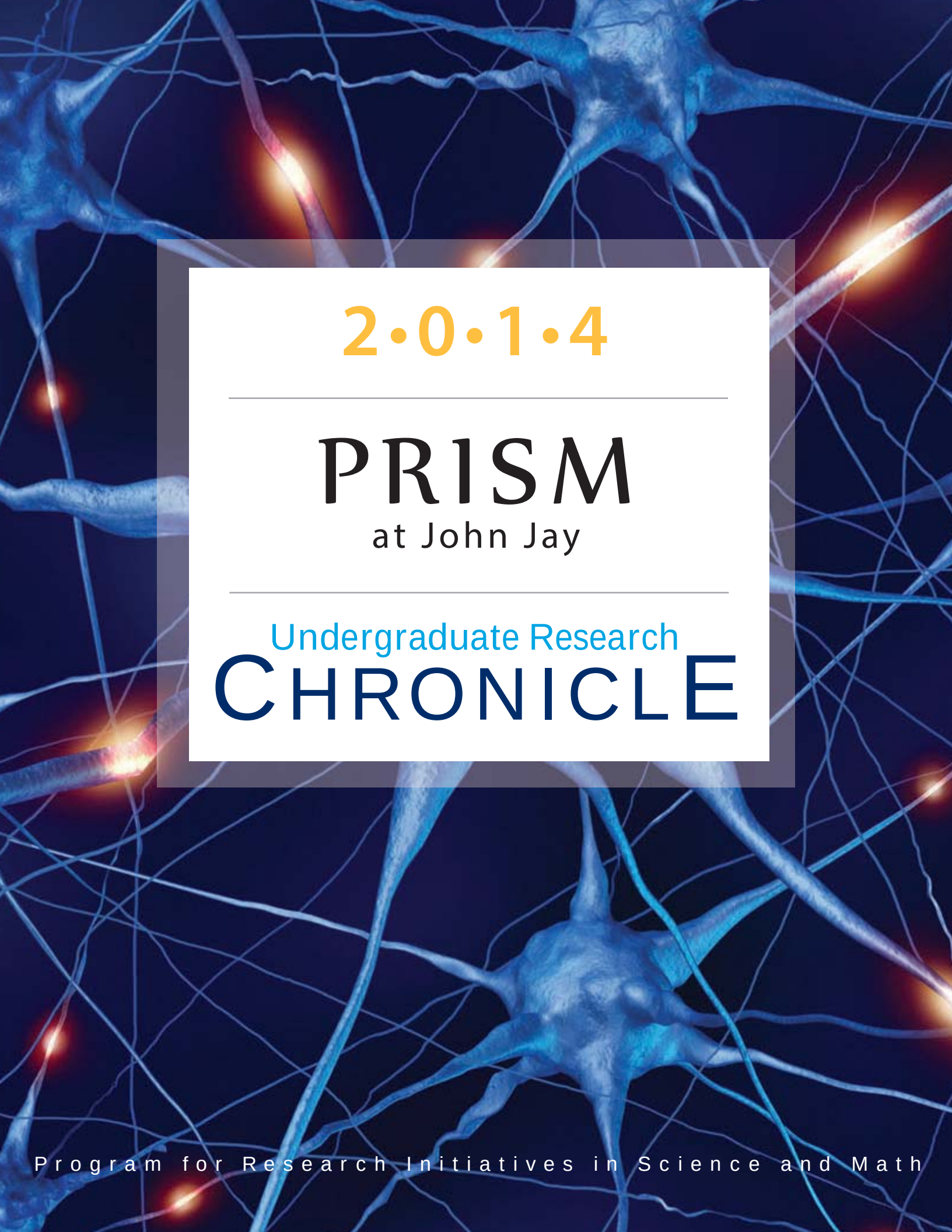

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PRISM
at John Jay

Undergraduate Research
CHRONICLE

Program for Research Initiatives in Science and Math

the element of surprise

Successful scientific inquiry is sometimes predicated by a clear set of expectations, but often there is an element of surprise involved in a new discovery. And it is that surprise that may lead us to understand something new about the universe. Just as in our laboratory work, there is a wonderful element of surprise in our work with PRISM. And this element comes in the form of the rich diversity and enormous success of our students.

Who would have expected that our students would be exploring research in areas as diverse as bacterial strains in probiotic food products, social media interactions, DNA extraction of the human microbiome, and deposition of gun residue in rain and fog? Or that so many of our students, who hail from all walks of life, would be moving on from John Jay to institutions like Stony Brook University, the Scripps Research Institute, George Washington University, and other top-tier universities? And if one had to define a set of expectations in advance, they probably would never have expected that 28% of our students would be co-authors on publications while the published literature suggest only an average of 10% for similar programs; or that 38% of our students would be presenting their work at major national research conferences when the literature suggests that <20% is more common.

So congratulations to all of you who continue to surprise, and amaze, us with your incredible successes - you are the essential element to our program's success.

~ Dr. Anthony Carpi

Undergraduate Researchers

Chantal Adlam

My mission to help improve health disparities worldwide one step at a time has taken me atop mountains, up trickling streams, in heavily forested woods and amongst the red rocks. I wish to help mitigate health incongruities that fall along ethnic, socioeconomic and national lines. In addition, I hope to also raise awareness within the medicinal chemistry arena about the relative merits of the use of plant resources as an more affordable alternative to medications by individuals in developing regions of the world.

The Photo-reduction of Soil-bound Mercury in the Presence of Water (Dr. Carpi)

Soil-bound mercury undergoes a cycle of redox reactions resulting in its emission and distribution in the environment. The presence of water has been shown to affect this process; however, the mechanisms of this interaction are unknown and several research hypotheses do not fully explain the behavior of the metal. Inorganic salts of mercury are easily hydrated to form complex ions such as HgClOH and $Hg(OH)_2$; however, these transformations have not been effectively examined. We hypothesize that chemical mechanisms may be in part responsible for the enhanced release of mercury from soils following the addition of water. To better understand this phenomenon, we examined the chemistry of the hydrated mercuric specie $Hg(OH)_2$, using Gaussian® molecular modeling software. Single point energy calculations showed that the symmetrical and the one-sided hydroxyl stretches of Hg(OH)2 required approximately 153.576074 Kcal/mol and 113.4356021 Kcal/mol of energy in order to remove the hydroxyl groups respectively. DFT calculations of the bond energies revealed that the levels of UV radiation penetrating the atmosphere do not seem to play a direct role in the conversion of Hg(OH)2 to Hg^0. Theoretically, these results suggest that the emission of Hg^0 from a sample containing solely mercury hydroxide, upon exposure to UV radiation, does not dissociate via the pathways examined under normal environmental conditions. Current work focuses on manipulating the bond angles and length of HgClOH and $[HgCl(OH)_2]^-$ to establish their ground state configurations, to locate transition states associated with the energy changes and to determine their dissociation pathways.

Valentina Aitbakieva

I am a born and raised Russian native. Before I came to the United States, I attended the University of Cinema and Television in Sankt-Petersburg with a major in electrical engineering. During my first few years living in America, I mostly dedicated my time to exploring American culture. I cannot remember how and when I became interested in science, but now I can certainly see that to be my future career path. Science is an open field, and molecular biology seems to be the most plausible opportunity for me to enjoy myself and make a difference. As of now, I am unsure of a specific career I wish to pursue, but I am confident that my participation in PRISM will lay the foundation for making that decision.

Isolation, Purification and Characterization of Pokeweed Antiviral Protein (PAP) Isoforms, and Comparison of Their Enzymatic Activities Towards the Tobacco Etch Virus (RNA) (Dr. Domashevskiy)

Ribosome-inactivating proteins (RIPs) are found in a wide range of plants. Their antiviral, antibacterial, and antifungal biological activities indicate that RIPs are major contributors to the plant's defense mechanisms. RIPs are N-glycosidases. They recognize, bind to, and depurinate the university conserved sarcin/ricin (S/R) loop of large rRNA, inactivating the ribosome and halting protein synthesis. In addition, some RIPs inhibit translation of viral RNA by directly binding to the RNA, thus preventing the viral infection. *Phytolacca americana*, known as common pokeweed, produces pokeweed antiviral protein (PAP), a type 1 RIP, which is less toxic toward eukaryotic cells in comparison with type 2 RIPs (such as ricin). PAP has nine distinct isoforms, which develop in different parts of the plant throughout its lifetime. Several isoforms have been shown to exhibit stronger enzymatic activity than others. However, the exact mechanism of how PAP selects its viral RNA substrates is unknown, and is of interest in this study. The essence of this project is to isolate and to characterize PAP isoforms and compare their enzymatic activities towards the tobacco etch virus (RNA), which in the future may play a fundamental role in understanding the PAP's mechanism and its antiviral activity. Understanding of PAP's selectivity for targeting RNA substrates may establish several applications in the biomedical and agricultural fields.

Keisha Alexander

Pursuing a Forensic Science degree was never a random decision. From a young age I have been in constant contact with police and fire officers, mainly due to the fact that my father was a firefighter. I grew up watching *The New Detectives*, *Forensic Files* and tons of police movies. When I enrolled at John Jay my career goal was to become a Forensic Pathologist or Medical Examiner. I later found I had a greater interest in biology and biomedical research. Specifically, I found host-pathogen interactions for human diseases such as hepatitis, human papillomavirus (HPV) and herpes viruses intriguing. After the completion of my undergraduate degree, I plan to apply for a PhD in virology or immunology.

A Cytological Screen to Identify Amyloid-Specific Chaperone Proteins in the Yeast *Candida albicans* (Dr. Rauceo)

Candida albicans is a commensal and pathogenic yeast found on the mucosal lining of humans. Not only does it affect over 60,000 persons a year, it is also a major hospital acquired infection. For *C. albicans* to maintain pathogenesis, adhesion to host surfaces is essential. It is known that the ALS family of glycoproteins helps mediate cell adhesion and aggregation in *C. albicans* and that chaperones are important for this process as they assemble and maintain proper folding of amyloid-forming proteins. This study seeks to identify specific chaperone proteins which are responsible for Als1 and Als5 adhesion. A phenotypic screen of several *Saccharomyces cerevisiae* chaperone mutants was performed. Plasmids containing ALS1 and ALS5 were transformed into mutant *S. cerevisiae* strains. The transformed strains were monitored for Als1 and Als5 mediated adherence and aggregation using light microscopy. A screen was also performed to determine whether amyloid formation was disrupted via fluorescence microscopy. My results showed that ssa1Δ, ssa2Δ, sse1Δ, scj1Δ, and hlj1Δ, mutant *S. cerevisiae* strains, exhibited reduced Als1 and Als5 aggregation. This suggests that these chaperones may play a role in maintaining adhesion function in these proteins.

Ashley Almonte

I started volunteering at the New York Hall of Science at the age of 14 and little did I know I would still be working at the same place six years later. Ever since then I knew science was a field I wanted to get into. After enrolling into a forensic science course in high school I knew that I wanted to pursue a bachelor's degree in forensic science. The class was not only intriguing, but challenged me in ways I could have never imagined. I am currently an undergraduate student pursuing a degree in Forensic Science – Toxicology track. The courses are captivating as well as challenging, which is exactly what I expected and wanted. Working in lab with Dr. He and working within the PRISM Program allows me to not only apply the knowledge I have been learning throughout my semesters at John Jay in a laboratory setting but also learn through experience, which I believe is the main key to success.

Determination of Cadmium in Environmental Water (Dr. He)

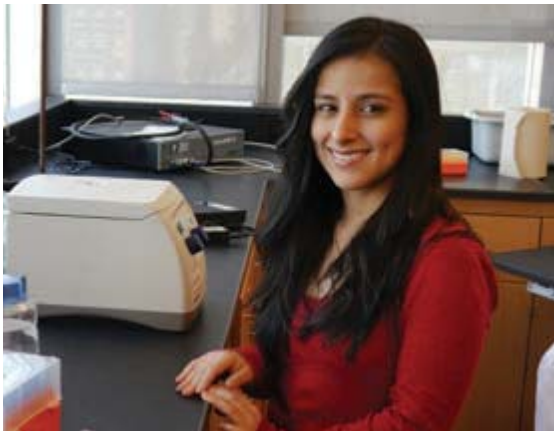
The element cadmium is widely acknowledged as an essential pollutant to the New York/New Jersey Harbor. Cadmium has been widely known as a probable carcinogen that is associated with lung cancer. Not only does cadmium affect human health, but it also affects the relationship between organisms and their environment. Cadmium is regularly used for battery production, as a weathering and ultraviolet light stabilizer in polyvinyl chloride plastic as well as a pigment in both artists' paints and metal plating. Being that cadmium does have potential to become toxic for humans, it is important that the levels of cadmium is monitored in bodies of water, such as the New York/New Jersey Harbor. Both New York State and New Jersey have developed programs in order to regulate cadmium in drinking water, food additives, and in the work place. For this research, an analytical procedure will be developed to determine the concentration of cadmium in water. The analytical procedure will involve various samples being digested using nitric acid (HNO_3) and hydrochloric acid (HCl). After digestion, all samples will be analyzed via FLAA. An external calibration method will be used to determine the cadmium concentration of the unknown samples. After the method is validated, using a NIST multi-element standard, the water in the Hudson River will be analyzed.

Karol Alvarez

I never thought I would end up pursuing a career in forensic science. It wasn't until I took a forensic science course in my last year of high school that I found myself in love with it. Each day I felt delight in the class, not only for the projects but because it challenged me to think outside the box and see things in a different prospective. English not being my native language, it has been a challenge that I had to overcome, but science has shown me that nothing is an obstacle when you are passionate about something. I am currently doing research, which I enjoy because it pushes me to be persistent, determinate and patient with every problem that I have to face. I believe forensic science is like a puzzle, in which every piece leads you to something else.

Development of a Novel Fingerprint Scanner Capable of Detecting Illicit Drugs in Sweat (Dr. Roberts)

The components excreted in the sweat from a fingerprint provide information about whether or not a person has taken or has been in contact with any illicit substance. The high demand for cocaine crossing the borders each day and the struggle for homeland security to stop the influx for such illegal substances calls for the creation of a more convenient and practical screening method. Therefore, the main goal of this research lies on the modification of a surface that can simultaneously detect the presence of illicit drugs as well as to identify an individual. Originally, 9-10,diphenylanthracene is being used to modify the surface which is known to provide well defined and readable fingerprints. The following step is to study the reaction of cocaine with a detecting reagent. Currently, Scott reagent, a two-step test, is used as a screening method to detect the presence of cocaine. Positive results are obtained as a blue color is formed in the second step of the test. According to the results, when chloroform is added, cocaine-containing sample was the only drug to produce a blue color in the organic layer. Therefore, the purpose of my research is to investigate if the blue color being observed is due to the formation of cobalt-cocaine complex. This research will be accomplished by employing separation techniques like thin layer chromatography and solid phase extraction to isolate the complex. Spectrometry techniques like UV/Vis and infrared will be used to confirm results.



Shain Bailey

It's extremely difficult, if not impossible, to shy away from whom you really are. It's similar to walking down a path you shouldn't be going and your gut-feeling says, "Something is not right." So your conscience continues to prick you until you change your course. That's the conviction I had, after completing a B.Sc. in another discipline. I felt empty. My 'language' felt unsubstantiated. Joyfully, the satisfaction came back after getting accepted into the amazing forensic science program at John Jay College. It was a quantum leap forward. Science in itself is an intriguing field of study that continues to unfold its mysteries around us. That's the very reason I chose forensic science. To the PRISM community and to my mentor I render gratitude, for making my scientific knowledge more developed and also for opening the doors that allow me to conduct in-depth research. Well, Med-school you are next.

Modification of a Surface for the Development of a Novel Device Capable Detecting Drugs and Explosives in Sweat (Dr. Roberts)

Fingerprint Identification uses the impressions made by the minute ridge formations or patterns found on the fingertips. Understanding detection limits and knowing what structures are formed, when reagents and drugs are combined, are significant in drug detection. They are particularly significant for the development of newer/advanced technology for the identification of illicit drug use. In an attempt to understand what caused the color change when the reagent and drug were mixed, I am using IR Spectroscopy, KBR technique, to determine whether there is a complex or an electronic transfer between the Cobalt thiocyanate and cocaine HCl. There are two identifiable carbonyl groups (1720.13cm−1 & 1630.25cm−1) that are significant, that shows extreme changes in their vibration when a pure spectrum of the HCl solution is compared to a Cobalt reagent mixed with HCl solution. My current work is to determine the detection limit and also to identify which of the two groups represent each wavenumber as the reaction is occurring when the reagent is added in order to determine the structure.

Nyeisha Brathwaite

A year ago the forensic program at John Jay was but a mystery that ferociously fueled my curiosity. Presently enrolled in the program I admit that it has not been easy. The few professors that I have encountered, with their impressive resumes and intimidating character, have surprisingly motivated me to keep striving for excellence. If they could do it so could I conquer the many obstacles and hurdles and hope to one day have a successful career in the sciences. I am very pleased that the highly accomplished and benevolent Dr. Zhang will accompany me on this journey as we partake in research together. While this amazing PRISM funded opportunity requires sacrifice of time, it has increased my overall confidence in my laboratory skills.

