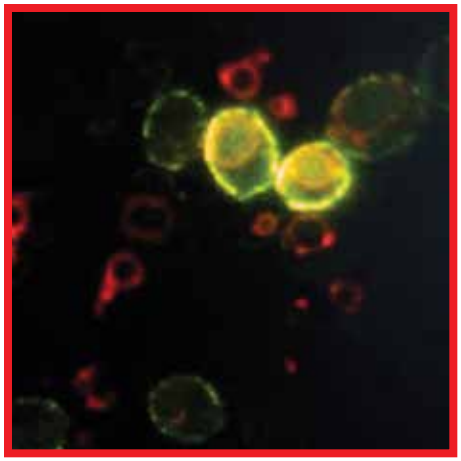
Yuan Zhuo Zhang

I developed an interest in forensic science at a young age, when I watched a series of TV shows related to the subject. After I earned my associate degree in science for forensics from Kingsborough Community College in Brooklyn, NY, I continued my studies as a forensic science major in the toxicology track at John Jay. As a student who graduated from the CUNY Justice Academy, I had the opportunity to get involved with the PRISM Undergraduate Research Program and continue doing research.

Some chemical reactions involved in industrial processes involve the of use metals as catalysts. These 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.

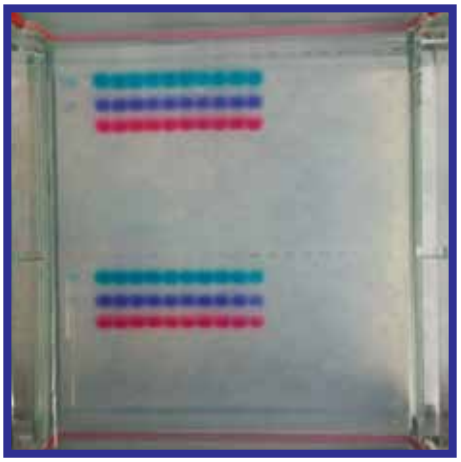
Green Catalytic Oxidations Using Multinuclear Non-Precious Metal Complexes (Dr. Zhang)

Multimetallic complexes are attractive catalyst candidates for a variety of organic reactions, and in particular tetranuclear copper complexes have proven to be efficient in the catalytic oxidation of alcohols. 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. The X-ray crystallography results showed that the copper complexes polymerize. Meanwhile, another copper complex made by a di-aldehyde was synthesized and under testing. We aim to design new multimetallic complexes based on non-precious metals, especially copper, to carry out the catalytic aerobic oxidation 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.



"I am hungry for knowledge and cannot wait to delve into the world of criminalistics."

– Marissa Cofane (page 11)

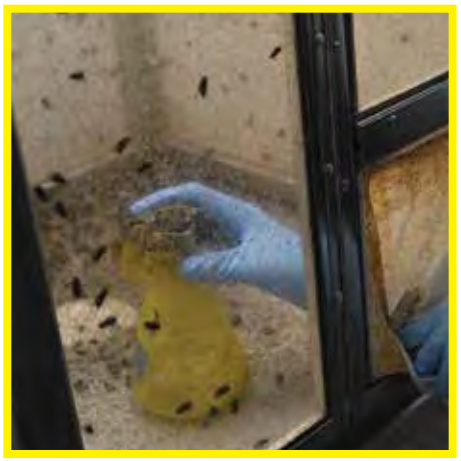


"I never pictured myself doing research, but it has been extremely rewarding thus far."

– Joseph A. Fragale Jr. (page 16)

"I enjoy the forensic science program because of the hands-on approach used to train students."

– Zenab Khan (page 18)



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

Aitbakieva*, V. R., & Domashevskiy, A. V. (2016). Comparison of Enzymatic Activities of Pokeweed Antiviral Protein (PAP) Isoforms toward RNA from the Tobacco Etch Virus. *The FASEB Journal, 30(1 Supplement),* 1083-12.

Champeil, E., Cheng, S. Y., Huang*, B. T., Conchero-Guisan, M., Martinez, T., Paz, M. M., & Sapse, A. M. (2016). Synthesis of Mitomycin C and Decarbamoylmitomycin C N 2 deoxyguanosine-adducts. *Bioorganic chemistry,* 65, 90-99.

Cheng, S. Y., Seo*, J., Huang*, B. T., Napolitano*, T., & Champeil, E. (2016). Mitomycin C and decarbamoyl mitomycin C induce p53-independent p21WAF1/CIP1 activation. *International Journal of Oncology,* 49(5), 1815-1824.

Domashevskiy, A. V., Rodriguez*, D. J., Gunawardana, D., & Goss, D. J. (2016). Preparation of Functional, Fluorescently Labeled mRNA Capped with Anthraniloyl-m 7 GpppG. *Synthetic mRNA: Production, Introduction Into Cells, and Physiological Consequences,* 61-75.

