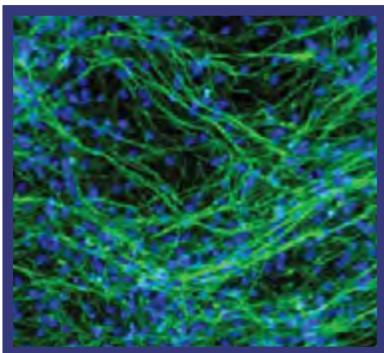
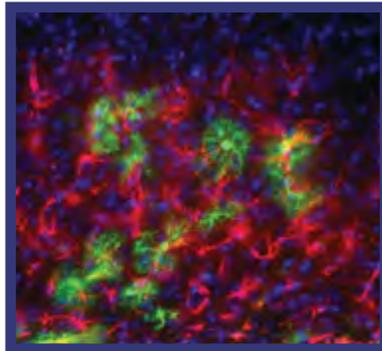




# undergraduate research

## CHRONICLE 2010



Program for Research Initiatives for Science Majors

# Welcome

I'm delighted to introduce the first PRISM student research Chronicle. Now in its fourth year, the Program for Research Initiatives for Science Majors (PRISM) was founded to improve and expand opportunities for students to participate in faculty mentored research. These opportunities not only provide student access to new equipment and procedures, they help build personal bonds between our students and faculty and help engage students in the practice of doing science. Thus, this Chronicle not only represents a culmination of the many achievements of our students, it is also a way to reach out to new students and demonstrate the diversity and depth of opportunities they have in our science programs.

I am particularly pleased to highlight the research projects collected in this issue as they represent a significant step in the growth of PRISM. Five of the students featured in this Chronicle have decided to pursue their studies via graduate school – a record number for our program. Danielle Scimeca, featured on page 15, has gone on to an MD/PhD program at the University of Miami. Jason Quiñones, featured on page 13, is now in his first year of a PhD program in Pharmacology & Toxicology at the State University of New York at Stony Brook. And Tee-shavi Narayne, Katherine Reynoso, and Amanda Vasquez, featured on pages 11, 14, and 16, respectively, have each moved on to masters and doctorate programs within the CUNY system. Other students, such as Nazia Mahmood (page 9), have opted to work in teaching or laboratory work while they prepare for graduate school.

I would like to take this opportunity to wish all of the students featured in this issue luck and progress in the coming year. And I also hope that new and continuing students see the opportunities that these research projects represent for them, and the successes that are possible in their lives. Enjoy.



*Anthony Carpi, PRISM Director*



# Undergraduate Researchers



Christina Hui

Our PRISM undergraduate students were involved in a wide variety of research projects in 2010. From studying the genetics of fungus to new fingerprint detection techniques to identifying pharmaceutical pollutants in water, students worked with mentors to design and implement research projects in criminalistics, toxicology, synthetic and environmental chemistry, and molecular biology. The progress and results have been impressive and show that these students are well on their way to promising careers in science. In the pages that follow, our 2010 PRISM scholars provide personal insight into what is driving them in their studies, and what research they have conducted at John Jay College.