Non-precious Metal Complexes Based on Multidentate Ligands for Catalysis and Fluorescence Sensors (Dr. Zhang)

Metal complexes based on simple multidentate ligands are attractive candidates for catalysis and fluorescence sensing. The facile condensation of aldehydes and amines under mild condition, affords a variety of multidendate Schiff base ligands that can be excellent precursors for some metal complexes. Several condensation reactions are being investigated to synthesize some interesting N,O- or N- ligands. Presently, further reduction of the unsaturated bonds in such compounds are being carried out to obtain new ligand sets. Copper and zinc complexes based on such ligands were prepared and they are being characterized by spectroscopic techniques and X-ray crystallography. Catalytic reactions for alcohol oxidation are being performed using some of the newly synthesized metal complexes, while optimal catalysts and reaction conditions need to be screened. The metal complexes, if proven luminescent, will be applied to the detection of some toxic molecules or ions.

Marleny Cabral

As the only child in my family to go to college it was difficult for me to make the right decisions when deciding what career path to pursue. I attended SUNY New Paltz but soon realized this was not the school for me. Hence, I transferred to John Jay College and enrolled in Forensic Science–Criminalistics and then switched my track to Toxicology. I am currently working with Dr. Rauceo on identifying the mechanisms that helps *Candida albicans* adapt to environmental stress. I love doing research because it has provided me with the fundamental skills necessary to perform science research. My future goal is to get a PhD in Toxicology. This degree will give me the necessary skills and experience to have a significant impact on minimizing the negative effects of cigarettes.

A Validation Study of Bacterial Strains in Probiotic Food Products (Dr. Rauceo)

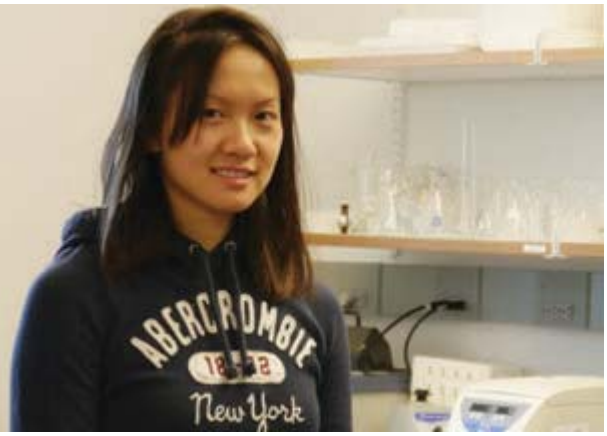
Probiotics are live microorganisms that can pose health benefits such as improved immune health when consumed properly. There are several commercially available products containing microorganisms with probiotic properties. Yogurt has been known to be one of the sources of such microorganisms; however, there is minimal scientific data available supporting the identity of the advertised probiotics. In addition, the extent to which these microorganisms survive through the passage of the digestive system has not been validated. The goal of this project is to: (1) isolate, and identify the bacteria present in 3 yogurts by 16S rRNA analysis; and (2) to determine the viability of the population throughout its trajectory in the digestive tract after encountering various pHs by fluorescence microscopy, and fluorescence-activated cell sorting (FACS).

Carlos Castilla

Ever since I was a young child I have been curious about how things work and particularly fascinated with technology. I would constantly take things apart and try to put them back together, although not always successfully. Some of my fondest memories involve standing with my dad in front of an open computer case trying to figure out what exactly the problem was this time that prevented it from turning on. I've always considered it more of a hobby than anything else, so it wasn't until midway through my time as an International Criminal Justice major at John Jay that I took an introductory programming course and rekindled my old passion for technology. Now I'm majoring in Computer Information Systems and hope to work as a software developer after graduating in 2015, eventually planning to found my own technology start-up.

The Design and Implementation of Cloud-based Persistence Storage to Aggregate Dynamic Real-Time Social Interaction Data (Dr. Khan)

The goal of this project is to develop a research platform that uses cellphone proximity to detect the occurrence of social interactions among study subjects, and supports the dynamic delivery of survey questions in a manner that is responsive to social interactions patterns. As no such platform exists at the present time, this project represents a significant advance in the application of emerging technologies to enable new quantitative social science research at John Jay College and beyond. The system consists of three distinct modules: a) A mobile application for the Android OS which is capable of collecting data regarding social interactions in real time, as well as presenting study subjects with questions dynamically based on social interaction triggers; b) A centralized data aggregation server implemented using the Ruby on Rails web framework and hosted in the cloud using Amazon Web Services; c) An analytic engine which is able to mine the social interaction and dynamic survey data. This project entails the design, implementation and testing of module b) and its integration with modules a) and c).



Mei Lan Chen

Science has always been a passion of mine. Learning about science in a classroom setting was interesting but researching in the lab is the highlight of it all. Working with Dr. Proni has been one of my best experiences and has pushed me forward to obtain a doctorate's degree. My future will involve cancer research and finding better therapeutic treatments for cancer with fewer side effects.

Separation and Spectroscopical Characterization of Organophosphorus Compounds: Ruelene, Acephate and Isofenphos (Dr. Proni)

Chiral organophosphorus compounds are usually used as insecticides in their racemic form for economic reasons. However, enantiomers are known to interact stereospecifically with biological systems and in many cases the exposure to the racemic mixture leads to selective microbial degradation of one of the two enantiomers. Moreover, the two enantiomers may degrade or accumulate in the environment differently, or may be toxic in different ways toward other species. In Dr. Proni's laboratory the enantiomers of five different racemic organophosphate compounds were isolated in the 2012-2013 academic year by HPLC chromatography (profenophos, leptofos, trichloronate, prothiophos, fenamiphos). Their absolute configuration through the concerted use of three different spectroscopic techniques such as optical rotatory dispersion (ORD), electronic circular dichroism (ECD), vibrational circular dichroim (VCD) was determined. To arrive to the definitive stereochemical assignment of the derivatives we have considered both experimental and TD-DFT predicted ORD, ECD and VCD responses. For all compounds we have investigate the biological activities of the racemic mixture and of the single enantiomers through ND50 (neurotoxicity) and enzymatic activity on EE-AChE studies. During the Fall of 2013 we concluded the isolation of ruelene: the spectroscopical characterization will be concluded during this semester. During the Spring semester of 2014 we will also conclude the isolation to single enantiomers of acephate and isophenphos. After isolation, we will spectroscopically characterize the compounds.

Shoronia Cross

In my four years of study at John Jay College of Criminal Justice, I have found myself drawn more and more toward materials science and nanotechnology research. My research into methods of coating glass and plastic surfaces with molecularly-imprinted polyaniline films for the electrochemical detection of explosives has introduced me to the fields of materials science and nanotechnology. I believe that the potential of these fields is limitless and that the sensitivity and inherent portability of these technologies will continue to revolutionize such vital fields as information processing, energy production, national security, diagnosis and medicine. Upon graduating from the Forensic Science program, I intend to pursue a PhD in chemistry, more specifically, materials science.

Electrochemical Detection of Analytes Using Molecularly-Imprinted Polyaniline Films (Dr. Roberts)

The illegal production and transportation of explosives poses a constant threat to public safety and national security. Those individuals involved in the production and transportation processes are routinely exposed to these explosive compounds, which are inevitably absorbed into the body, metabolized, and subsequently excreted through matrices such as sweat. A method of detecting the minute quantities of these compounds within the sweat of a fingerprint requires high specificity and sensitivity. The electroactive properties of polyaniline (PANi), as well as its ability to be molecularly imprinted when synthesized in the presence of a template molecule, made PANi an ideal polymer for testing this concept. Imprinting protocols are being optimized for analytes such as caffeine and p-nitrophenol (pNP). The use of PANi nanofibers is also being explored to impart greater sensitivity, due to the increased surface-to-volume ratio inherent in nanostructures. A method of coating glass surfaces with a thin film of PANi nanofibers to obtain a uniform coating of high electrical conductivity is in development. By imprinting these nanofibers with a template molecule, and subsequently exposing the film to the target analyte and subjecting the imprinted film to cyclic voltammetry (CV), the generated oxidation-reduction peaks will be used to verify the presence of the analyte within the film. This sensor will serve as a proof of concept for an electrochemical sensor capable of trace detection of explosives and their metabolites.

Natalia Fernandez

Having witnessed crimes, I always knew I would pursue a degree related to law. I have always been interested in sciences, and I even enrolled into medical school in the Dominican Republic in 2010. However, I did not feel satisfied with the degree I was pursing. So, that is when I decided to leave my home country, and pursue a degree in Forensic Science. I started to do research in spring 2013 with general chemistry professor Dr. Ecevit at BMCC about the anti-cancer activity of phthalocyanines, and then I decided to apply for PRISM and did research last summer in bioremediation with BMCC chemistry professor Dr. Navarro about using spent teabags as adsorbents of heavy metals. Currently, I am working with Dr. Proni at John Jay on synthetizing new lawsone derivatives, and I am really excited that I am finally doing research in my field of interest.

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 that could create de-inking problems in the documents analyzed. During the summer and fall semester of 2013, we prepared several new derivatives for fingerprint detection, which presented improved solubility properties (more apolar compounds) that were fully characterized by mass spectrometry and NMR spectroscopy. During the spring of 2014, we will prepare in high scale new derivatives of the molecule of lawsone. The overall goal of the project is to determine if these compounds are more or less effective to detect fingerprints compared than the original lawsone molecule.

Jenny Fong

When I first entered John Jay, I was unsure of the path I wanted to take. After spending two years studying criminal justice, I realized it was just not for me. I wanted something more challenging. Within the same time period, I attended a forensic science exhibition. That exhibition sparked my interest in the forensics major. Luckily for me, John Jay had a wonderful forensics major, which I joined immediately. Unable to decide between the molecular biology track and the toxicology track, I am now studying both. Dr. Korobkova's research interested me greatly, and through PRISM, I was able to join her and received an excellent opportunity to learn more from her. I hope to use the new skills and knowledge I obtained from this experience to achieve my career and academic goals in the future.

Interactions Between Flavonoids and Cardiolipin-Cytochrome C Complex (Dr. Korobkova)

Flavonoids are present in everyday food, specifically fruits, vegetables, and tea. Flavonoids are known for their anticancer and antioxidant effects. We suggest that the mechanism behind their beneficial properties involves their interactions with mitochondrial membrane components, namely cytochrome c (cyt c) and cardiolipin (CL). The binding of CL to cyt c results in the formation of a complex, whose peroxidase activity is significant compared with that of a free cyt c. The oxidation of lipids catalyzed by this complex changes the permeability of mitochondrial membrane and, subsequently, modulates apoptosis. We hypothesize that flavonoids interact with the CL-cyt c complex thus altering its catalytic activity. An Amplex Red assay was used to estimate the peroxidase activity of the complex in the presence of flavonoids. When Amplex Red is oxidized, a product called resorufin is formed. Resorufin is fluorescent and a fluorimeter was used to assess the amount of Amplex Red oxidized. Flavonoids were added to a mixture of cyt c, liposomes, hydrogen peroxide, and Amplex Red. In the presence of flavonoids, we observed an overall decrease in fluorescence, which signifies the suppressed peroxidase activity of CL-cyt c complex. In future studies, we will investigate how the presence of flavonoids affects the folding state of cyt c bound to CL. A flavonoids' structure-activity model will be developed based on the results of the experiments. This study will allow us to gain an insight into the mechanisms underlying flavonoids' health beneficial properties.

Stephania Guzman

I became interested in forensic science when I took a class with my professor Mr. Sheldon in my senior year of high school. It really helped me decide what I wanted to do since I was indecisive. I visited the John Jay campus and automatically fell in love with the school and the city. During my first year, I took Biology with Dr. Lents and instantly became interested. Soon after I began doing research with him and realized that I absolutely loved research. There's nothing like discovering something new or learning new techniques. PRISM has given me the opportunity to explore my curiosities and has encouraged me to take interest in graduate school. After college, I want to get my PhD in pharmacology. I hope to someday do research for a pharmaceutical company.

DNA Extraction of the Human Microbiome on Living and Decomposing Bodies (Dr. Lents)

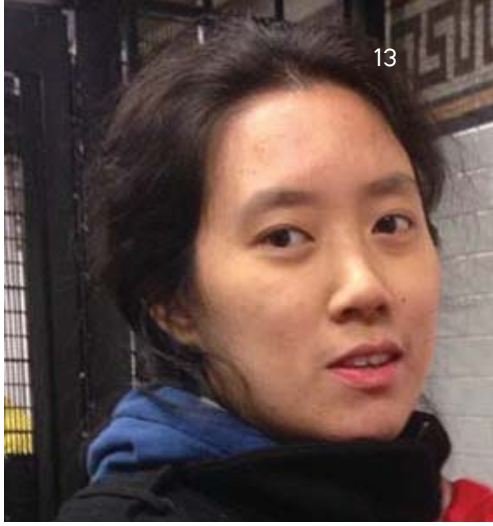
This project will be focused around the human microbiome, specifically dead and live subjects. Last semester was primarily focused on the DNA extraction from swabs taken from ear and nasal cavities in live subjects. During the first phase of this project, we worked with five specific bacteria and found their gene sequence. From there we developed primers manually and ran PCR (polymerase chain reaction) on those samples. We made sure the primers had at least one or more mismatches to the closest relative of the selected bacteria. This served as a basis to confirm the correct procedures were being followed and that we got positive results. We then traveled to the body farm in Knoxville, Tennessee and obtained swabs from the nasal and ear cavity of six cadavers. We extracted the DNA from these samples and then performed PCR with the corresponding primers we developed during the fall semester. We then ran the PCR samples using gel electrophoresis. After obtaining these results we performed a gradient PCR on the primers to obtain their optimal annealing temperature. From here, we plan on continuing to perform PCR with the live and dead samples and eventually send the samples out for sequencing.

Vida Ho

Every afternoon, my first grade teacher would take the class to the school library for story time. Rarely did any of the books fascinate me until I came across a book called *The Bone Detectives*. The skulls on the cover intrigued me, and I immediately chose it. This book led me into a different world; the font, language, and pictures were foreign to me. I immediately borrowed the book and asked my father, "What is the job of a bone detector?" My little curiosity grew more and more after every word my father said. His motivational speeches kept me striving to learn more about forensic science. Since then, I have decided forensic science would be my career goal. I am finishing my last semester at John Jay College.

Construction and Functional Characterization of a Mutant Isoform of the *Candida albicans* Adhesin Als1p (Dr. Proni)

The human fungal pathogen *Candida albicans* resides in the gastrointestinal tract and mouth of healthy individuals. The *C. albicans* genome includes the ALS family of cell-surface glycoproteins. Als proteins are required to mediate adhesion and cellular-aggregation to host surfaces and were shown to play a role in *C. albicans* infections. Als-mediated aggregation is dependent on the formation of amyloid domains. We hypothesized that a site-directed mutation of valine326 to asparagine (V326N) in the Als1p amyloid-forming region will reduce aggregation and amyloid formation, because similar results were observed with Als5p. The goal of my project is to functionally characterize an Als1pV326N mutant isoform. We utilized polymerase chain reaction (PCR) and directional cloning to construct two shuttle vectors that will express wild-type (wt) Als1p or the Als1pV326N mutant isoform. Both vectors consist of an N-terminal V5 epitope that will be used for protein visualization. We transformed these plasmids into the non-pathogenic yeast *Saccharomyces cerevisiae* in order to produce Als1p and Als1pV326N. Our immunofluorescence assay results showed the presence of Als1p and Als1pV326Non yeast cell surfaces. Our aggregation assays showed increased aggregation for cells producing wt Als1p compared to the Als1pV326N mutant. Therefore, we conclude that the role of valine 326 in aggregation is conserved between Als1p and Als5p. We are currently exploring whether reduced aggregation in the Als1pV326N mutant is accompanied with the inability to form amyloids.



Bik Tzu Huang

Ever since high school, science and math were the main subjects that I enjoyed. From that interest I decided to study forensic science at John Jay. Along my journey in John Jay I have learned new things, broadened my understanding of the different disciplines in science and also came to understand myself better. As a senior, the time to decide what to do after college has come. The answer to that question still remains unclear. But rather than because I don't know what to do, it's because there are too many interests to choose from. Hopefully after college I can narrow down my interests and go into a profession that enables me to use my knowledge to help people and make contributions to the world.

Analysis of Amoxicillin through NMR (Dr. Champeil)

The aminopenicillin, amoxicillin, is used in many treatments against bacterial infections such as pneumonia, ulcers and urinary tract infection. When used incorrectly in combination with other drugs, aminopenicillin can have detrimental side effects. NMR spectroscopy, one of the tools used in drug analysis, is an easy and useful tool since it allows for direct observation of multiple components of the sample. This research focuses on using 1H NMR spectroscopy for the analysis of amoxicillin to quantitate and detect its active ingredients in urine samples. The final objective is to test the validity of this method by measuring the amount of amoxicillin in real samples. To date, we found that direct analysis of amoxicillin in a urine matrix is analytically difficult because amoxicillin peaks in the NMR spectrum interfere with that of urine components. Most recently, we decided to pre-treat samples with a SPE reversed phase cartridge. Cleaner spectra were obtained around 4.5 – 6.5 ppm and allowed for detection of samples at a concentration as low as 0.05 mg/mL, which wasn't possible previously. Future work will focus on confirming the method. A calibration curve based on samples that have gone through SPE extraction and calculation of the percent recovery will be done and real samples analyzed.