Li, L., Zhang*, Y. Z., Liu, E., Yang, C., Golen, J. A., Rheingold, A. L., & Zhang, G. (2016). Synthesis and structural characterization of zinc (II) and cobalt (II) complexes based on multidentate hydrazone ligands. *Journal of Molecular Structure,* 1110, 180-184.

Li, L., Zhang*, Y. Z., Yang, C., Liu, E., Golen, J. A., & Zhang, G. (2016). One-dimensional copper (II) coordination polymers built on 4'-substituted 4, 2': 6', 4"-and 3, 2': 6', 3"-terpyridines: Syntheses, structures and catalytic properties. *Polyhedron*, 105, 115-122.

Piszczatowski*, R. T., & Lents, N. H. (2016). Regulation of the CCN genes by vitamin D: A possible adjuvant therapy in the treatment of cancer and fibrosis. *Cellular Signalling,* 28(10), 1604-1613.

Piszczatowski*, R. T., Rafferty, B. J., Rozado*, A., Parziale*, J. V., & Lents, N. H. (2015). Myeloid Zinc Finger 1 (MZF-1) Regulates Expression of the CCN2/CTGF and CCN3/NOV Genes in the Hematopoietic Compartment. *Journal of Cellular Physiology,* 230(11), 2634-2639.

Presentations

2015 Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA

Aguilar*, W., Champeil, E. "Correlation of Mc and Dmc-Adducts Structures with the Role of P21 in the Toxicity of the α-icl and β-ic," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

De Los Santos*, S., Domashevskiy, A. "Analysis of the Effects of Turnip Mosaic Virus Protein-Linked Genome on Ricin a Chain Depurination of Eukaryotic Ribosomal RNA," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Duran*, L., Delgado-Cruzata, L. "Studying the Loss of DNA Methyltransferase DNMT1 in BRCA1 Expression in Breast Cancer," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Fernandez*, P., Chen, P., Han, C., Sagen, J. "Behavior Expression Profile of alpha-Conotoxin PeI A in Chronic Constriction Injury Model in Rats" Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Hargett*, I., Delgado-Cruzata, L. "Understanding the Role of TET Proteins in 5-Hydroxymethylation in Hepatocellular Carcinoma," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Klafehn*, E., Corthals, A. "2D to 3D Rending of Bones Samples from *Sus scrofa*," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Peralta*, R., Carpi, A. "Using Moss as a Biomonitor to Detect Atmospheric Sources of Mercury," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Proano*, R., O'Dricoll, E., Frietze, K., Boulanger, L. "Characterizing MHCI cytoplasmic domain phosphorylation *in vitro* and its role in binding interactions," Annual

Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Rodriguez*, D., Domashevskiy, A. "Synthesis of Fluorescently-Labeled Tobacco Etch Virus (TEV) RNA and its Interactions with Pokeweed Antiviral Protein (PAP)," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Rodriguez*, R., Salcedo*, E., Rauceo, J. "Localization Analysis of a Major Osmotic Stress Response Gene in the Fungus Candida *albicans*," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Rouse*, D., Carpi, A. "The Reduction Mechanism of Mercuric Oxide in the Environment," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Seo*, J., Wagner, N., D'Souza, V. "The Effects of Upstream Nucleotides on the Readthrough Rate of VEGF-Ax," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Shillingford*, S., Luca, O., Blackmond, D. "The Oxidation of Allylic Alcohols to Ketones with the use of Electrochemistry," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Trinidad*, D., Lents, N., Guzman*, S., Parziale*, J., Lerer*, A. "Analysis of the Human Microbiome on Living and Decomposing Bodies," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

Zhang*, Y., Zhang, G. "Diverse Copper(ii) Complexes with Simple Nitrogen Ligands: Structural Characterization and Applications in Aerobic Alcohol Oxidations in Water," Annual Biomedical Research Conference for Minority Students (ABRCMS), Seattle, WA; November 11-14, 2015.