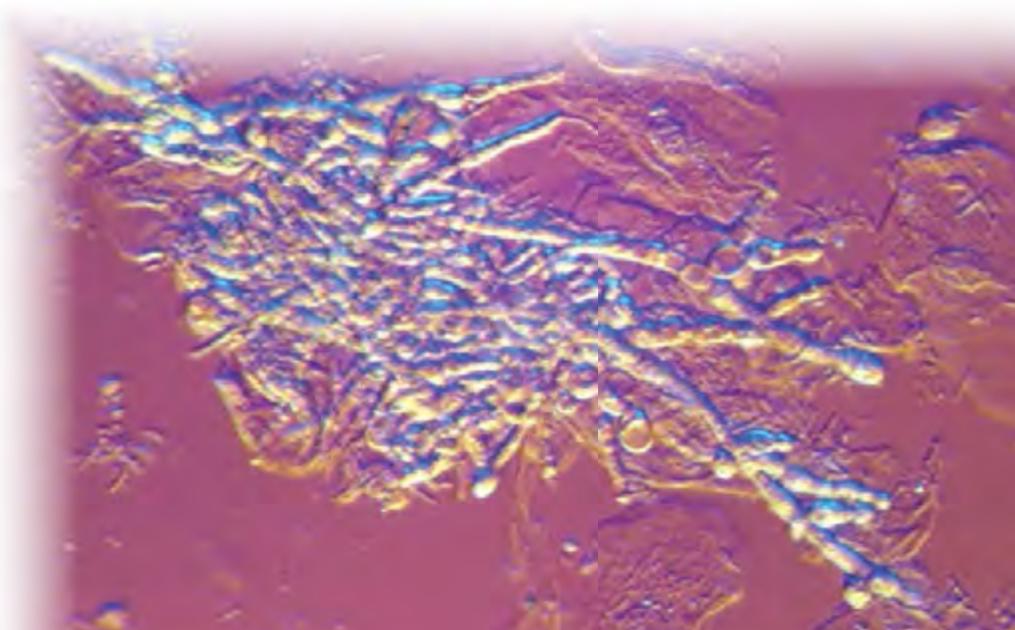
## CHANTEL AMARILLO

I am a senior student in Forensic Science – Molecular Biology Track – conducting my research in Dr. Jason Rauceo's lab, which works with the fungus *Candida albicans*. I became involved with the Rauceo lab when Dr. Rauceo asked me if I would be interested in an opportunity to conduct undergraduate research. After taking BIO103 with Dr. Rauceo, I discovered that I enjoyed his teaching style immensely and the manner by which he encourages independent thought. Understanding that all forensic science students must perform an internship or research, I decided that not only was the research offer necessary, but that I would be surrounded by good company;

including that of my research partner Leonid Sukala. As of now, this research experience has enriched my education at John Jay. My undergraduate research has been focused upon exploring the mechanism of SKO1 transcription via biomolecular methods. More specifically, how the relationship of transcription factor Rlm1p as a regulatory candidate of SKO1 is affected by Psk1 regulation.

### Genomic Identification of Putative Sko1 Promoters and Development of Low Copy Protein Extraction Protocol for *Candida albicans* (Dr. Rauceo)

*Candida albicans* is an opportunistic fungus, which resides throughout the human body. The cell wall is fundamental for maintaining fungal homeostasis, cell shape, and interaction with the external environment. The broad aim is to understand the mechanism of maintaining cell wall integrity upon anti-fungal drug treatment. We have previously identified the novel Psk1-Sko1 cell wall damage signaling pathway, which maintains dynamic cell wall structure in response to the anti-fungal drug caspofungin. Our current objective is to determine molecular mechanisms that underlie the Psk1-Sko1 cell wall damage signaling pathway. Two separate strategies have been employed to explore the interactions of Psk1-Sko1 components. First, in silico analysis was used to identify a putative Sko1 DNA – binding sequence in Sko1-target gene promoters. Using the web resource Regulatory Sequence Analysis tools ([\[rsat.ulb.ac.be/rsat/\]\(http://rsat.ulb.ac.be/rsat/\)\), we have identified the binding sequence T\(G/T\)ACGT\(A/C\)A in 60.95% of Sko1 dependent genes. Conservation of the aforementioned promoter sequence in the baker's yeast \*Saccharomyces cerevisiae\* suggests a conserved Sko1-DNA binding interaction. Second, a novel protocol was developed to extract low copy proteins from \*C. albicans\*' cells. Previous attempts to extract low copy proteins utilized harsh and time-consuming methods. Our strategy uses a commercially available mild detergent \(Y-PER yeast protein extraction reagent Pierce\) reagent. Immunoblotting tests show Transcription factor Sko1p was extracted in yields comparable to other traditional protocols. Ongoing experimentation will evaluate the efficacy of the developed protocol upon extraction of other low copy transcription factor and kinases predicted to be part of the Psk1-Sko1 signaling pathway.](http://</a></p>
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## DAVONNE AUGUSTE

I am a forensic science student specializing in toxicology at the John Jay College of Criminal Justice. As an international student from St. Lucia, I chose this field because of the growing need of experts in the field of Forensic Science in the Caribbean Region. My career objective is to be able to provide effective service to the people of St. Lucia. My ultimate career goal is to become an environmental toxicologist. Ever since I became aware of global warming, the passion which I have developed for the environment is beyond comprehension. Through the undergraduate research that I have been doing at John Jay College over the past two years, it puts me in a well rounded position to gain the necessary skills and experience that is required to be effectively applied in graduate school.



### Studying the Effect of Illicit Drugs on Human Hair Melanin Using Infrared and Raman Spectroscopy Techniques (Dr. Kocak)

Melanin is the major pigment found in the skin, hair, and eyes of human beings. Although significant research on the drug interactions with melanin has been conducted, it is still unclear as to what extent these interactions affect human hair from different ethnic backgrounds. Illicit and antipsychotic drugs may bind to the melanin of human hair, however the mechanism of this binding is not clear and it may differ depending on the ethnic background of the individual. Advances in the understanding of the binding effect of these drugs can be important as forensic evidence in the court room. In this research, melanin will be

reacted with cocaine and morphine at various pH ranges. First with synthetic melanin and then with melanin extracted from hair samples obtained from people of different ethnicities. The results obtained will be compared and analysed with pure melanin before and after the reactions. Successful completion of this project will allow for the understanding of the processes involved in drug incorporation with melanin of different pigmentations. This would yield a greater understanding in the biases that may be involved with drug hair testing and facilitate the detection of drug concentration across various ethnicities.