Stacey Ishmail

Forensic Science has always been my life long interest. It is the combination of science with law enforcement that builds the fascination and excitement that have held me captive for life. After high school, John Jay College became my first and only choice of college simply because it allowed me to combine the two overwhelming passions of my life – a major in Forensic Science and minor in Police Studies. Throughout my laboratory courses, involvement in the gunshot residue research, and crime lab internships, I have come to realize that my destiny is and always has been to devote my career to society and the justice system. Upon graduation, I will be pursuing a Master's of Forensic Science in Forensic Chemistry and eventually a PhD in Chemistry or Forensic Science. I have no intention to hurry this journey for it provides me with the highest degree of satisfaction, fulfillment, and gratification that revolves around my love and desire for this field.

The Chemical Composition and Deposition of Gunshot Residue in Conditions of Rain and Fog (Mr. Diaczuk and Dr. Reffner)

This project explores the chemical composition and density pattern of gunshot residue deposited onto a target in ambient air, rain, and fog. Using the computer software ImageJ, an objective method was used to examine the density pattern of gunshot residue. A subjective method using Photoshop was also used to count the particles. The advantage of these methods is that they are inexpensive and do not involve the use of chemicals, which can alter the state of the particles. Infrared Spectroscopy is being used to compare the chemical composition of gunshot residue before and after it is deposited onto a target in ambient air, rain, and fog. Due to their different aerodynamic capabilities, the propellant types used in this project are flattened ball and disc shaped. These were loaded in Winchester 38 Special and Federal American Eagle 38 Special cartridges, respectively. The muzzle-to-target distances for each shots are 8 and 12 inches. The rain and fog conditions were created artificially in order to conduct this experiment within the controlled setting of the laboratory. A jig was designed to deliver water on demand in reproducible known volumes, measured in gallons per minute. The water droplets so created became an intervening medium that the unburned and partially burned propellant particles had to negotiate on their way to their target. The method of assessing gunshot residue particles in different weather conditions can be crucial in the reconstruction of shooting incidents that occurred under such conditions.

Tasheda Kelly

Choosing Forensic Science as my major in college was a spur-of-the-moment decision. I'd been working at a bank for 3 years, basically stuck and not even realizing it. Friends and family kept asking what I wanted to study and finally, after one time too many, I just blurted out "forensic science." That's how my journey began. Once said, I couldn't take it back. And after coming to John Jay and joining PRISM, I'm happy I never tried to. This major has been challenging and has helped me to become more focused on a career path, and PRISM has afforded me opportunities that I would never have come across without it. Going to conferences, building a relationship with a mentor I admire, I can't imagine having accomplished any of this without PRISM. It may have been a spur-of-the-moment decision, but I have no regrets.

UV/Vis Analysis of the Interaction between Glutathione Peroxidase and Flavonoids through the Absorbance of NADPH (Dr. Korobkova)

Glutathione peroxidase (GPx) is an important antioxidant enzyme, which protects cells from the damage caused by hydroperoxides. Presently, we investigated how flavonoids, constituents of leafy vegetables, fruits, and herbs, may affect the activity of GPx and thus modulate the antioxidant defense of cells. Epigallocatechin gallate (EGCG), a component of green tea, was chosen as a model. The enzymatic activity of GPx was determined by measuring the linear decrease of UV/Vis absorption intensity of nicotinamide adenine dinucleotide phosphate (NADPH). In the absence of the flavonoid, the enzymatic activity of GPx was determined to be 1.59X10-4 mM H2O2/second. Upon the introduction of EGCG in increasing concentrations, the activity of GPx was suppressed. The results indicate that the flavonoid inhibits the peroxidase activity of GPx, suggesting a mechanism for its pro-oxidative activity, observed previously by other researchers. The results of the studies will contribute to the knowledge of the biochemical processes underlying health beneficial effects of flavonoids.

Richard Khusial

I was always interested in math and science but couldn't find an interesting career path that incorporated both. After being uninterested in my information technology courses I decided to venture into forensic science. I have completed a Math minor and currently I am pursuing both the Toxicology and Molecular Biology tracks in the Forensic Science program. The courses are fast-paced and challenging which keeps me motivated and interested. By doing research I was able to gain valuable experience, which I wouldn't have learned in a classroom. I believe the knowledge and skills that I learned at John Jay will help me in my future academic pursuits.

Mercury Transport in the Environment (Dr. Carpi)

Mercury is a neurotoxin which has significant implications for human health. In soil, divalent mercury can be reduced to volatile elemental mercury, resulting in its further transport and contamination of the environment. Our research is designed to identify the mechanisms of this reduction process by studying whether temperature has an effect on the production of elementary mercury from Mercury (II) Oxide. We are currently attempting to control the parameters of the experiment. The intensity of ultraviolet lights in the UV-A and UV-B are being analyzed to obtain two UV lights with similar intensities. A T-test is being used to compare the different intensities from the different chambers in the hoods. Once equipment pairing is complete, mercuric oxide samples and mercuric chloride samples will be compared under various environmental conditions to assess the mechanisms driving reduction and emission.

Cristina Kinahan

I am now a junior at John Jay College. I chose to attend John Jay because it is well known for its Forensic Science program and, compared to most schools, financially affordable. I am highly interested in toxicology and have been doing undergraduate research for about a year. I have found doing research as an undergraduate to be an amazing opportunity. It allows us an entirely different type of laboratory experience and generally gives us an advantage when applying to graduate programs.

Separation and Spectroscopical Characterization of Metamidophos, N-methyl Metamidophos and Acephate, Organophosphate Compounds (Dr. Proni)

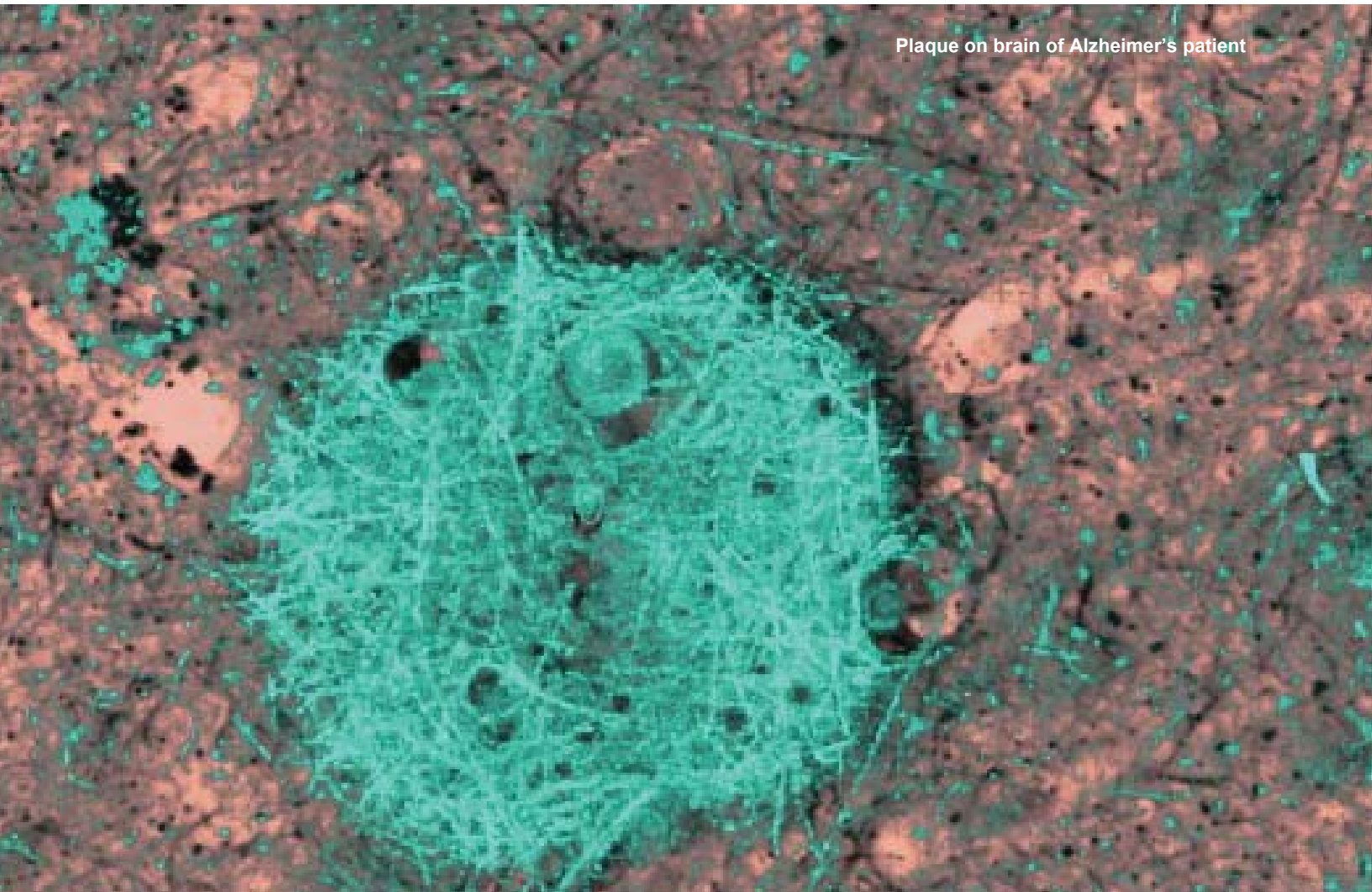
Most of the commercially important insecticides and lethal chemical warfare agents belong to the class of chiral organophosphorus compounds. The biological effects of organophosphates are generally highly dependent on the chirality of the pentavalent phosphorus atom. Five different organophosphate compounds were isolated using HPLC chromatography. For all compounds we will investigate the biological activities of the racemic mixture and of the single enantiomers through ND50 (neurotoxicity) and enzymatic activity on EE-AChE studies. During the Fall semester of 2013, we separated and spectroscopically characterized acephate. In the Spring of 2014 we will concentrate our efforts in separating methamidophos and N-methylmethamidophos. After isolation, we will spectroscopically characterize the compounds. We will continue our research using different organophosphate compounds.

Xiao Shan Law

Forensic Science is never ending and that is why I love it. Every day, the field is continuously renewed with new information discovered and developed through raw data. I chose Forensic Science specifically because I knew I would never get bored of it. I knew that there would always be something new along the way to catch my attention, to motivate me. This way I can never say I am done. Honest to say, I never thought I would choose science as my choice of study nor did I think I would end up studying the application of science to law. However, it had always been like a magnet which I had always been drawn to.

Comparison of Gunshot Residue and Firework Residue Characteristics using the Scanning Electron Microscope (Mr. Diaczuk)

Firework residues and gunshot residues, commonly abbreviated as GSR, are both produced by the burning of compounds composed of and through a rapid cooling of vapors that follow. Because fireworks are also composed of elements which identify specifically to the presence of GSR, the use of fireworks were suggested to form particulates non-differentiable from GSR. Firework residues, similar to GSR, consist of a two to three molten combination of lead, barium, and/or antimony, elements which are used as an initiating explosive, an oxidizer, and as fuel in ammunition. The uniqueness of GSR and the credibility of the material for use as evidence, therefore, become questionable. With the use of the Tuscan Vega3 XM Scanning Electron Microscope, fast, high resolution, and three dimensional imaging of the two types of particles can be used for morphological comparison (Labcompare, 2013). In addition, the instrument consists of an EDAX software application for x-ray dispersion spectroscopy which allows for elemental composition and elemental distribution analysis of both the GSR and firework residues.



Plaque on brain of Alzheimer's patient

Anna Lerer

When I first came to the United States, I lived in a neighborhood overrun by drug abuse. Without realizing it, this is how I became interested in toxicology. I decided to take a different approach to the "education" I was receiving on the streets and enrolled into a nutrition program where I earned a Holistic Health Counseling certification. I was on a mission to help my fellow men, but I still wanted to know more. So I enrolled in the Forensic Science program at John Jay where I took my very first science class. The program greatly challenges me and I find it very exciting. Today, Dr. Lents and I work to determine how certain supplements affect drug tests and how they may cause a false negative read out. When I graduate I wish to work in the healthcare industry and help people lead better lifestyles.

Zinc Reduces the Detection of THC by ELISA Urine Testing (Dr. Lents)

Zinc sulfate has been observed to have an adulterating effect on urine in acute marijuana smokers. As of yet, there are no ways to detect zinc supplements in urine, possibly making it an effective adulterant. The research focuses on testing the effect of zinc sulfate on THC levels in urine. First, synthesized urine was used. The urine was infused with various concentration of THC. Then it was infused with various ions such as calcium, magnesium, copper, zinc and manganese, also at various concentrations and tested using a standard ELISA drug testing kit. Zinc sulfate was the only ion that produced a false negative result. Using this information, urine samples from anonymous live subjects will be used. The subjects are instructed to take a zinc supplement after the intake of marijuana. Again a standard ELISA assay will be run and also a zinc assay to determine the correlation between the concentration of zinc in the urine and the ELISA read out.

The samples with be run under Mass Spectroscopy to determine the amount of THC present in the urine. This will determine whether the zinc simply affects the ELISA test or the actual kidney function of the subjects. If zinc has an effect on the kidneys, further testing will be conducted to determine the pathways of zinc's effect on the human body.

Yessenia Lopez

When I first started at John Jay in 2010 I intended to pursue a double-track in Toxicology and Criminalistics and to begin working after graduation, until I was invited to a PRISM meeting during my freshman year. After seeing the upper classmen present their projects I became curious about the program and interested in doing research. Dr. Cheng's work with pesticides and neurodegenerative disease appealed to me because of my family's history and experience growing up on a farm. I joined PRISM in the Summer of 2013 and I have enjoyed every single minute that I spent in the lab. The ability to design your own project and carry out the experiments is exciting and makes the hard work worth it. My research experience has been wonderful and has encouraged me to pursue biomedical research after I graduate.

AßPP Expression Induced by Dthiocarbamate Pesticides Maneb and Mancozeb (Dr. Cheng)

Alzheimer's disease is the most common neurodegenerative disease affecting older patients. Neurotoxins, such as lead, have shown to elevate ß-amyloid precursor protein (AßPP) expression, increasing ß-amyloid (Aß) peptide levels. The accumulation of $Aß_{1-42}$, the most toxic form, is responsible for creating the plaques that interfere with the cell signaling that is associated with Alzheimer's disease. Like many other neurodegenerative diseases, Alzheimer's disease has a complex mechanism and is not fully understood. The aim of this study is to elucidate the toxic response of PC12 cells in response to the exposure of the dithiocarbamate pesticides maneb (MB), and mancozeb (MZ) for different incubation periods and at different concentrations. AßPP levels were determined through Western blot analysis and a dose response and time curve were created. The data shows that as the concentration of MZ increased and the exposure time of MB increased, so did the levels of AßPP. The next part of the project, which will be the main focus of this semester, is to determine if the increase in AßPP levels is a result of increased translation or decreased protein degradation.

Glen Mahon

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

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

When glass breaks mechanically due to an applied force it breaks in a specific pattern. Radial fractures will occur that radiate out from where the force was applied and tangential fractures will occur in a circular pattern around where the force was applied. The glass will also develop marking on it called rib marks and these start perpendicular to the side where the force was applied and stop parallel on the opposite side of the glass. These rib marks are useful in that they can tell which side of the glass the force was applied which can aid in investigations but they could serve more purposes. 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. Three parameters will be tested initially using TLC plates as the glass source and an air rifle to see if they would change the rib marks to determine if they can give indication of the caliber of the pellet or its speed and the parameters are: changing pellet caliber, changing speed of the pellet, and changing the angle of the glass. If conclusive data is obtained then architectural grade glass will be used and hopefully a firearm. Through the use of a high speed camera it was determined that radial fractures are the first set of fractures that occur when a pellet or a bullet penetrates a glass plate.

Herold Menier

For a large part of my life, I have dreamt of perfect beings. These perfect beings are incapable of doing wrong, cannot be prevailed over, never being challenged to accomplish their mission nor having to struggle to achieve glory and fame. But those perfect beings that wander the inner corridors of my mind are just that, dreams. I believe a true scientist is someone who aims for perfection and the ideal all the while never being able to fully achieve it nor being afraid to fail when attempting to do so. My definition of a scientist is the reason that I am pursuing a career in forensics, which in my opinion is one of the most trial-and-error based of the science disciplines. I will then gradually reach a level that allows me to be able to perform crime scene reconstruction, after gaining some years of experience from my successes and especially my failures. After all, it is always better to succeed but you learn so much more from failing.