2016 Collegiate Science and Technology Entry Programs Conference, Lake George, NY

Aguilar*, W., Champeil, E. "Synthesis of α- and β-monoadducts," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Duran*, L., Delgado-Cruzata, L. "Studying the Loss of DNA Methyltransferase DNMT1 in BRCA1 Expression in Breast Cancer," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Fernandez*, P., Chen, P., Han, C., Sagen, J. "Behavior Expression Profile of alpha-Conotoxin PeI A in Chronic Constriction Injury Model in Rats," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Klafehn*, E., Corthals, A. "2D to 3D Rending of Bones Samples from *Sus scrofa*," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Mercado*, A., Delgado-Cruzata, L. "Studying the Inhibition of TET Proteins in Liver Cancer Cells," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Stewart*, O., Domashevskiy, A. "Biophysical studies of Liposomal Pokeweek Antiviral Protein for HIV Therapeutics," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

Peralta*, R., Mann, E., Carpi, A. (2016) "Using Moss as a Biomonitor to Detect Atmospheric Sources of Mercury," Collegiate Science & Technology Entry Program (CSTEP) Statewide Student Conference, Lake George, NY, April 9, 2016.

2016 Society of Toxicology Annual Conference, New Orleans, LA

Metodieva, M., Simone, N., Seo*, J., Ta*, C., and Cheng, S.Y. "Maneb and Mancozeb Induce Senescence via p53, p27 and p15/16 Pathways" 55th Society of Toxicology

continued

***Denotes PRISM student or alumnus.**

Annual Meeting, New Orleans, LA, March 13-17, 2016

Seo*, J., Huang*, B.T., Cheng. S.Y., and Champeil, E. "p53-independent Activation of p21 in Response to Mitomycin C and Decarbamoyl Mitomycin C" 55th Society of Toxicology Annual Meeting, New Orleans, LA, March 13-17, 2016

2016 Experimental Biology, San Diego, CA

Aitbakieva*, V., Domashevskiy, A.V. Comparison of Enzymatic Activities of Pokeweed Antiviral Protein (PAP) Isoforms toward RNA from Tobacco Etch Virus. *Experimental Biology: FASEB J.* 30:1083.12, San Diego, CA, April 2016.

De Los Santos*, S., Domashevskiy, A.V. Examination of Turnip Mosaic Virus Genome-Linked Protein (VPg) as an Effective Novel Inhibitor of Ricin A Chain (RTA). *Experimental Biology: FASEB J.* 30:607.7, San Diego, CA, April 2016.

Rodriguez*, D., Domashevskiy, A.V. Interactions of a Fluorescently-Labeled Tobacco Mosaic Virus (TMV) RNA with Pokeweed Antiviral Protein (PAP). *Experimental Biology: FASEB J.* 30:591.1, San Diego, CA, April 2016.

Other Conferences Attended

Hargett*, I., Delgado-Cruzata, L. "Perceived Educational Barriers and Persistence of Minority Women in a STEM Major at John Jay College," 29th National Conference on Undergraduate Research, Spokane, WA; April 16-18, 2015.

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. "StereoJchemical Determination of Methamidophos and Ruelene, Organophosphorus Compounds," 250th ACS National Meeting

Sanchez *, K., Klempner, S., Li, R. "Developing an Enzymatic Processing Method for the Forensic DNA Analysis of Bone Specimens," Women in Physical Sciences 2015, Lincoln, NE, October 15-17, 2015.

Klafehn, E. "Post Mortem Analysis of the Histomorphology of Trauma and 2D to 3D Rendering of Bone Samples from *Sus Scrofa*," 2015 Binghamton Research Symposium & Graduate School Application Retreat, Binghamton, NY, October 17, 2015

He, Y., Lopez*, K, Wong*, T., McNamara*, C., Swenson, S. "Integrating Research into Instrumental Analysis Curriculum: Investigation of Environmental Pollutants in Hudson River", Environmental Consortium of Colleges & Universities, November 7, 2015.

Cofane*, M., Diaczuk, P. "Examination of Wall Surfaces for Traces of Blood," ACSR 26th Annual Training Conference, Clark, NJ; February 9-11, 2016.

Hargett*, I., Delgado-Cruzata, L. "Understanding the Role of TET Proteins on 5-Hydroxymethylation in Hepatocellular Carcinoma," CUNY/SUNY Annual Exploration & Observation: Undergraduate Student Research & Creative Activities, Albany, NY; February 24th, 2016.

Wong*, T., McNamara, C*., He, Y., Swenson, S. "Development of Interactive Learning Modules Used in Teaching Instrumental Analysis," Pittcon 2016, Atlanta, GA; March 6-10, 2016.

He, Y., Green, C., Chaney, R., Tan*, F., Ye, H., Mei*, V., Kurti, M., Lampe, K. V. "Elemental Profile of Tobacco Used in Counterfeit Cigarettes", Pittcon 2016, Atlanta, GA;

March 6-10, 2016.

Lopez*, K., He, Y., Swenson, S. "Determination of Cadmium in Environmental Water Samples Collected in Superfund Sites in New York City," Pittcon 2016, Atlanta, GA; March 6-10, 2016.