Environmental Decay of Primer Impression Marks (Mr. Diaczuk)

My research is a microscopic experiment based on the degradation of tool mark evidence, more specifically on the environmental degradation of the indented markings left by firearms on a bullet casings' primer. This research is designed to determine how long it would generally take for the indented tool marks on the primers to become unmatchable to a known standard that was fired from the same gun and matched prior to the beginning of the experiment. It will also be conducted in different weather conditions as well as different types of soil. I will be using my microscopic techniques on the LEICA FS M comparison microscope, along with numerous attachments to analyze my samples. A recording of the weather while the bullet casings are in the ground throughout the course of this experiment will be conducted as well. The acidity of the soil used for this experiment will also be taken. By the end of this experiment, a gradual visual change in the primer of the cartridges will show just how those particular environmental conditions affect the cartridge over time.

Jazlene Montes

I have always had a passion for math and science. Starting in second grade by solving math problems for fun to reconstructing a rodent skeleton from owl pellets in the fourth, as I grew so did my fascination in the subjects. During my senior year of high school, while taking an introductory forensic science course at Hunter College, my mind was set to pursue the degree in Forensic Science. I began attending John Jay College to study Forensic Science to expand my knowledge and enhance my skills. I seek to further my education by obtaining a Ph.D. in the future and hope my research with PRISM support will assist determining my field of study.

The Effects of Manganese-containing Dithiocarbamates on Activated Doublestranded RNA Dependent Protein Kinase (PKR) and Mammalian Target of Rapamycin (mTOR) Signaling Pathways (Dr. Cheng)

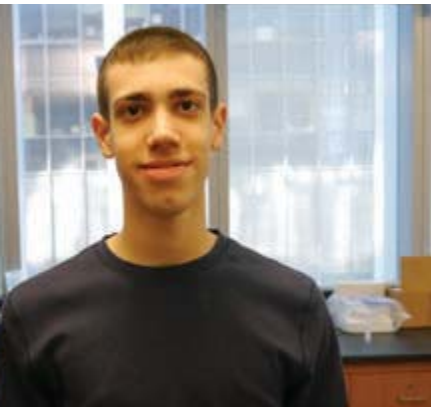
Manganese-containing dithiocarbamates have been suggested to play a role in neurodegenerative diseases. Alzheimer's disease (AD) is a neurodegenerative disease, which is characterized by memory loss. The underlying molecular mechanism of environmental toxins in AD is not fully understood. Activated doublestranded RNA dependent protein kinase (PKR) has been found to deteriorate the neurons in brains affected by AD. Down regulation of mammalian target of rapamycin (mTOR) has been associated with the pathogenesis of AD. The molecular connection between PKR and mTOR is recently discovered that PKR is able to phosphorylate p53, which can hinder activity of mTOR in response to amyloid ß peptide 42 (Aß42) which is elevated in AD patients. The focus of this study is the activation of PKR before and after chemically treating cells with manganese-containing dithiocarbamates, maneb (MB) and mancozeb (MZ), for various lengths of time and at various concentrations.

Tanya Napolitano

Science has always been my passion. From an early age I questioned everything and anything, looking for relations, causes, and effects. Science opened up the door for me, giving me answers to the harder questions I always asked myself. For example: "Why is the sky blue?" Science has always been the only thing to quiet my curious mind. Therefore, majoring in the sciences was a no-brainer to me. Only by dedicating my life to science can I find the answers I seek because it seems like the more I know, the more I realize I have no clue. For that reason I plan on getting my PhD in chemistry after I graduate from John Jay. I hope to be a part of many research projects throughout my life, finding answers to questions that no one knows.

Lawsone's Derivatives: Synthesis and Spectroscopic Characterization (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 that could create de-inking problems in the documents analyzed. During the summer and fall semester of 2013, we prepared several new derivatives for fingerprint detection, which presented improved solubility properties (more apolar compounds) that were fully characterized by mass spectrometry and NMR spectroscopy. These molecules that have been synthesized are: JM40+1-naph, JM40+2-naph, JM40+anthracene, JM40+Fluorenone, Lawsone+1-naph, Lawsone+2-naph, Lawsone+anthrance, and Lawsone+fluroenone. So far this semester, we are synthesizing and separating about 500mg of each product to later work with. Next for the Spring semester, we will spectroscopically study these compounds by means of Ultraviolet-Visible and fluorescence spectroscopies and to use them to stain fingerprints. The overall goal of the project is to determine if these compounds are more or less effective to detect fingerprints compared to the original lawsone molecule.



James Parziale

I am currently an upper senior John Jay College of Criminal Justice pursuing a degree in Forensic Science specializing in Molecular Biology and Toxicology. While I always did my classwork when I was a young child, I was never truly engaged in what I was learning. I was told information and once the exam was placed in front of me I regurgitated said information. It was not until I entered high school that I discovered the beauty of science. My science teachers did not just feed the class information to be memorized, but they questioned everything that I thought I understood until I realized I knew next to nothing. It made me think, reason, explore, and want to learn more. Both PRISM, and the faculty at John Jay have continued to foster my interest in science, and growth as a scientist.

Determination of the All-Trans Retinoic Acid Signaling Pathway in the Activation of RAR and RXR Receptors leading to Expression in MZF-1 and the Relationship between CTGF, NOV, and Platelets (Dr. Lents)

CCN3 otherwise known as NOV (nephroblastoma overexpressed), and CCN2 also known as CTGF (connective tissue growth factor) are two proteins involved in cell proliferation, differentiation, blood clotting and wound healing. The expression of the CCN proteins are initiated by MZF-1 (myeloid zinc finger-1) transcription factor. ATRA (all-trans retinoic acid; vitamin A) has been shown to increase MZF-1 activity in cells. ATRA works in cells between two different types of receptors: retinoic acid receptors (RAR) and retinoid X receptors (RXR). ATRA allows for the dimerization on the specific receptors from the RAR and RXR families, leading to further cellular signaling promoting expression of the MZF-1 transcription factor and in turn CCN2 and CCN3. Platelets, which have a close relationship to the CCN2 and CCN3 proteins, bind to the proteins as well as share similar function in regards to wound healing. The exact pathway involving ATRA and its relationship to MZF-1, platelets, CCN2 and CCN3 will be explored through experimentation. Recently HS-5 (human stromal fibroblast found in the bone marrow) were being co-cultured with MEG-01 (megakaryoblast; platelet precursor), and treated under varying conditions (with ATRA, Valproic Acid (VPA), and with both together), to see if expression of CTGF is prevalent under each condition and in what amounts. If success in experimentation is achieved, the possibility of utilizing vitamin A before a medical procedure such as blood donation, or bone marrow transplant may allow for the patient to recover much more rapidly, saving time and money for the healthcare system.

Daysi Proano

Imagining my life as a pyramid, I started from the bottom and little by little I keep climbing step by step with the hope to eventually someday reach the top and becoming a medical doctor. I emigrated from Ecuador after graduating from high school hoping to get into a higher education level in the United States. By becoming a new resident, I realized that if I wanted to go to college, I first had to learn English. Once I got accepted to Queensborough Community College, I found out that science is a fascinating field where experiments allow one to understand and explain phenomena, usually taken for granted. For this reason, I chose Forensic Science as my major at QCC because I think it is an interesting field of studying science, especially chemistry and biology. As a student that belongs to the CUNY Justice Academy, I had the opportunity to get involved with PRISM, a program offered by John Jay College. This opportunity enhances my laboratory skills and allows me to broaden my experience in research by bonding with a professor. I intend to earn a BS and then be able to continue with a degree in biomedical sciences.

Folin-Ciocalteau Assay: Determination of the Total Amount of Antioxidants in Commercial Beverages (Dr. Svoronos - QCC)

This project intends to measure the total phenolic content present in tea beverages via the Folin-Ciocalteau method in a way similar to the one used by the wine industry. This procedure uses the Folin's phenol reagent that oxidizes the polyphenols in the tea beverages into polyquinones. The reduced phosphomolybdate/ phosphotungstate reagent produces a blue color that allows the visible spectrophotometric determination of polyphenolic antioxidants originally present in the tea bags. The results are expressed as Gallic Acid Equivalents and the measurements are made using the Beer-Lambert's Law. This method was extended to several commercially available teas and also measures the semiquantitative measurement of the antioxidants' decomposition after 7 days which gives an estimate of the percentage of air oxidized decomposition of the polyphenols. Following the Folin-Ciocalteau assay, the amount of antioxidants present in juices will be determined and compared to evaluate the polyphenolic content in various brands.

Baibhav Rawal

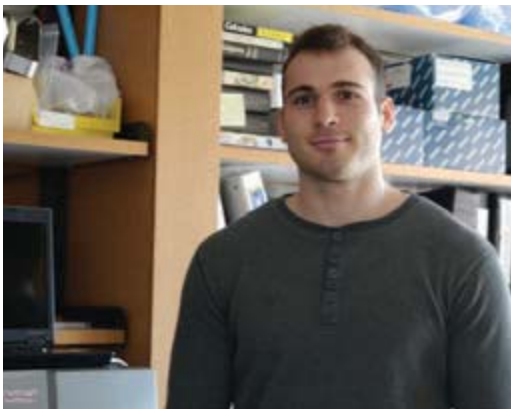
I am a graduating senior pursuing a degree in Forensic Science with a specialization in Molecular Biology. At the end of my sophomore year, I got the opportunity to participate in a funded faculty-research program. Under the mentorship of Dr. Korobkova, I worked in several research projects over the past 2 years. In this course of time, I was able to sharpen my lab skills and research techniques. I also developed a keen interest in the field of toxicology and analytical chemistry while working in Dr. Korobkova's lab. I plan to continue my education through graduate school and perform research in those fields. I am very thankful to PRISM and my mentor for their generous contribution.

Influence of Flavonoids on the Activity of Glutathione Peroxidase (Dr. Korobkova)

Flavonoids are naturally occurring plant pigments that have been linked to reduced risk of cancer and neurodegenerative diseases. Glutathione peroxidase (GPx) is an important antioxidant enzyme, which protects cells from the damage caused by hydroperoxides. Our research focuses on studying the role of flavonoids on GPx activity. Some of the flavonoids employed in this study include Epigallocatechin gallate (EGCG), Catechin and Naringenin. The enzymatic activity of GPx was determined by measuring the linear decrease of UV/Vis absorption intensity of NADPH. The enzymatic activity of GPx in the absence of the flavonoid was used as a reference. Upon the introduction of flavonoids in increasing concentrations, the activity of GPx was suppressed. The results indicate that the flavonoids inhibit the peroxidase activity of GPx, suggesting a mechanism for its pro-oxidative activity.

Samuel Reinfeld

I'm a curious guy in the general sense. As a young boy I enjoyed researching miscellaneous topics.The Internet era was just beginning so my thirst for detailed knowledge was thoroughly quenched. Growing older my interests subsequently evolved. I started questioning the very fabric of existence. It wasn't until I entered the Forensic Science program that those questions turned into new ones. That is one of the many things I have learned on my odyssey; the questions will never end but that doesn't matter. The only thing that matters is the quest for truth and I never know what will materialize. Sometimes I don't know what I am doing but that's what learning is about. To quote Wernher von Braun, "Research is what I'm doing when I don't know what I'm doing."



Mapping Out Interactions between Viral Genome-Linked Protein (VPg) from Turnip Mosaic Virus and Pokeweed Antiviral Protein (PAP) (Dr. Domashevskiy)

Phytolacca americana produces pokeweed antiviral protein (PAP), a ribosomal inactivating protein (RIP). PAP is an RNA N-glycosidase. It enzymatically cleaves purines on the sarcin/ricin loop (S/R loop) of the large ribosomal RNA. This leads to the inhibition of the translocation step in protein synthesis. This anti-viral property of PAP lowers infectivity of plant and animal viruses. Here, we investigate interactions between PAP and a viral protein (VPg) that is covalently linked to the 5' end of the Turnip Mosaic Virus (TuMV) RNA. VPg inhibits PAP enzymatic activity and up regulates viral protein synthesis. The research entails detailed mapping of the specific binding regions between VPg and PAP. Different truncated mutants of VPg will be used to determine the regions within VPg that are required for binding to PAP and its down regulation. VPg has different PAP and eIF binding regions, since VPg-71 lacks the eIF-binding site yet tightly binds to PAP. This research will provide knowledge about the regions within the VPg that are necessary for the inhibition of N-glycosidase activity of PAP and other RIPs, and may serve as an antidote against harmful RIPs like ricin.

Pokeweed

Ruth Romero

This is my first semester at John Jay. I am pursuing a degree in Forensic Science in the Toxicology track. Before John Jay, I was part of the Justice Academy at my previous school, Hostos Community College, pursuing the dual program in Forensic Science. Through the PRISM program, I already have several semesters working in Dr. Roberts' lab. I started as an extern even before becoming a student at John Jay, while I was completing my associate's degree. Since I can remember, I have always been fascinated with the sciences, and the idea of working in an actual laboratory, performing experiments. Now the idea is a reality, as I have the privilege to work side by side with a mentor, Dr. Roberts, who supports and guides my input on his research. For me personally, coming from a different country as a female and part of the minority, this opportunity is one of the first steps on my journey to a successful career in science.

Surface Modification for the Detection of Illicit Biomarkers in Fingerprint Sweat (Dr. Roberts)

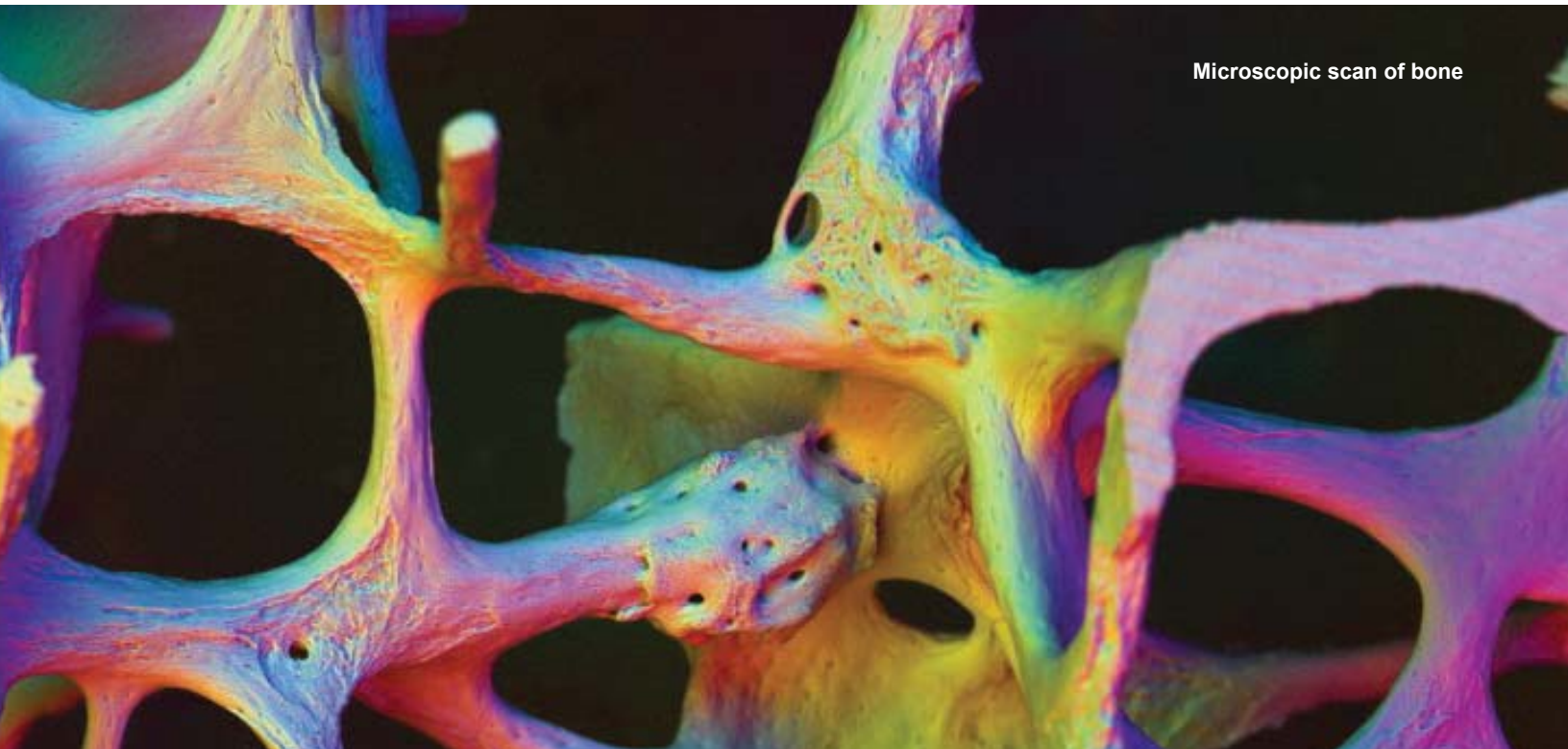
Most drug detection techniques require adding the reagents after a fingerprint has been isolated. A drug commonly trafficked is marijuana, whose active ingredient is Delta-9-TetraHydroCannabinol (THC). We proposed to modify the surfaces in order to identify the parent compound and its biomarkers. The goal is to create an active and reactive surface that can be affordable and amenable to mass production. In the experiments, two different standard reagents, Duquenois-Levine and KN (Fast Blue B Salts), were used in the presumptive test and the compound THC will be used to modify the various surfaces. First we worked with glass surface and its modification for both reagents. We obtained some preliminary results with the glass surface modification, but the work is still in progress. Other proposed surfaces to modify are plastic and cloth. The reagent Duquenois-Levine primarily reacted more effectively in the plastic surface than glass or cloth. There are many variables that are being examined in order to have clear results. These include the time of the reaction/change of color from the instant when the fingertip comes in contact with the surface to when the change of color is completed. Another alternative and more reliable modified surface that we are mainly working with is the polydimethylsiloxane surface (PDMS). With PDMS, we were able to obtain some results with the use of the reagent KN (Fast Blue B Salts). After combining the PDMS surface with the KN reagent, we had positive color change reaction at contact with the THC. The results were not the same for the reagent Duquenois-Levine. For future work, the focus will be to work with standard protocols and the chemical spot test in the manufacturing of the reagent Duquenois-Levine in the laboratory, in order to have more options in the identification of the drug and the limitations with using an already prepared reagent. Future work will also investigate the possible different uses of PDMS surface modification. Overall we will keep working on the modification of various surfaces.