Mann, E., Khusial*, R. Carpi, A. "A mechanistic investigation of the reduction and volatilisation of mercury in soil," 250th Annual Meeting of the American Chemical Society, San Diego, CA, March 15, 2016.

Khan Z*, Lents NH. "Generating a Systematic Model to Approximate Time of Death by Examination of Taxonomic Differences Over Time in the Human Microbiome of Decomposing Bodies," 6th Annual Forensic Science Student Research Exchange, Cedar Crest College, Allen Town, PA. April 9th, 2016

Trinidad DD*, Lents NH. "Using the Human Necromicrobiome to Estimate the Postmortem Interval," 6th Annual Forensic Science Student Research Exchange, Cedar Crest College, Allen Town, PA. April 9th, 2016.

Duran*, L., Delgado-Cruzata, L., "Knockdown of DNA Methyltransferase 1, DNMT1, causes suppression of BRCA1 Expression in Breast Cancer Cells", Eleventh Annual Student Caucus and Poster Presentation, American Association for Cancer Research Annual Meeting, New Orleans, LA; April 15-20, 2016.

Hargett*, I., Delgado-Cruzata, L. "Understanding the Role of TET Proteins on 5-Hydroxymethylation in Hepatocellular Carcinoma," 11th Annual Student Caucus and Poster Presentation, American Association for Cancer Research Annual Meeting, New Orleans, LA; April 15-20, 2016.

Mercado*, A. Hargett*, I., Delgado-Cruzata, L. "Studying the inhibition of TET proteins in liver cancer cells," Eleventh Annual Student Caucus and Poster Presentation, American Association for Cancer Research Annual Meeting, New Orleans, LA; April 15-20, 2016.

Rodriguez*, R., Conrad* K.C., Salcedo*, E.C., Rauceo, J.M. "Analysis of Orf19.7296p in the Candida albicans Osmotic Stress Response," 2016 American Society for Microbiology (ASM) Microbe Conference Boston, MA; June 16-20, 2016.

Trinidad DD*, Lents NH, Guzman S*, Parziale JV*, Lerer A*. "Using the Human Necromicrobiome to Estimate the Postmortem Interval. ASM/ICAAC Microbe 2016. Boston, MA. 17-June 2016.

Presentations about the Program

Ronan, D., Carpi, A. "Undergraduate Research Experience and Changes in Career Ambitions for Underrepresented Students in STEM," Annual Meeting of the National Association for Research in Science Teaching, Baltimore, MD, April 17, 2016.

Carpi, A., Ronan, D. (2016) "Creating Minority Scientists: How Undergraduate Research Drives Changes in Career Ambitions for Students Underrepresented in STEM Disciplines," 8th Conference on Understanding Interventions that Broaden Participation in Science Careers, Philadelphia, PA, February 27, 2016.

***Denotes PRISM student or alumnus.**

2017 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 70 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.

2017 PRISM Keynote Speaker: Dr. Christopher E. Pedigo

Dr. Christopher E. Pedigo earned a bachelor of science degree in forensic science from John Jay College in 2009. As a PRISM student, Dr. Pedigo specialized in molecular biology and worked with his mentor, Dr. Yi He. Their work studying gastric fluid mediated arsenic speciation using inductively coupled plasma mass spectrometry resulted in a presentation at the Eastern Analytical Symposium and a publication in the Journal of Environmental Science and Health.

After completing his degree, Dr. Pedigo served as an adjunct instructor at John Jay for quantitative analysis and modern biology courses. He also worked as a tutor in the Math and Science Resource Center and as a laboratory technician in the Department of Sciences. During all these years at John Jay, he worked weekends as a bartender to help finance his college tuition.

In May of 2016, Dr. Pedigo earned his doctorate in molecular and cellular pharmacology from the University of Miami's Miller School of Medicine. There he worked in under the guidance of Dr. Alessia Fornoni and Dr. Sandra Merscher, studying novel mechanisms of kidney disease.

A recipient of numerous travel grants, Dr. Pedigo has attended conferences in San Diego, Chicago, Helsinki (Finland) and Pisa (Italy). He is the recipient of an American Heart Association Pre-Doctoral Fellowship and has several academic publications, including a first author article in the Journal of Clinical Investigation.

Dr. Pedigo is currently working as a postdoctoral fellow at the Yale School of Medicine under the mentorship of Dr. Shuta Ishibe. In this position, Dr. Pedigo studies genetic susceptibilities leading to kidney disease in populations of African ancestry.

During his presentation, Dr. Pedigo will talk about this very important work, and will share some of the experiences that helped shape his career path.

2017 PRISM Outstanding Undergraduate Researcher: Ronal Peralta

This year Mr. Ronal Peralta 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.