Andre Rozado

I grew up in Brazil where I first became interested in science. I moved to the United States in search of opportunity and education. I started an associate degree in science at BMCC - CUNY. Dr. Lalitha Jayant, a biology professor, introduced us to a new forensic science peer program with John Jay College. This program allowed me to automatically transfer to John Jay to pursue my baccalaureate degree in Forensic Science. In John Jay I learned about PRISM and the research learning opportunity it offers to all forensic science students in good academic standing. The current research conducted in this program will bring forensic science to a new level. I am currently a Forensic Science Molecular Biology and Toxicology track senior. I am looking forward to presenting our work in the Experimental Biology Convention 2014. PRISM has been supporting me and giving all researchers opportunity to be ready for greatness.

Pathway in Each Nephroblastoma Gene, also known as NOV/CCN3 and Connective Tissue Growth Factor (CTGF) CCN2, Which Regulates Hematopoietic Potential Via Transcription Factor Myeloid Zinc Finger 1 (MZF-1) (Dr. Lents)

The goal of this research is to reveal the complete pathway of the differentiation of blood progenitor cells. The signaling in question is the expression of CCN3 (NOV) and CCN2 (Connective tissue growth factor (CTGF)) that is initiated by the transcription factor Myeloid Zinc Finger 1 (MZF-1). It is known that all-trans retinoic acid (RA) increases MZF-1 production in some cells. RA works through two distinct families of receptors: the retinoic acid receptors (RAR) and the retinoid X receptors (RXR). The effects of the retinoic acid in these families of receptors promote heterodimerization of those nuclear receptor families, which signals transcription of RA responsive genes. The cells will be exposed to specific RA agonist and antagonist for each type of nuclear receptor. The aim is to clarify the mechanism of the first step in the differentiation pathway. Our hypothesis is that if patients are being treated with vitamin A prior to surgery or donating blood or bone marrow, it could provide a faster healing process and patients will have a faster recovery. The continuation of this project is the research of the platelets roles in hemostasis, clot development and the wound healing process. This semester the retinoic acid receptor project has been combined with the induction and isolation of platelets. It is being done by treatment of Meg-01 cell line with Valporic Acid (VPA) 2x10-3M. The differentiation of this cell line was observed during summer works and the platelets are being isolated now. Many papers show a connection between Vitamin A and the platelet induction in the Meg-01. Therefore, the role of CCN2 in this differentiation pathway will be further analyzed to determine the role that vitamin A may play in the wound healing and clotting mechanisms. It is our hope that this work will further our understanding could reveal ways to improve the efficiency of blood donation and bone marrow transplantation.



Microscopic scan of bone

Zully Santiago

John Jay has provided me with a fantastic education, and doing biochemical research over the last year with Dr. Domashevskiy through PRISM has solidified my goals to continue my education to obtain a PhD. Investigating why pokeweed antiviral protein (PAP) selects specific RNA viral constructs has encouraged me to investigate RNA viruses long term and to understand the various mechanisms in targeting them. I've gotten so much joy—and appreciation of my studies—from applying what I have learned throughout my undergraduate career to what I do in the laboratory. For every experiment I run, no matter how tedious, I know that the discoveries revealed by my work may be valuable to the scientific community later on. I sincerely thank all of my professors, my friends, my coworkers, and my family. I could not have achieved, endured, and learned so much or maintained such high goals without you.

Insights into the Interactions of Pokeweed Antiviral Protein (PAP) with Viral RNAs: Binding Affinity and Structural Selectivity (Dr. Domashevskiy)

Pokeweed antiviral protein (PAP) is a ribosome inactivating protein (RIP) produced by the common pokeweed plant (*P. Americana*) as part of its defense system against infections. RIPs are N-glycosidases that remove purines from the sarcin/ricin (S/R) loop of ribosomes; this interferes with the transcription of mRNA. PAP also directly depurinates viral RNA and reduces the virulence of viruses such as influenza, HIV-1, and the herpes simplex virus (HSV) *in vitro*. Although PAP's cap-binding of viral RNA is well documented, its selection of uncapped viruses such as influenza or polio is not understood. This study seeks to characterize the binding interactions between PAP and a variety of highly structured 3'-untranslated regions (3'-UTRs) of naturally capped RNA viruses: tobacco mosaic virus (TMV), turnip yellow mosaic virus (TYMV), brome mosaic virus (BMV), and alfalfa mosaic virus (AlMV). Uncapped TMV and AlMV and capped TMV, BMV, and TYMV constructs were synthesized. Approximately half of the BMV sample was capped as indicated by gel electrophoresis; however, TMV capping was minor. Capped TYMV could not be determined. Nevertheless, there is a substantial amount of uncapped substrates ready for depuration by PAP followed by quantitation of the liberated adenines by fluorescence spectroscopy via HPLC. Binding-affinity correlations and favorability of the reactions through thermodynamics will follow. Correlation to the structural differences within the 3'-UTRs are expected to yield valuable information about PAP-substrate recognition and the depurination of viral RNA. Understanding PAP's mechanism and its selectivity may be used for selective targeting of PAP to plant and animal viruses.

Matthew Scarcella

I am currently a senior at the CUNY Baccalaureate for Unique and Interdisciplinary Studies. I started out my studies at Brooklyn College as a biology major and ultimately decided that I was not that invested in their degree program. Through a series of unforeseen events, I had come to apply to the CUNY BA under the advisement of Kate McPherson at the program, and the mentorship of Dr. Anthony Carpi at John Jay. With their help, I have been able to take the majority of my science subjects at John Jay, while enjoying time at Hunter, Brooklyn, and Baruch campuses for my general education requirements. I am currently conducting research with Dr. Anthony Carpi on the mechanisms of the reduction of mercuric oxide, and the journey thus far has been both exciting and rewarding.

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

Various species of mercury can be found as contaminants in soil. Mercuric oxide is one of the more common contaminants, and can undergo reduction to elemental mercury, which leads to its long range transport, traveling long distances as elemental mercury vapor. In an effort to understand the mechanisms by which this process occurs, we have conducted a series of laboratory experiments and molecular modeling studies. Laboratory experiments suggest that HgO undergoes dissociation when exposed to light and even in the absence of third-party electron donor molecules. Molecular modeling studies, using Gaussian 09W, have confirmed the ground state configuration of the molecule and have been tested for the existence of an excited state molecular orbital that leads to instability and dissociation. Recent studies have shown that the bond holding the molecule together is relatively weak, and that further experimental testing should be done with optimal temperature control.

Jiwon Seo

Forensic Science has that tint of mysteriousness and thrill. It immediately triggers a childish but explosive imagination, blending various CSI episodes with Sherlock Holmes deduction. I could spend hours in the fantasy, but a time comes when I have to stop playing a detective and return to the real world: to a very normal circumstance that requires a very normal behavior. I had no choice but to dismiss my childish fantasies and start accepting the dry reality, but PRISM offered a research opportunity. In a stress free and voluntary environment (special thanks to Dr. Cheng), I investigate whatever questions comes into my mind. It gives me the chance to actualize some of the fantasies. I became interested in toxicology while studying the effect of a toxic chemical, and I plan to double track on toxicology and molecular biology.

Study of Various Starvation Periods in the Cell Cycle Phase as Observed from the Flow Cytometry: Optimizing Experimental Methods for Mitomycin and Decarbamoyl Mitomycin C (DMC) Study (Dr. Cheng)

Mitomycin is a widely used chemotherapeutic agent that can induce cell death through p53 pathway. However, many cancer cells lack p53, and are immune to mitomycin treatment. A derivative form of mitomycin was discovered, 10-decarbamoyl mitomycin C (DMC). This compound seems to use a p53 independent pathway to induce cell deaths, and is a very promising chemotherapeutic agent. The research is aimed at elucidating the precise mechanism behind DMC's cytotoxic activity by studying the changes in the dominant cell phase cycle. The study with mancozeb, a known cytotoxic chemical, has shown that it is possible to point out which cell cycle phase is affected by the chemical. For an accurate identification of the affected cell cycle phase, however, it is necessary to first eliminate the variations in cell phases. This is achieved by phase synchronization before the chemical treatments. The current study of interest is to evaluate the condition of starvation in regulation of cell cycle phase via flow cytometry analysis.

Derek Sokolowski

I came to John Jay College in order to discover how I fit within the sciences, especially in forensic science. I was always the kid in the class who wanted to learn more than what was given in class and I loved doing experiments as simple as mixing vinegar and baking soda to make carbon dioxide gas. I am particularly interested in biology because it is as some people say the "Living Environment" and to experiment with something that can affect the world in such a small way is fascinating. I also have a particular interest in photography and I plan to try to integrate photography in my future post undergraduate career when I pursue a PhD in Biology.

The Microbiological Time of Death: Using the Human Microbiome as a Forensic Application to Indicate the Time of Death of A Human Body (Dr. Lents)

The Human Microbiome project will experiment on the change of bacterial populations before and after death as a forensic application in crime scene investigation to determine the time of death. In this project the main goals will be to create an experiment where a specific bacteria will be designated as an ideal candidate that exists in the human microbiome on the surface of the skin, to quantify the change in bacterial populations on both living and deceased human subjects, and to determine a specific rate of change in bacterial population levels that can be used in the field and determine the time of death. So far, the experiment of the project is being articulated to maximize accuracy and precision of the results by designing and testing primers for the DNA samples after extraction and adjusting the DNA PCR replication protocol to the experiment's parameters to optimize data output.

Eugenia Salcedo

Growing up, I always felt a desire to pursue science, yet I could not find a path that fulfilled me. When I graduated high school, pursuing a degree in science didn't seem like an option for me despite my curiosity because it involved spending a lot of time in school and that affected my objective of working. As graduation approached, I felt truly unhappy and empty, and after almost finishing my degree in economics I realized that science was the right path for me. After putting a lot of thought into my future I decided to apply to the Forensic Science Program at John Jay College. This program offered me the opportunity to explore the basic sciences and helped shape what my future career path will be. After several research experiences, I have decided to continue on to Chemical Biology. This will allow me to continue pursuing biology-related problems, such as cancer, from a chemistry perspective.

Characterization of the *Candida albicans* Osmotic Stress Response Gene orf19.7296 (Dr. Rauceo)

The intracellular ion environment is crucial for the survival of all organisms and is maintained by ion transporters both on the plasma membrane and on endomembranes. In particular, the cytoplasmic pH and the concentration of major metal cations such as Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} are tightly regulated since these are central to many cellular processes. The regulation of such transporters is dependent on signaling pathways, which allow cells to monitor the state of the environment and respond to environmental challenges by modulating the expression of certain genes. Several transcription factors have been shown to be involved in the osmotic stress response including Sko1. In the non-pathogenic yeast, *Saccharomyces cerevisiae*, Sko1 is a major regulator of the High Osmolarity Glycerol (HOG) signaling pathway. In addition, in *Candida albicans*, Sko1 plays a role in the osmotic stress, and cell wall damage response. In *C. albicans*, the gene orf19.7296 has been suggested to be a putative cation conductance protein and a Sko1 gene target. The goal of this project is to characterize the role and function of orf19.7296 in osmotic stress signaling.

Kelly Song

When I was growing up, teachers would ask the infamous question, “What do you want to be when you grow up?” Unlike many of my classmates, I had no a clue until senior year of high school. Most responses involved business, medicine, or education. I did not understand why not one person was pursuing a career in sciences, whether it is in chemistry, physics, or biology. I enjoyed chemistry, but this made me question whether it was even possible to have a career in science in general. In my senior year of high school, my financial management teacher asked this very question and the response was the same. To this day, I am still puzzled by this. However, after sampling other fields, I knew science was the one and here I am today, about to graduate John Jay with a Bachelors degree in Forensic Toxicology.

Reference Frame Reportage (Dr. Yaverbaum)

The Principle of Relativity is central in the development of fundamental physical laws, yet relativity is emphasized only to a small extent in contemporary physics curricula. It is grasped and deployed successfully to an even smaller extent. For the past three years, therefore, students’ understanding of kinematic rudiments has been monitored in the context of a college physics course that has been deliberately organized through a theoretical framework of relativity. Investigations have been conducted to probe student mental models pre- and post-physics instruction. In recent pilot studies, data obtained through three original instruments showed that it is possible to measure the impact of a relativity framework on general physics comprehension. The current goal is to focus precise attention on visual cognition. In order to do so, eye-tracking technology has been introduced. The Tobii TX-300 eye-tracker will collect optical-focus data from one of three instruments: a visual presentation and assessment known as Reference Frame Reportage (RFR). This instrument presents 3-body animations in varying combinations of inter-related motions. As a student responds to questions about such animations, the eye-tracker collects high-precision data regarding the regions of motion on which a student-participant chooses to focus—and for how much time. Such data provides access to cognitive decisions that underlie responses to the accompanying physics questions. The cognitive implications are inferred from tracking metrics known as Fixation Count and comparative Total Fixation Duration (with zeroes) with respect to visual Areas of Interest (AOI).

Christine Ta

Growing up with four other sisters, we spent hours in a day role-playing different occupations. One profession I especially enjoyed was acting as a detective. I love solving puzzles and mysteries. Eventually, I developed an interest in crime mystery drama, and that was the first time I heard of Forensic Science. Trying to figure out who was the perpetrator and piecing back the scenarios leading up to the crime, I find both challenging and entertaining. However my fascination did not stop there. I recalled following a trail of ants and kept on wondering, “Why are they going down the hole?” My curiosity for these ants developed into my fascination with biology and the concept of cause and effect. These two hobbies of mine and my curiosity of life led me into my pursuit of becoming a medical examiner. In pursuing this goal, I am in my fourth year studying Forensic Toxicology at John Jay. Forensic Toxicology plays a crucial role in many aspects of the world. In this major I learned the importance of the body’s interaction with substances such as drugs and harmful environmental toxins. This led me into researching neuronal deaths caused by exposure to manganese-containing pesticides.

RTP801 Regulates Senescence Cell Induced by Dithiocarbamates (Dr. Cheng)

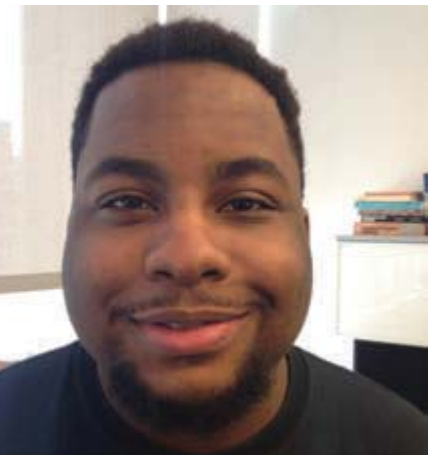
RTP801, a stress-related protein triggered by adverse environmental conditions, was found to play a role in inducing cell death when exposed to manganese-containing dithiocarbamates such as maneb (MB) and mancozeb (MZ). The objective of my research project is to see whether or not dithiocarbamate-induced RTP801expression is associated with cells to undergo senescence associated (SA) death. First, the effect of MB and MZ on senescence cell death will be evaluated qualitatively and quantitatively. In assessing amount of senescence associated cells, senescence biomarker ß-galactosidase *in situ* staining will be performed to qualitatively analyze if MB and MZ would cause senescence, and further colorimetric analysis will be conducted to quantitatively analyze how much of the cells do follow senescence pathway. Preliminary data showed that MB and MZ did exhibit the increase numbers of cells stained with the senescence biomarker. In theory, if the elevated RTP801 expression is associated with senescence cell death, then the amount of ß-galactosidase stained cells would decrease after knocking down the expression of RTP801 by RTP801 shRNA (shRTP801). This proposed project will first confirm that MB and MZ can trigger senescence cell death; then shRTP801 will be used to study the role of RTP801in MB and MZ induced senescence.