Ronal joined PRISM in the summer of 2014 under the mentorship of Dr. Anthony Carpi. His project focuses on how moss can be used to monitor the presence of mercury, a neurotoxic metal, in the environment. In his nomination letter, Dr. Carpi wrote that Ronal "is always excited to learn new things about our work, and science in general; and he displays the kind of inquiring mind that will help him excel as a scientist. Ronal has also become much more confident in the lab, he has truly become an independent worker able to take on new tasks and comfortable mentoring less experienced lab members through experiments and data processing."

Ronal's work focuses on testing the use of moss to monitor mercury, a toxic metal, in air. Because it has the ability to absorb ions directly from the air, moss could provide a less expensive way to find mercury contamination sources. Moss samples were placed at three sites around a sewage sludge incinerator in New Haven, CT, exposing the samples to ambient conditions for three weeks in July of 2015 and 2016. After this time, samples were analyzed and the patterns of mercury accumulation in the samples were compared with the distance from local sources. The results suggest that this method is sensitive enough to reveal patterns in atmospheric mercury pollution even in a complex urban environment.

Ronal applied this year to various PhD programs in biomedical sciences to fulfill his career goal to be an independent scientist. He selected the Interdisciplinary Biomedical Graduate Program at University of Pittsburgh School of Medicine, where he will begin this fall.

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 submits a nomination letter that is not only impressive but also heartfelt, showcasing the close working relationship between mentor and student.

Dr. Nadya Morales-Cummings (BASF), Dr. Kwame Osei-Sarfo (Innovimmune Biotherapeutics) and Dr. Mary Ann Pohl (Tri-Institutional Therapeutics Discovery Institute) formed this year's selection committee.

Pictures from the 2016 PRISM Undergraduate Research Symposium, May 4th, 2016.
Top row: PRISM Graduating class of 2016 and Dr. Anthony Carpi.

Former PRISM Symposium Speakers and Outstanding Undergraduate Researcher Award Recipients

2016
Keynote: Anastasiya Yermakova, PhD (University at Albany's School of Public Health)
John Jay Class of 2008
Award Recipient: David Rodriguez, currently at BASF

2015
Keynote: Daniel Cocris, D.M.D (Rutgers School of Dental Medicine)
John Jay 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 Class of 2007
Award Recipient: Eugenia Salcedo, currently at University of CA-San Francisco

2013
Keynote: Lisa DeWald, PhD (Stony Brook University)
John Jay Class of 2004
Award Recipient: Anna Stoll, currently at Michigan State University

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

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

2010
Keynote: Julie Layshock, PhD (Oregon State University)
John Jay Class of 2005
Award Recipient: Jason Quiñones, PhD, currently at SUNY Downstate Medical Center

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

2008
Keynote: Marcel Roberts, PhD (Boston College)
John Jay 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.

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.

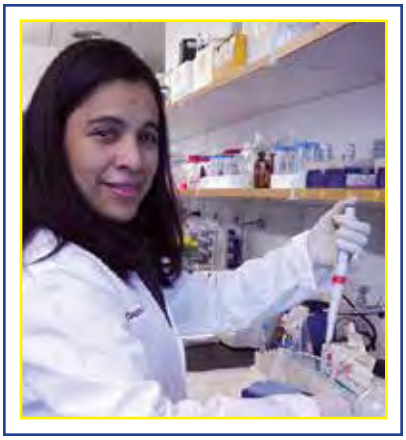
My main research interests focuses on alternative biological matrices to detect drug exposure to cannabis and to novel psychoactive substances (NPS), and wastewater drug analysis. The alternative samples that we study are oral fluid, dried blood spots and hair. Among the heterogeneous and emerging group 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.

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.

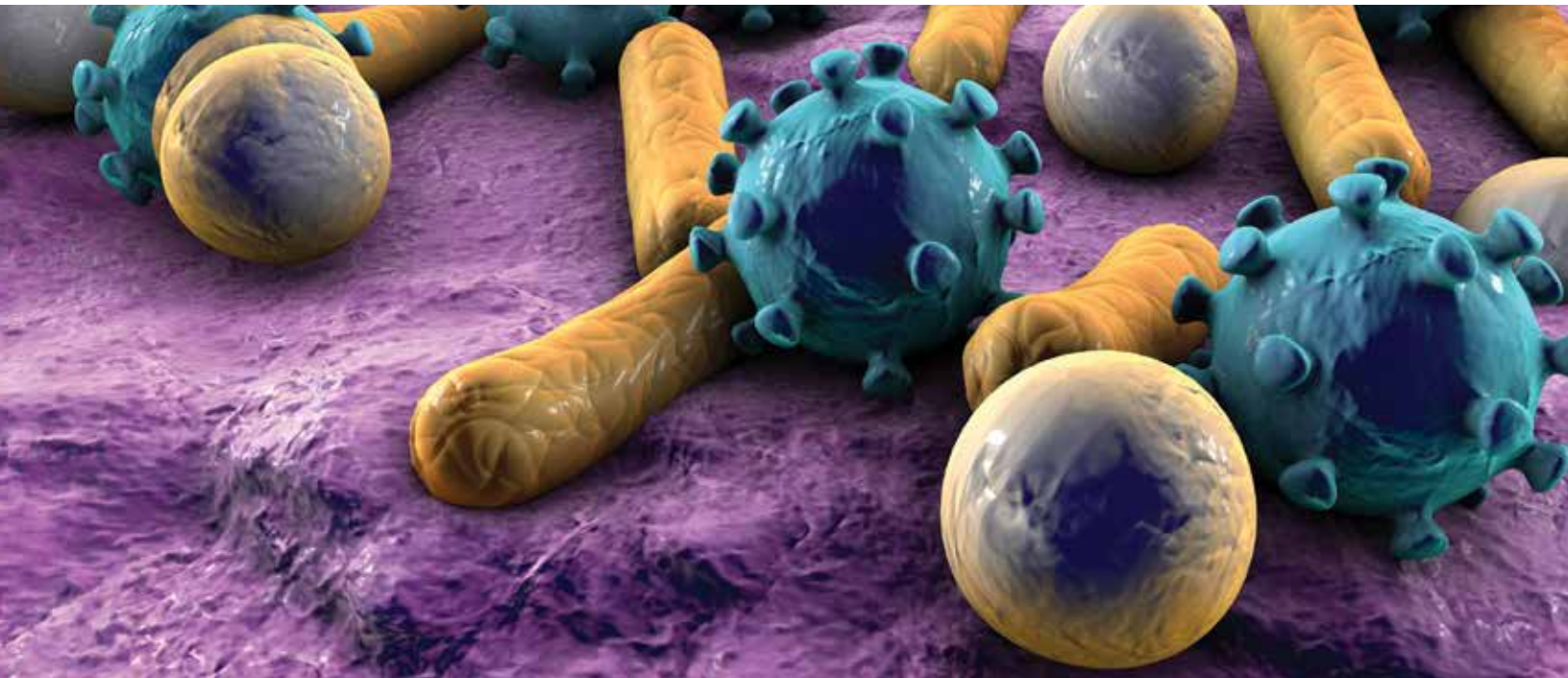
Nathan Lents, PhD

(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 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).

Mechthild Prinz (University of Ulm)

Associate Professor

Areas of Expertise: Forensic biology, forensic genetics

My interest in science started with an application in mind: I wanted to work towards environmental protection and wrote my master's thesis on bio indicators for air pollution. It was a coincidence that brought me to an institute of legal medicine where I discovered another applied science: forensic of DNA analysis. "DNA fingerprinting," as it was called back then, immediately captured my attention, and I haven't been bored since. After many years of casework and research in forensic biology crime laboratories in Germany and the US, I am happy to be teaching and interacting with students in an academic setting. I continue to work on minimal traces of DNA and pursue research establishing optimal crime scene collection protocols, improved individualization, and advanced interpretation modes on relevance and statistical significance. I am also interested in other aspects of forensic biology, such a body fluid identification.

As a mentor I make myself available to meet with students and share my knowledge. With most of my projects students can expect to get challenged and be involved in collating background information and establishing protocols. My research group meets regularly and members support each other in all aspects of the work.

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.