Sudip Ulak

I used to be amazed how it is possible that a small box like a radio can produce different types of voices. This curious nature of mine led me to open electronic devices. This curiosity grew with me, and I started to work with computers, I started to open the CPU to check how it worked and started doing formatting, installing windows in my friends and families computers. They made me a tiny technician who fixes minor computer problems. My interest in computing was sparked by a web design competition during high school. While it was a challenging competition, I was truly inspired by my computer teacher's deep subject knowledge; I felt grateful for the opportunity to learn about programming languages, operating systems, and computer hardware. Then I started to learn QBasic programming language. Later I wanted to develop a business program where all goods can be entered so that one can be able to access remaining stocks. I wanted to build this software to help my father's business. I was not able to build that software since my knowledge was inadequate at that time. However it acted as a catalyst. Now I am working with Dr. Johnson on this project. His presence as a mentor motivated me to learn different topics; this way I found my interest, which is machine learning.

Activity Annotation Using the Microsoft Kinect (Dr. Johnson)

This is a student-centered research project in which the goal is to improve known techniques for automatic recognition and categorization of everyday human activity. Data is gathered using the Microsoft Kinect device via a custom interface designed using the Microsoft Kinect Software Development Kit (SDK). The Kinect is a combination RGB and depth (IR) camera supplemented with software which offers extra functionality for tasks such as body and posture recognition [1]. The device can automatically provide 3D coordinates for 21 selected joints in the human body, which we take as the raw data in our project. These so-called skeleton- frames are arranged as time-series data which we analyze using Hidden Markov Model methods (such as scaled Baum-Welch). The main emphasis of our research is to improve feature-extraction techniques, for which we propose a number of new schemes. The data that has been collected is in 60 dimensions, so we are modeling it into 6 dimensions so that it would fit into hmm model, and cancel out unnecessary information and run the model efficiently.



Shawn Williams

As an avid viewer of NCIS, I was quickly drawn to the prospect of being like those TV characters I admired so much, which is why I applied to the Forensic Science program at John Jay. Once in the program I realized that there was a sharp contrast between what is seen on TV and what actually occurs in forensic science. However, I found myself obtaining a deeper appreciation for science, specifically biology and biochemistry, which is why I chose the molecular biology track. I currently work with Dr. Domashevskiy studying Pokeweed Antiviral Protein. This protein is effective against many different viruses and cancers, which makes it an exciting medical prospect; being at the forefront of how this protein works is something I am excited to be a part of.

Effects of Translation Initiation Factors on PAP-RNA Interactions (Dr. Domashevskiy)

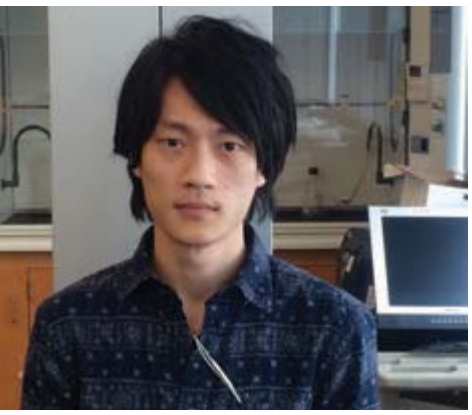
Pokeweed antiviral protein (PAP) is a broad spectrum antiviral agent displaying activity against plant and mammalian viruses alike. Though PAP's antiviral activity has been well documented since as early as the 1920s, the mechanism of PAP antiviral activity and how it selects its substrate RNA molecules remains elusive. It is suggested that eukaryotic initiation factors (eIFs), proteins involved in the initiation of translation, play a role in recruiting PAP to 3' un-translated regions (UTRs) of viral RNA molecules. UTRs contain structures that are recognized by eIFs that, in turn, recruit ribosomes to the RNA for translation. The goal of this research is to try and identify if the 3'UTRs of viral substrates are responsible for its selection by PAP and if so, to identify what type of structures are responsible. During the fall the cDNA of viral substrates with various 3'UTR structures were purified and transcribed. The purification of eIFs from *E. coli* cultures is currently in progress. Fluorescence measurements will be used to measure the affinities of PAP for the different 3' UTR structures of viral RNAs in the presence or absence of eIFs and then HPLC techniques will be used to determine the extent of RNA depurination.

Shari Yarde

I am an international student from Barbados. I came to John Jay College of Criminal Justice to pursue studies in Forensic Science because my passion in life has always been science and I knew I wanted a career in this field. I chose to attend John Jay because I was told it was the best college to attend for Forensic Science. After being accepted into the PRISM program, I was eager to begin working with my mentor Dr. Carpi. My goal after I graduate is to pursue my PhD in toxicology. When I first came to John Jay I thought I would just obtain my degree and graduate, but being at the college has given me a different view of the forensic science field and has also given me many opportunities that I wouldn't receive elsewhere.

The Mechanisms of Soil to Atmosphere Exchange of Mercury (Dr. Carpi)

Mercury is an element with the symbol Hg and atomic number 80. It is important to study because it is an environmental hazard and its toxic effects depend on its chemical form. The study of mechanisms of mercury emissions and the factors that affect these emissions is important in order to protect the environment. Dr. Anthony Carpi studies the emission of mercury from soil surfaces and the factors that affect these emissions. In the past decade, his lab has published articles about the effects of UV radiation, depth and humic matter on mercury emissions from soil surfaces. Experimental and molecular modeling techniques, determined that UV-B light causes bending of mercuric chloride ($HgCl_2$) and dissociation to elemental mercury (Hg^0). Previous results obtained showed an unexpected increase in the mercury flux during the pre-light period, which is believed to be a result of the sample drying. There was also a significant difference in mercury flux data obtained from two different samples analyzed under the same conditions which may be caused by the slow increase in light intensity after it is turned on. This spring I will be focusing on determining the reason for the spike in mercury flux during the pre-light period and also obtaining consistent results for the mercury flux during the post-light period. Experiments on mercuric chloride will be repeated utilizing a sleeve made of aluminum foil to observe the effect of the light intensity at the beginning of the light period on data. Mercury chloride samples under the same light conditions will be analyzed at varying temperatures to see how light and temperature function independently in driving flux.



Yu Ye

Since childhood, I have been always in love playing with math and physics. The process of problem solving is quite addictive to me. When applying all those things I learn from math or physics in real life activities such as sports, it makes life more interesting. Ironically, I had not really taken any chemistry class until my third year in John Jay College. It was a challenging start. But I like challenges. After joining the PRISM program, it opened my eyes to so many great researchers on and off campus and their works. Working in a research lab allows me to strengthen troubleshooting skills, teaches me to look at things from a different perspective and to be patient. This research experience will definitely benefit my journey in forensic science.

Development of a Novel Fingerprint Scanner for Colorimetric Detection of Drugs (Dr. Roberts)

The purpose of this project is to develop a simple and inexpensive novel device that is not only able to detect illegal drugs and/or their metabolites but also has the ability to identify the individual using the obtained fingerprint. Nicotine addiction is one of the hardest addictions to break. It can lead to the inhibition of chromatin-modify enzymes, resulting an increasing ability of cocaine to cause addiction. Therefore, studying nicotine addiction may provide information about addiction of other drugs like cocaine. The color reagent that is used to detect nicotine and cotinine is 1,3-dibutyl-2-thiobarbituric acid (DBTB), which has been synthesized using N,N-dibutyl-thiourea, diethyl malonate, and sodium acetate. The DBTB will detect the drug(s) on PDMS surface and the limit of detection will be determined. One or more confirmatory test such as spectroscopic method will be used to confirm the colorimetric effect is resulted from the interaction of DBTB and the drug(s).

Publications and Presentations

In addition to our Annual Symposium, PRISM students regularly present their research to their peers on CUNY campuses, and at professional events. Below are a few of the many professional accomplishments students achieved this past academic year.

Publications

Cross, S. * (in press). Surface modification for the collection and identification of fingerprints and colorimetric detection of urea nitrate. *Journal of Forensic Sciences.*

Joshi, D., Field, J.*, Murphy, J., Abdelrahim, M.. Schonherr, H., Sparrow, J., Ellestad, G., Nakanishi, K., & Zask, A. (2013). Synthesis of antioxidants for prevention of age-related macular degeneration. *Journal of Natural Products,* 76 (3), 450-454.

Li, R., & Law, X. S.* (2013). A case study of the application of DNA evidence to avert injustice. *Proceedings of Fifth international Forum of Contemporary Criminal Law* (Vol. II, pp. 430-439), Beijing, China.

Li, R., Klempner, S., Carter, D.*, & Saenz, Y.* (2013). Evaluation of methods to process bone evidence for forensic DNA analysis. *Proceedings of 22nd Conference on the International Academy of Legal Medicine* (pp. 265-268). Pianoro (Bologna), Italy: Medimond s.r.l.

Marota, D.M., Nantel, A., Sukala, L.*, Teubl, J.*, & Rauceo, J.M. (2013). Genome-wide transcriptional profiling and enrichment mapping reveal divergent and conserved roles of Sko1 in the *Candida Albicans* osmotic stress response. *Genomics,* (4) 363-371.

Williams, C-A.* & Lin, J.Y. (2013) Involvement of NF Kappa B in pontentiated effect of Mn-containing dithiocarbamates on MPP^+ induced cell death. *Cellular and Molecular Neurobiology* (33) 815-823.

* denotes PRISM student author

Presentations

Alexander, K.* & Rauceo, J.M. *Identification of upstream activators for yeast cell wall damage and osmotic stress signaling.* Abstract for poster presentation. Annual Biomedical Conference for Minority Students (ABRCMS), San Jose, CA, November 2012.

Anthony, T.* & Lents, N.H. *Exploring the mechanism of how zinc supplements reduce the detection of THC in urine.* Annual Biomedical Conference for Minority Students (ABRCMS), San Jose, CA, November 2012.

Carbal, M.* Teubl, J.* & Rauceo, J.M. *Role of Candida albicans transcription factor Sko1 in combinatorial stress signaling. Abstract for poster presentation.* Annual Biomedical Conference for Minority Students (ABRCMS), San Jose, CA, November 2012.

Calderone, A.* *The role of RTP801 in maneb- and mancozeb-induced cytotoxicity.* 52nd Society of Toxicology Annual Conference, San Antonio, TX, March 10-14, 2013.

Carpi, A., Ho, A.*, Frei, A. *Temporal and regional variation in mercury deposition in New York State and implications for climate-related changes*. 2nd Catskill Environmental Research & Monitoring Conference, Highmount, NY, October 26, 2012.

Cross, S.* *Modification of a glass surface for the colorimetric detection of urea nitrate*. Northeastern Association of Forensic Scientists (NEAFS), Cromwell, CT, September 2013.

Hui, C.*, Cheng, S-Y., Carpi, A. *Effects of Mercuric Chloride on Cell Surface Expression of Dopamine Transporter in PC12 Cells.* 52nd Annual Meeting of the Society of Toxicology, San Antonio, TX, March 10-14, 2013.

Ishmael, S.* The deposition of gunshot residue in conditions of rain and fog. Northeastern Association of Forensic Scientists (NEAFS), Cromwell, CT, September 2013.

Mitchell, A.* & Rauceo, J.M. *Analysis of the ALS1 amyloid forming sequence in Candida albicans.* Abstract for poster presentation. Annual Biomedical Conference for Minority Students (ABRCMS), San Jose, CA, November 2012.

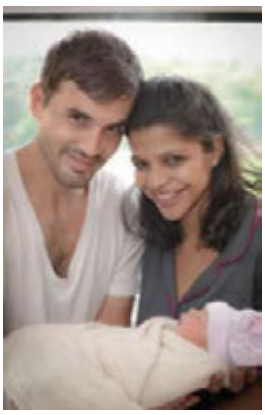
Orta, O.*, Fostier, A.., & Carpi, A. *Deforestation leads to chronic soil mercury emissions.* 11th International Conference on Mercury as a Global pollutant, Edinburgh, Scotland, July 28 - August 2, 2013.

Proni, G., Vasquez, A.*, Chen, M.* & Malerich, J.P. *Preparation and spectroscopic characterization of chemical derivatives of lawsone: Novel Reagents to detect fingerprints.* 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.

Salcedo, E.*, Sukala, L.* & Rauceo, J.M. *Discovery of newly conserved roles of the yeast transcription factor Sko1.* Abstract for poster presentation. Annual Biomedical Conference for Minority Students (ABRCMS),San Jose, CA, November 2012.

Sukala, L.* & Teubl, J.* *Regulation of the osmotic stress response by transcription factor Sko1*. Abstract for poster presentation. ASM Conference on Candid and Candidiasis, 2012.

Alumni Updates



Eva (Santos) Wingo (2012): There's no research news from Eva, yet, but there is a lovely new addition to her family. Last year Eva got married and she and her husband received a precious bundle of joy named Selah Marie. Eva is in her second to last semester in the Masters in Adolescent Science Ed (Chemistry) program at Hunter. She also became an official member of the KDP honor society.

Lauren Weidner (2010): In April of 2013, Lauren was awarded a Dissertation Teaching Award. This award allows the awardee to develop and teach their own class focusing on their discipline. Lauren developed the first forensic entomology class at Rutgers University entitled Forensic Entomology: The use of insects in criminal investigations. The overall goal of the course is to gain an understanding of how forensic entomology is utilized in law and in the courtroom through learning to identify forensically important insects and analyzing their development to determine minimum post mortem interval (m-PMI). The students will use these skills to analyze a mock crime scene and produce a case report.

Alison Keenan (2003): In June of last year, Alison began a position as a Research Fellow at Harvard Medical School in the Center for Computational and Integrative Biology. She has published a handful of articles in the past year, mostly pertaining to targeted metabolomics in the context of obesity and diabetes. Her current position is focused on cardiovascular disease as an important non-infectious co-morbidity of HIV. She is getting married in June to another PhD whom she met while working in Copenhagen over the last few years. His name is Kamil Borkowski. She will also give the keynote lecture at the PRISM Research Symposium in May!

2014 PRISM Symposium

2014 Outstanding Undergraduate Researcher, **Eugenia Salcedo**, with mentor **Jason Rauceo**.

Dr. Alison Keenan
2014 Keynote Speaker

Dr. Alison Keenan received a Ph.D. from University of California-Davis in June 2012, where she worked in Dr. John Newman's lab. Her dissertation focused on targeted metabolomics in the context of omega-3 fatty acid metabolism, obesity and diabetes. Dr. Keenan attended John Jay College between 2003 and 2007, where she graduated Cum Laude from the Toxicology track of the Forensics major. As a PRISM student she worked in the labs of Dr. Diana Friedland and Dr. Anthony Carpi. She is currently a Research Fellow with a joint appointment between Massachusetts General Hospital and Harvard Medical School in Boston, MA.

Dr. Keenan spoke about her academic path, where it has taken her, and how John Jay fit into the picture. She discussed her scientific work at UC-Davis, the University of Copenhagen, and Harvard. While all three experiences were quite different, Dr. Keenan shared how they gave her a breadth of knowledge that has been very valuable in shaping her career.

Established formally in 2006, but building on the foundations of a program that began as early as 2000, the Program for Research Initiatives for Science Majors 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 two dozen 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.

This year's Outstanding Undergraduate Researcher award has been given to **Eugenia Salcedo**.

Eugenia has been part of PRISM since January 2012, working with mentor Jason Rauceo since Summer 2012. Together, they have studied the characterization of an osmotic stress response gene in *Candida albicans.* They became interested in this gene because its expression levels were high in the wild type strain, and significantly low in two mutants (hog1 and sko1), which are major players in the *C. albicans* osmotic stress response.

Why is this important? Becaise it's important to understand the osmotic stress response in *C. albicans* and what players are involved. We all have *C. albicans* in our bodies, however changes to its environment such as pH can allow it to cause infections, and in immunocompromised people it can become pathogenic (cause disease), creating serious problems – and even death – if it invades the organs etc. Understanding how *C. albicans* responds to this environmental changes can allow for the fungus to be targeted in places where some commonly used drugs might not work, and allow for more efficient therapeutics to be developed.

After graduation, Eugenia plans to take a year off from study before continuing to graduate school. Her goal is to pursue a PhD in chemical biology, with a focus on cancer research, and ultimately translating those findings into research on therapeutics.