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

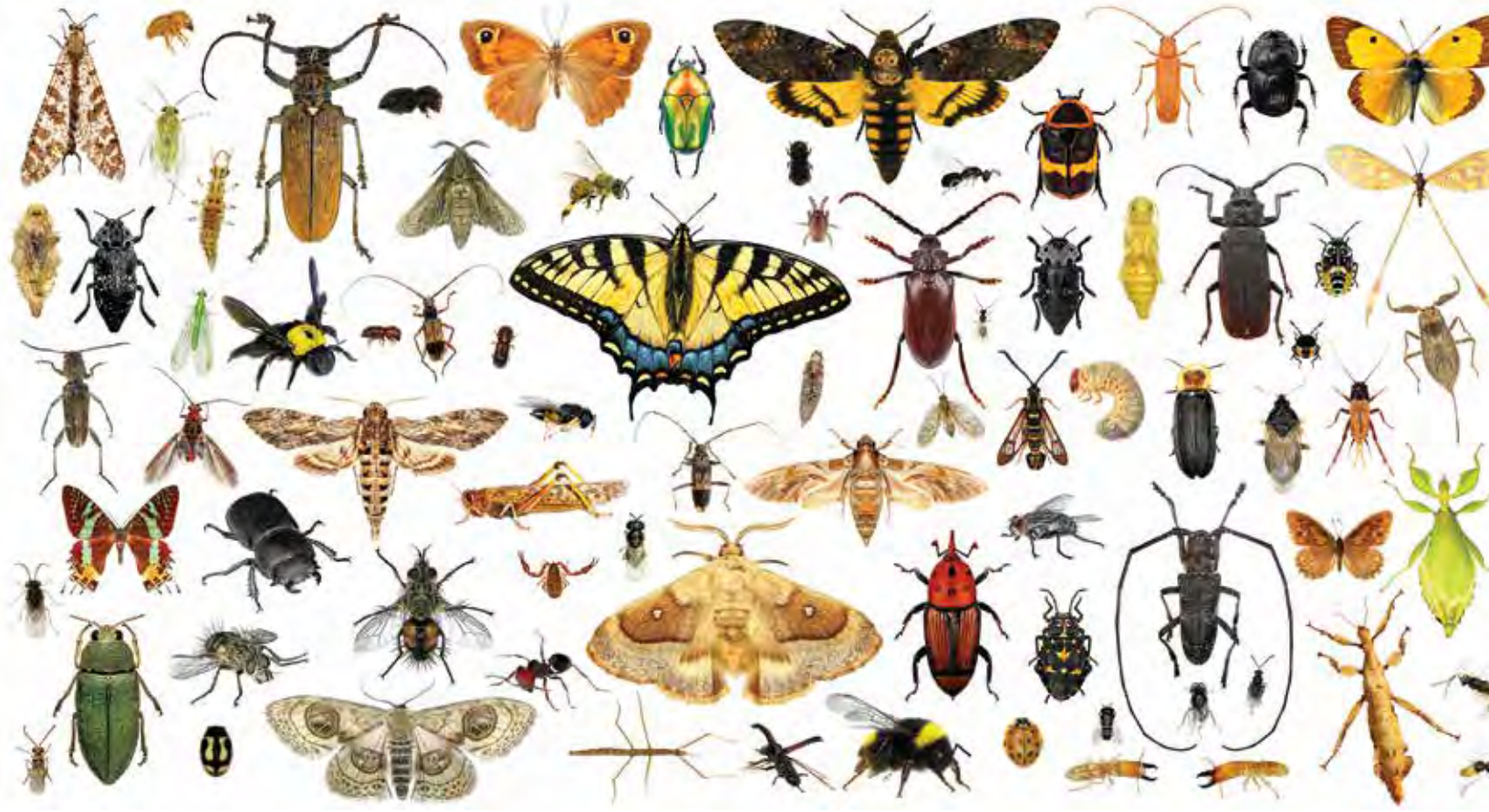
Areas of Expertise: Forensic entomology, biology, entomology, ecology, entomotoxicology, insect behaviour

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.



Linda Chiu Rourke, MS, D-ABC

(John Jay College)

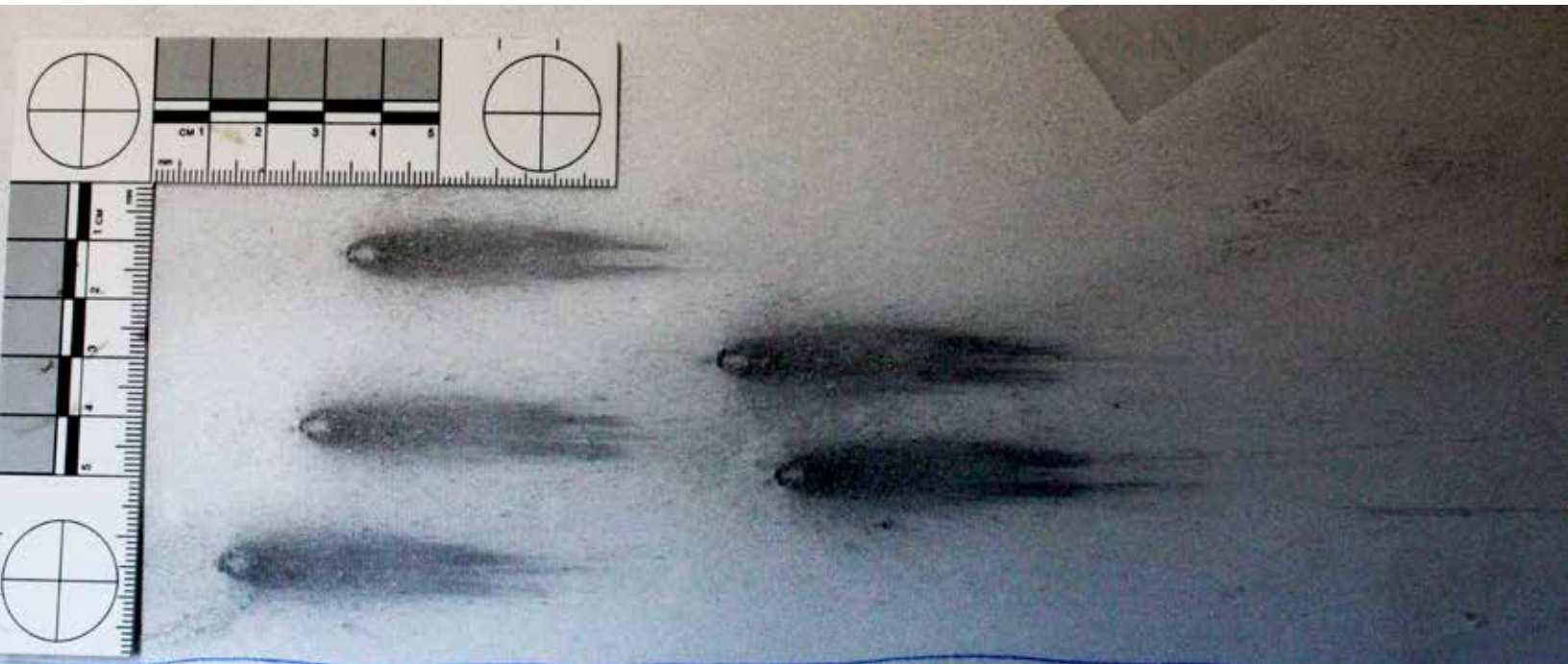
Lecturer

Areas of Expertise: Criminalistics

As a kid, I always did well in math and science classes and had excellent academic experiences at Stuyvesant High School, The Cooper Union and The University of Pennsylvania. I studied science because I did well in this discipline, but after earning a bachelor's degree in biochemistry, I still did not have any idea what I wanted to do with my life. I did not even know about forensic science until a friend gave me a book that described physical evidence analysis in death investigations. Learning that I could use science to help solve crimes changed my life, and so I began my graduate studies at John Jay College.

It was here that I developed my problem-solving abilities in under the guidance of Dr. Peter De Forest. My first semester in graduate school, I joined a research group studying all aspects of gunshot residue analysis. Throughout graduate school, I also worked on projects involving soil analysis, mitochondrial DNA analysis, and biogeographical ancestry. I also began working with Dr. De Forest on forensic cases, which was an important complement to my academic education.

I have mentored students researching familial DNA analysis, presumptive blood testing methods, optical crystallography of triacetone triperoxide, blood ethanol concentration in stored blood samples, trigonometric analysis of bullet ricochet marks, glass fractures from projectile impacts, and various technical applications in forensic molecular biology. In the past year, I have also mentored several honors students through their capstone projects. Given this wide variety of physical evidence research, my main goal is to help students develop their problem-solving skills. I believe that this approach to mentoring helps students develop critical thinking skills that benefit them in all aspects of life.



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

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John Jay's Dean of Research

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

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.

PRISM was founded on the principles of excellence and equity. The Program provides hands on research and career development training that encourage the diverse population of STEM students at John Jay to pursue PhD and other graduate degrees. An outgrowth of a smaller undergraduate research initiative funded by the New York State Education Department's CSTEP program, PRISM has expanded considerably over the years. CSTEP funding was critical to first establishing undergraduate research as an important component within John Jay's Department of Sciences. Funding from the US Department of Education, the National Science Foundation, and New York Education Department fueled the growth and extensive success of the initiative.

PRISM's success can be measured in a number of ways. From just a handful of students participating in its early years, the Program now engages more than 40 students in mentored research each year. More than 200 students have participated in mentored research since PRISM's inception. Our newest program, the PRISM Junior Scholars Program offers academic assistance and stipends to an additional 60+ science students per year. Most significantly, PRISM has directly contributed to the matriculation of more than 70 students in professional degree programs in STEM, science education, and health. PRISM graduates now work around the country as senior scientists in government laboratories, professors and science educators in academia, and professionals in industry and healthcare, among other careers.

For more information, contact us at **PRISM@jjay.cuny.edu**
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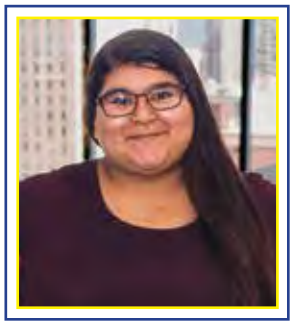

Erica Klafehn
PRISM Academic Advisor

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PROGRAM FOR RESEARCH INITIATIVES IN SCIENCE AND MATH

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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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