Former PRISM Symposium Speakers and Outstanding Undergraduate Researcher Awards

2013
Keynote: Lisa DeWald PhD (Stony Brook University)
John Jay: Graduating Class of 2004.
Award Recipient: Anna Stoll

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

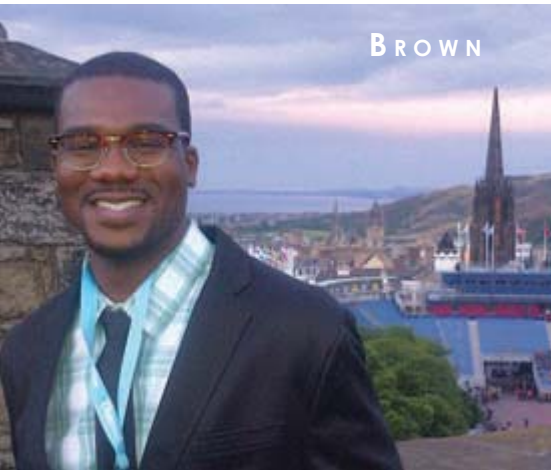
2011
Keynote: Kimberly Papadantonakis, PhD (CA Institute of Technology)
John Jay: Graduating Class of 2002.
Award Recipient: Richard Piszczatowski

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

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

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

Research Mentors



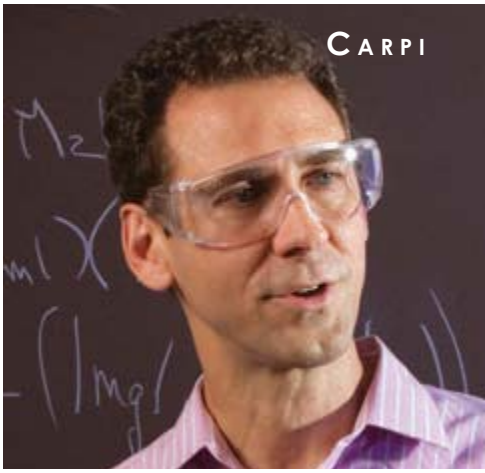
Garry Brown, PhD (University of Mississippi)
Postdoctoral Research Fellow/PRISM Mentor

Areas of Expertise: Analytical and environmental chemistry

My journey in becoming a scientist started in high school when I volunteered at local Home Health Hospital assisting men, women, and children suffering with HIV/AIDS. I became interested in understanding how a virus could trigger a systematic mechanism, leading to damage or even death. I majored in biochemistry at Xavier University of Louisiana in order to understand the complex mechanisms of biological organisms. My goal was to one-day help to find a cure for deadly pathogens that affect humanity.

A key experience in my life, which altered my research career objectives, was the 2010 Deep Water Horizon Oil Spill that occurred on the United States Gulf Coast. As a native of the Louisiana Gulf Coast, my community received significant damage from several disasters. I decided to pursue research that could potentially aid in the recovery and remediation of this region and focused one area of my dissertation work at the University of Mississippi on investigating the impact of the Deep Water Horizon oil spill. I utilized my knowledge of mercury speciation in water to investigate the impact of the oil spill on the speciation of mercury in the Mississippi Coast waters and also its effect on the seasonal hypoxia events in the Gulf waters. My work yielded a much needed speciation profile of mercury in the Gulf of Mexico.

Currently, I am continuing my research on the biogeochemical cycling of mercury by serving as a Postdoctoral Research Mentor for PRISM in Dr. Anthony Carpi's laboratory in the Department of Sciences. My work in his lab includes studying the mechanisms of reduction and subsequent emission of mercury from environmental surfaces such as soils. Through my work, I endeavor to solve environmental problems through analytical chemistry and inspire young scientist curiosity in environmental research.



Anthony Carpi, PhD (Cornell University)

Professor of Environmental Chemistry and Toxicology

Areas of Expertise: Environmental toxicology and science education

I've been interested in the sciences for as long as I can remember – making small electromagnets as a kid and blowing up hydrogen balloons that I filled by electrolyzing water in my bedroom. After majoring in chemistry at Boston College, I poked around for a year, eventually becoming interested in environmental science. I was lucky enough to get a position as an air pollution engineer with the Connecticut Department of Environmental Protection, and three years later decided to go to graduate school. Not one to be confined to a lab, I completed my masters research roaming around northern New Jersey measuring the impact of a waste incinerator on the local environment, and my doctoral research was spent in Oak Ridge, TN, carting around 200 lbs of field instruments to measure the emissions of mercury from soil.

The work in my lab focuses on understanding the chemistry and transport of environmental mercury. Mercury is a leading cause of advisories on fishing resources, and mercury deposited to the environment can be remobilized by various chemical phenomena. Most recently we have been studying the effect of deforestation on the release of mercury from soils. Intact forests and forest soils serve as a sink of environmental mercury, binding it and preventing its mobilization; loss of forests due to fire, environmental damage, or human encroachment can remobilize this metal and lead to significant human exposure. We are in the middle of a series of laboratory and field studies taking place in both New York and the Brazilian Amazon to quantify how the loss of forests and forest fires contribute to mercury pollution and subsequent human exposure to the heavy metal.

Research training in my lab is best thought of as an apprenticeship: students work closely with me and other students in the lab conducting background research, designing experiments, carrying out experiments while learning about equipment and lab procedures, analyzing and interpreting results, and finally working toward presenting or publishing that work.

Elise Champeil, PhD (University of Ireland, Trinity College)

Associate Professor of Chemistry

Areas of Expertise: Synthetic organic chemistry

I chose to work in organic chemistry because it is a hands-on science with a very creative side. I have always been interested in creating new things and in the scientific process through which matter gets transformed. In this respect, there is some artistic dimension about organic chemistry which has always appealed to me. And of course, I chose it because it is fun!!! New colors, new smells, compounds that glow in the dark… Who's never dreamed of becoming a magician?

My current research interests include: 1) Synthesis of DNA-Mitomycin C adducts. Mitomycin C (MC) is an anti-cancer agent. We are interested in synthesizing various DNA adducts of mitomycin C, and also adducts of an MC derivative: decarbamoyl mitomycin C (DMC). Both adducts have been shown to trigger cell death via different pathways. 2) Analysis of drugs of abuse by NMR spectroscopy to detect the presence of drugs of abuse in human urine or in beverages using water suppression techniques. 3) Synthesis of molecular sensors. We are interested in developing systems of the donor–acceptor kind which can be used to detect the presence of fluoride anions or mercury and glow in the dark at the same time!

Shu-Yuan Cheng, PhD (St. John's University)
Assistant Professor of Toxicology

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

I began my career as 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 clinical medication, even with the right dose. 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.

My current research is to study the role that environmental toxins (dithiocarbamate compounds) play in neurodegenerative diseases such as Parkinson's disease. The main focus of my research is (1) to elucidate the role of dopamine transporter in the dithiocarbamates triggered toxicity, (2) to uncover the underlying toxic mechanism such as NF kappa ß signaling pathway and AKT/mTOR signaling pathway, and (3) to reveal the relationship of low doses of dithiocarbamates with senescence cell death.

As a mentor, I encourage students to read, think and plan their research before they start. I constantly meet with them to discuss the background of their projects, their accumulated data, and their future experiments. I strongly encourage students to present their results at conferences: at John Jay and at national, or even international conferences. I hold 5-6 lab meetings per semester to follow up their research progress.

Lissette Delgado-Cruzata, PhD (Columbia University), **MPH** (Mailman School of Public Health)
Assistant Professor of Biology

Areas of Expertise: Epigenetics, cancer epidemiology

I have been in a lab for as long as I can remember; my parents are both chemists. 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 at the University of Havana, Cuba, and experimented with biotechnology and molecular biology methods. I later came to New York and got 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 in association to disease states. The thing I have enjoyed the most has been to observe 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 mindblowing.

I expect to run the first epigenetics lab at John Jay. I want to investigate further how the epigenetic mark, DNA methylation, is regulated in cells and what role it might have in early steps of cancer development. These studies will be carried on cell culture systems with mammalian cells. We will look at expression of enzymes involved in DNA methylation maintenance (DNMTs) and those involved in processing of DNA methylation, TET family proteins. We will study genetics and protein expression of these, using cells derived from breast cancer patients from the New York Breast Cancer Family Registry. Results from these studies can be very helpful in elucidating which other molecular events mediate familial and sporadic breast cancer. In addition, we will use epigenetics in forensic sciences to determine the type of tissue in an unknown sample, all tissues have different epigenetic signatures and this can be very helpful in a forensic setting.

DELGADO-CRUZATA

Peter Diaczuk (City University of New York)
Adjunct Lecturer – Criminalistics

Areas of Expertise: Ricochet analysis and explosives

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

Artem Domashevskiy, PhD (City University of New York)
Assistant Professor of Biochemistry and Molecular Biophysics

Areas of Expertise: Biochemistry, molecular biology and biophysics

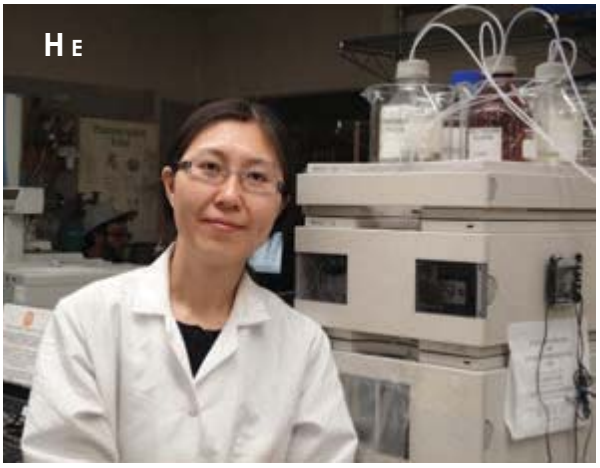
Our laboratory uses methods in molecular biology and biophysics to study structure, function, and properties of pokeweed antiviral protein (PAP) isolated from *Phytolacca americana*. Specific projects interests include:

- Agricultural epidemics can have disastrous effects on the nation's health via crop yield and safety and on its economy through costs of containment and eradication, reduced domestic demand, and global embargoes. A better understanding of the activities of PAP, e.g., how PAP selects its target RNAs for depurination, could help in devising ways to control pathogenic epidemics in plants.
- Experimental cancer chemotherapy uses plant toxins coupled to a cancer marker recognition antibody to specifically deliver the toxin to the cancer cells. Side-effects of the toxin molecules remaining in the circulation or released from lysed cancer cells may be eliminated by using liposomal drug delivery and effective RIP inhibitors. PAP encapsulated into a lipid vehicle is being investigated as an anticancer agent, and the toxin delivery is tested for efficiency.

DOMASHEVSKIY

Students in this laboratory can 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.

I prefer using integrations of several mentoring styles: “Prescribing” (for complicated problems I provide solutions to my students for they might not have a good overview in those cases; from my experience I feel entitled to indicate how problems can be solved in the most efficient way; I often insist that students follow my advice; because of my expertise and experience I can point at solutions in an effective way, etc.), followed by “Advisory” and “Cooperative” styles of mentoring.

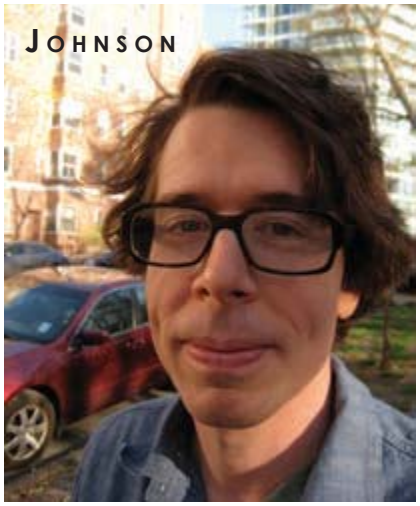


Yi He, PhD (City University of New York)
Associate Professor of Chemistry

Areas of Expertise: Analytical chemistry and environmental forensic toxicology

When I was growing up, I admired my parents and their scientific careers. My mother was a physician and my father was a senior engineer. Their love of science had a great deal of influence on my interest in this field as well. In high school, I excelled in both chemistry and physics, which also led to my pursuing a scientific career. As a senior in college, I was able to publish my first paper, which was very exciting for me. As one of the top students, I was easily accepted to a prestigious graduate program that allowed me to learn about solid phase microextraction. My lab was one of the first to really develop this relatively new technique. It was exciting to be involved in something so new.

My research interests include method development of novel sample preparation techniques, especially microextraction, and their application to environmental and forensic analysis; elucidation of multi-element fingerprints of forensically important trace evidence; and investigation of trace level arsenic in environmental and biological samples.

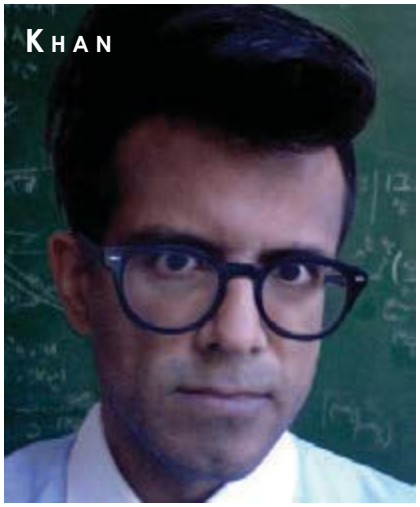


Hunter Johnson, PhD (University of Maryland – College Park)
Assistant Professor of Mathematics and Computer Information Systems

Areas of Expertise: Mathematical logic

My parents gave me an Atari 400 when I was very young, and it came with a BASIC interpreter. I somehow got a book that showed how to program short games that would do things like move an "@" symbol around in a field of "*" symbols. I found this deeply impressive. Later, in college, I read a book called *Excursions in Number Theory*, by C. Stanley Ogilvy, which made me reconsider mathematics. As a philosophy major, I had absorbed a Spinozistic reverence for all things mathematical, and when I realized I was relatively good at it, I decided to make it a career.

Mathematical logic has a lot to do with the definability of concepts in formal languages. So does AI, and I have always been attracted to the confluence between those two things – the interplay of the nature of a concept and how its complexity is reflected in its possible representations. My official research is in what are called NIP theories, which is a subspecialization within model theoretic stability theory. This can be rephrased, without too much loss, as the study of relations with finite VC dimension. When I was just beginning my PhD research, there had been breakthroughs in applying some abstract model theory to practical questions relating to Artificial Neural Networks. For a long time, I tried to improve these results, but ended up doing the opposite of what I meant to do. Namely, I imported an idea from machine learning into model theory, which has proven to be fruitful. Since then, my work has been more model theoretic, but I am always looking for opportunities to go back in a CS direction.



Bilal Khan, PhD (CUNY Graduate Center)
Professor of Mathematics and Computer Science

Areas of Expertise: Computer networks, social networks, graph theory, modeling, simulation

I became interested in computers as a child, because I found the mix of creativity and precision required to design programs that control a machine compelling. I studied computer science at MIT, but then decided that I needed to study mathematics to make computers do the things that we as humans, with our incredible brains, do almost effortlessly. In the succeeding years, I have been working to advance the application of computation and mathematics to uncover hidden dynamics in modern societies, from the perspective of flows (information, disease, money, etc.) that circulate in dynamically changing social networks. The work I do involves discrete mathematics, system modeling, data analysis, simulation, and building real computer systems. I like working with students because they are curious and creative about the world, and have the dedication to invest the time and effort to develop the skills needed to be effective as scientists, engineers, and citizens.

Ekaterina Korobkova, PhD (University of Chicago)
Assistant Professor of Chemistry

Areas of Expertise: Biochemistry, biophysics, physical chemistry

When I was 17 years old and I was a first year undergraduate student, I became fascinated by chemistry while taking a physical chemistry class. I knew at that time chemistry would become my lifetime occupation. I enjoy the process of solving a chemical problem, experimental or theoretical, and enjoy struggling through it to find a solution.

A substantial number of experimental evidence collected over the last decade supports the involvement of mitochondria in the key processes associated with cancer such as cellular apoptosis, growth, metabolism and energy supply. Oxidation-reduction reactions occurring in mitochondria and endoplasmic reticulum generate the flow of electrons. Leaking electrons may interfere with surrounding molecules, producing reactive oxygen species (ROS). ROS react with DNA, which results in the formation of covalent modifications on DNA bases. In our lab we study the dynamics of the expression of glycosylases, DNA damage repair proteins, in response to stress. We are also interested in the mechanisms of action of cytochrome c, a protein attached to the inner mitochondrial membrane. It has been known for a long time that this protein participates in electron transfer process, which ultimately leads to the synthesis of ATP. Recently cytochrome c was found to play a significant role in apoptosis. In the last ten years, extensive proteomic analysis has been performed on the mitochondria of various types of cancerous cells. One of the proteins found consistently overexpressed in the mitochondria of cancerous cells as opposed to the normal cells is chaperone HSP60. This protein is located in the mitochondrial matrix and plays a significant role in protein folding, assembly, transport and degradation of damaged proteins as well as in the regulation of apoptosis. The identification of small molecules specifically targeting the interactions of HSP60 with other proteins is one of the ongoing projects in our lab.

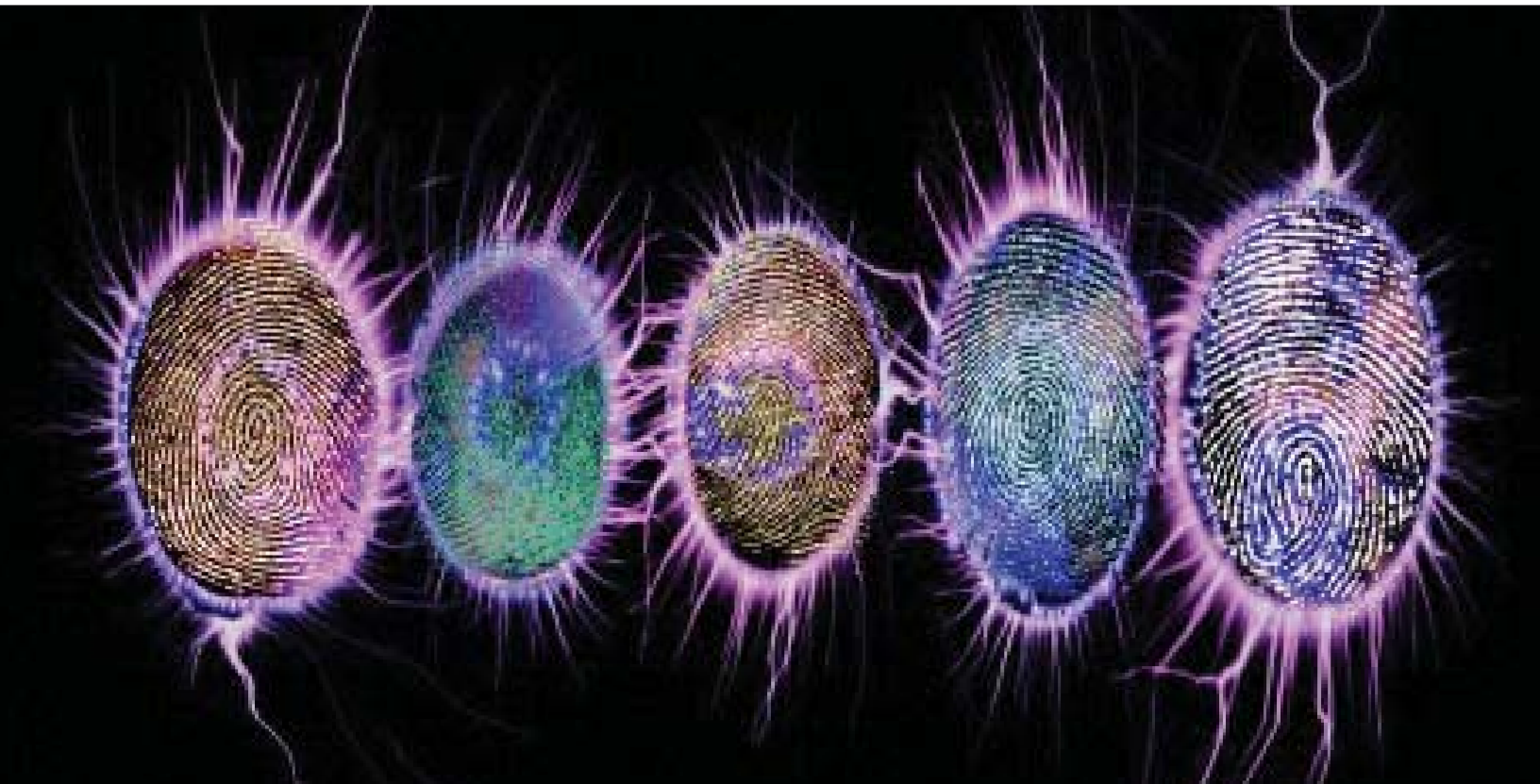
Thomas Kubic, JD/PhD (City University of New York)

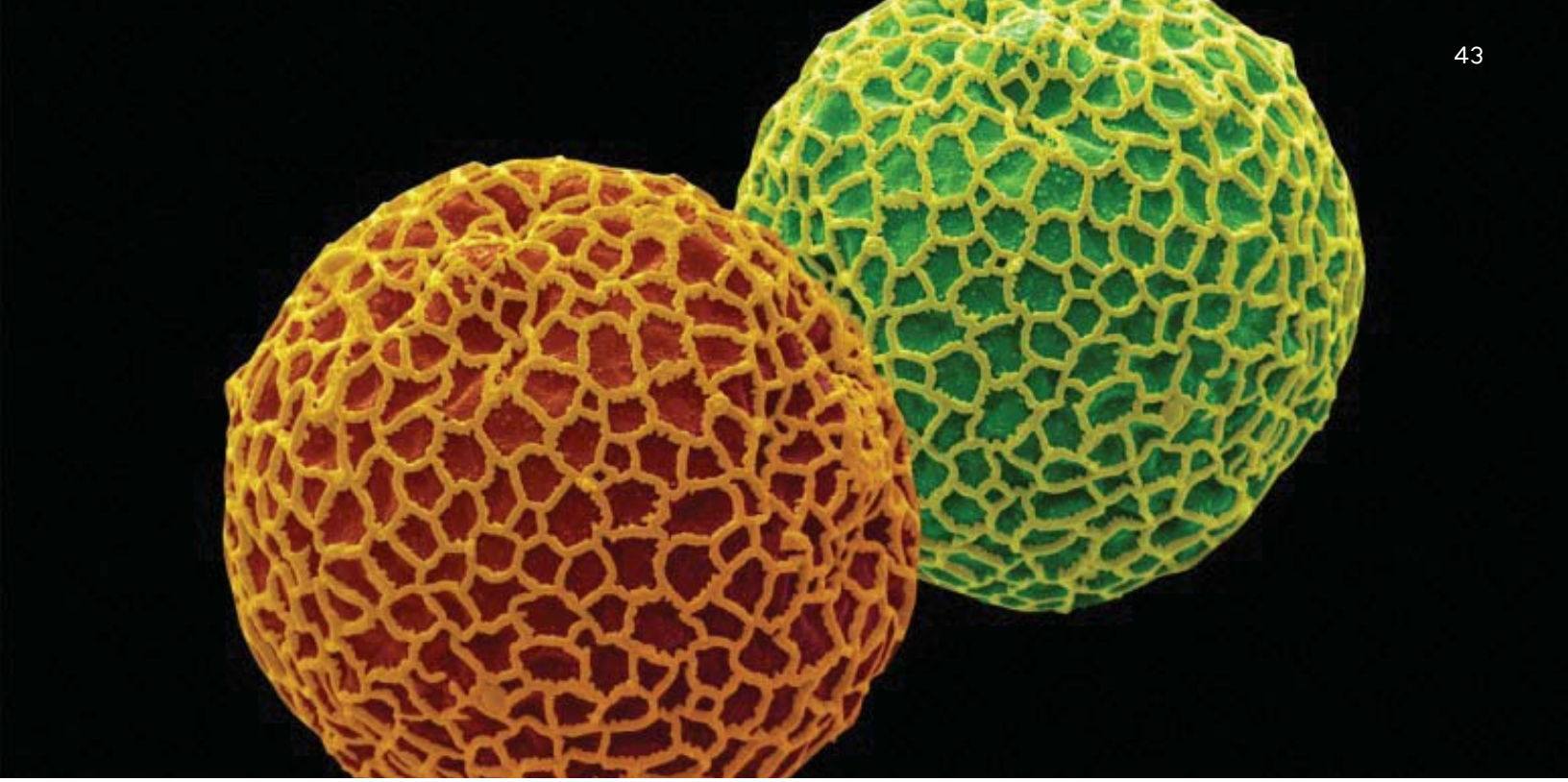
Associate Professor of Criminalistics and Chemistry

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

I got involved in forensic science by serendipity and long before the advent of CSI television or the O.J. Simpson Case. In the early 1970s the country was in a recession and the research company for which I worked doing government defense research closed. I was in the habit of eating and sleeping in a warm and dry place (so was my wife), so I joined the Nassau County Police Department. After graduating the police academy, I was assigned to patrol duty. After I spent a year on the street, the Department realized that I possessed a MS in Chemistry and transferred me to the crime laboratory. I was eventually promoted to Detective and spent 23 years there until I retired from service in 1995. While at the crime laboratory, I became very interested in the analysis of micro-transfer evidence by light and electron microscopy and micro-spectrometry. The Department was one of the first municipal laboratories to obtain a Scanning Electron Microscope with X-ray Analyzer (SEM-EDS) to perform GSR analysis. While there I obtained my law degree from St. John's University and was admitted to the New York State Bar.

Subsequent to my retirement from law enforcement, I spent three years as the forensic application specialist for a leading SEM Company and was recruited and joined the full-time faculty of the Science Department at John Jay College, where I continued my interest in criminalistics. I was recognized by The Criminalistic's Section of the American Academy of Forensic Sciences with the Paul Kirk Award. Upon my completion of my PhD, I was promoted to Assistant Professor of Forensic Science and Chemistry at John Jay, eventually was advanced to Associate Professor instructing classes in forensic instrumentation, advanced physical evidence, expert testimony and research ethics. I also teach chemical separations and analytical spectroscopy courses within the Doctoral Chemistry Program at the CUNY Graduate Center.





Nathan Lents, PhD (St. Louis University Medical School)
Associate Professor of Molecular Biology

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

As an undergraduate, I did research on nematodes (round worms) that infect soybeans plants. It was cool because half of the lab members were "plant people" and half were "worm people" but the research was all focused on what happens when plants and worms meet. Of course, the goal of all of this was to protect the plants and kill the worms, and this gave the plant side of the lab a very smug attitude. During breaks from college, I worked in a totally different research environment – industrial microbiology. Specifically, we worked on strains of soil bacterium that are used to synthesize large amounts of amino acids for use as additives in livestock feed. It was very interesting to see how cutting-edge genetic engineering was used for a very complex agricultural need, and it was this experience that led me to change my career path from medicine to biomedical research. I went to graduate school at Saint Louis University and studied control of the cell division cycle by intracellular signaling pathways. I then completed a postdoctoral fellowship at NYU Medical Center where I learned how to use computational techniques to reveal patterns in biological data. This was also where I began learning about the complex control of gene expression.

The Lents lab has started two exciting new projects in the area of forensic biology. We are analyzing the community of microbes that live on human skin and how it changes after the death of the human host. This involves collection of bacterial swabs from decomposing human bodies, so this project is in collaboration with the Anthropology Research Facility at the University of Tennessee. Our lab is also involved in developing rapid DNA-based technology for the identification of pollen that is casually inhaled by humans when they are in proximity of a flower in bloom. By identifying which flowers a person was recently exposed to, investigators may get clues to link victims or suspects to specific locations in the hours prior to being swabbed.

LENTS

Richard Li, PhD (University of Wisconsin-Madison)
Associate Professor of Forensic Biology

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.

Mechthild Prinz, PhD (University of Ulm)
Associate Professor of Forensic Biology

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 more of a coincidence that brought me to the university's Institute of Legal Medicine where I became involved in forensic DNA analysis and discovered this fascinating new field with another important application. "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 applied research in two different forensic biology crime laboratories, I am happy to now be in an academic setting and to be able to share my knowledge. I am going to continue my work on minimal traces of DNA and will pursue research on 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 or population genetics.

Gloria Proni, PhD (University of Bologna)

Associate Professor of Organic Chemistry

Areas of Expertise: Supramolecular and molecular chirality, optical spectroscopy (electronic and vibrational circular dichroism, UV-Vis & fluorescence spectroscopy), synthesis and characterization of small molecules

All the students I worked with in the past 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 "going above and beyond" mentoring effort, which means 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 the student will be exposed to a problem (for which we need an answer). The student will go through previous observations and literature work in order to educate him/herself about the problem under investigation. Then he/she will design (with help) and conduct the necessary experiments in order to solve the problem. He/she will also work on control experiments in order to build scientifically sound results. Based on the experiments and with the help of the mentor, some conclusion will be formulated. When the problem under analysis is answered the results will be organized in order to present them to a larger public.

Currently in my lab we have two major projects running and some collateral ones to complete. During 2014 we will continue to explore the colorimetric and fluorescent properties of lawsone and derivatives. We will also separate and spectroscopically characterize more organophosphorus compounds, as well as try to conclude the other research lines that are still open.

Jason Rauceo, PhD (City University of New York)

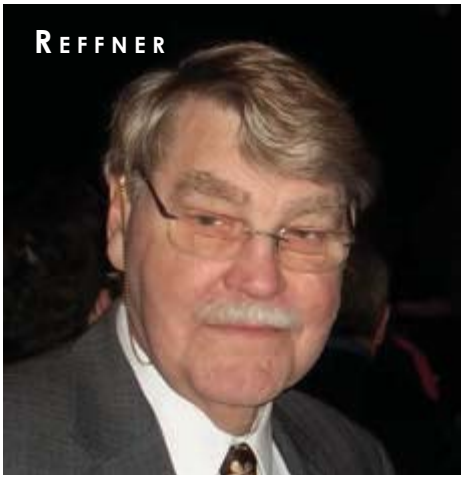
Assistant Professor of Biology

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

I was a late bloomer when it comes to my interest in science. As I became more involved in my science studies, I began to appreciate science for its inquiry and I was able to see all of the possibilities. I pursued a scientific career mainly to understand the mechanisms underlying clinically relevant diseases. 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 mechanism underlying the cell wall stress response. We are also interested in how cell-surface glycoproteins mediate attachment to host surfaces. Currently, we are exploring how the transcription factor Sko1 confers stress protection to cells challenged with hyperosmotic stress and antifungal drugs. 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 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.



John Reffner, PhD (University of Connecticut)
Associate Professor

Areas of Expertise: Microscopy, molecular spectroscopy and materials science

Mentoring undergraduate students is a process that begins by defining a problem that is meaningful, solvable and provides a challenging learning experience. Observation, documentation, preservation, examination, contemplation, speculation, verification and publication are the stepping stones that lead to a successful research project. As a mentor my role is to be an information resource, a guide, a counselor and a catalyst.

Current research in my lab centers on improving the value of analyzing trace evidence. Specific projects are: evaluation of micro-spectroscopy for the characterization of dyed fibers, developing analytical methods for forensic laboratories in emerging countries, investigating the counterfeit drug problem, and establishing methods for determining match criteria related to trace evidence comparisons.

Marcel Roberts, PhD (Boston College)
Assistant Professor of Biomedical Engineering

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 and food safety. My interest and love for science is linked to my love for science fiction and all things geeky and nerdy.

Daniel Yaverbaum, MS (City College of New York), **MPhil** (Columbia University Teachers College)

Lecturer of Physics

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

Currently in my lab, we are organizing and analyzing the data taken from the 70-odd students who participated last semester in a project known as "Transforming Reference Frames." This project seeks to probe student mental models regarding Galileo's Principle of Relativity. This spring, we expect to set up and start using 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 of Chemistry

Areas of Expertise: Inorganic/organometallic chemistry, inorganic forensic analysis, fluorescence sensors and supramolecular chemistry

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 exactly the things around us are. I believe it was the curiosity that made me learn chemistry very well and eventually choose the chemistry major in college. I started doing my research when I was a sophomore in the research laboratory of an organic chemist, Prof. Yuan, for the synthesis of a medicinal intermediate, 7-chloro-8-methylquinoline. I was able to complete the synthesis of this molecule after winter and summer breaks and then I worked on my thesis under the supervision of a physical chemist for the thermochemical study of a metal-amino acid complex, which resulted in the publication of my first journal article. Going to a graduate school was quite straightforward and then I got the chance to perform cutting-edge research in chemistry involving synthesis, structures, luminescence and other physical properties of metal-organic complexes. Further research experiences in China, Switzerland and United States have built me up with a really international profile.

It has been exciting running my own research laboratory since Fall 2013 at John Jay. Currently in my group we are interested in many aspects of synthetic chemistry of metal-based compounds and their applications in forensics, catalysis and luminescence. Students in our group will receive broad training including synthesis, fluorescence sensors, metal catalysis, crystal engineering, and inorganic forensic chemistry. Hands-on research experience in modern synthetic techniques including Schlenk line and glovebox operations, and a variety of spectroscopic techniques (NMR spectroscopy, gas chromatography-mass spectroscopy (GC-MS), high-performance liquid chromatography (HPLC), FT-IR, UV-Vis and fluorescence spectroscopies) will be invaluable to the careers of my students.

Program Information and Staff

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 of Criminal Justice. The Program was founded in the same year as the adoption of the course FOS 402: Undergraduate Research Internships, an expansion of the capstone offerings in the undergraduate Forensic Science major. These initiatives were part of a broader effort to encourage faculty-student research mentoring. PRISM was the outgrowth of a smaller undergraduate research initiative funded by the New York Education Department, CSTEP. CSTEP funding was critical to first establishing undergraduate research as an important component of the Department of Sciences, and CSTEP along with the US Department of Education and National Science Foundation have been critical support mechanisms contributing to the growth of this initiative. As PRISM has expanded, the number of students served by it has grown commensurately. In its first year of operation, PRISM realized an expansion of student participation from a handful of students a year to 19 students who actively participated in mentored research and several dozen additional students who participated in program seminars and training activities. In its most recent year of operation, 45 students have participated in mentored research and received research stipends, an additional 23 students have participated in research training activities, and well over 100 students have participated in program seminars and training activities. PRISM has been highly successful in increasing the number of students moving on to post-graduate education and successful careers in science. For more information, contact us at PRISM@jjay.cuny.edu, visit our website www.prismatjjay.org or 'like' our PRISM group on Facebook®.

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PRISM
at John Jay