## MANUEL CHAPARRO

When I was a junior at John Jay College, I learned that students could get involved in the research that science professors were conducting and immediately became interested. Since we work a lot with microscopy and trace evidence in Criminalistics, I wanted to be involved in research that was along the same lines with what I was studying. I asked around and found out that Dr. Petraco, my former General Chemistry professor, was conducting research on statistical analysis of tool mark striation patterns using microscopy. I joined his research team and, after some training, began scanning and analyzing patterns. I have learned a lot working with Dr. Petraco, and am continuing to learn as we push the research further.



### Statistical Analysis of Screwdriver Striation Patterns (Dr. Petraco)

Trace evidence is a very controversial form of evidence because of the lack of research behind its analysis. For example, tool marks left behind by a screwdriver. Most, if not all, screwdrivers look exactly alike to the naked eye, so how is it possible to tell one screwdriver from another when trying to identify the screwdriver used at a crime scene? My mentor and I are performing research which involves the statistical pattern recognition of striation patterns (lines/grooves) of tool marks (screwdrivers, specifically). When screwdrivers are made at a factory it is hypothesized that they are never made exactly the same. There are always some imperfections to them. These imperfections should make each and every screwdriver unique. This unique-

ness is valuable in discriminating one screwdriver from another, and arguably become more valuable when a screwdriver is scraped along a surface and a striation pattern is created. In this study we propose to use a light section microscope to visualize and measure the surface profiles of striation patterns made by screwdrivers. The striation pattern will be recorded digitally, and the position and widths of each line/groove will be measured using 3D metrology software. We will then use mathematics of machine learning to analyze the surface profiles we collect. Ideally we want to use an algorithm which does not need to be trained to recognize patterns, which would provide a completely objective and unbiased measure of striation pattern similarity.



## ROSELYNN CORDERO

At fifteen sitting in the back of Ms. Khan's chemistry class, I knew that this subject, although challenging, was going to be the grounds for my success. It was a revelation that came to me so early in life that from that moment on I dedicated my high school career to earn the grades that would get me into the college that was going to nurture my flair for science. Two years later, I enrolled at John Jay College for Criminal Justice and majoring in Forensic Science. It has opened my eyes to so many opportunities that were not available to generations of scientists before me. Forensics was a fresh and new approach that involved all disciplines of science implemented in the form of justice and the legal system. My future plans after receiving my bachelor's degree in Forensic Science is to continue my education at the graduate level in Chemistry. I wish to become a Forensic Chemist and continue as a researcher, as well.

### Fingerprinting Analysis with an Automated Identification System: AFIX (Dr. Proni)

Currently on the market, there are many programs used for fingerprint analysis. These programs are branches of the IAFIS, the fingerprint database used in the FBI. It is of vital importance to determine how reliable each system is. A PC-based system called AFIX-Tracker®, a minutiae-based fingerprint identification system developed by AFIX Technologies, is used in this research project. The present investigation aims to understand if the AFIX-Tracker, Version 5.7.3 performs better during the fingerprint matching after a manual or an automatic minutiae extraction and to compare the results with the ones obtained with the previous version (4.0) of the software. In particular, I am

focused on searching 1,000 rolled prints against a database of pressed fingerprint; in this analysis the minutiae will be extracted manually or with the help of the Smart Extract feature included in the software package. A biographical and a latent prints databases which are uploaded with 1,000 fingerprints are used in this investigation. Pressed prints will be used to imitate latent prints while rolled pressed will be used to populated the biographical database. The results obtained from version 4.0 found that the manually extracted minutiae provided better results than the smart extract feature.



PRISM students at work in the lab



## CARLOS CUELLAR

I was born in Cali, Colombia. At the age of 9, I came to live in New York and through the years living here I started to integrate more into the culture. After I graduated from high school, I decided to go to John Jay College and study Forensic Science because I really enjoyed the chemistry classes that my high school offered. In my senior year at John Jay, I decided to do research on how fungicides potentiate the effects of MPTP, a compound that is known to cause Parkinson's disease. I found this research project to be really interesting. At the moment I am really excited that at the end of this research project we might develop a protein mechanism that could result in a better understanding of the toxic effect these fungicides have on neurons. After I graduate, I plan to go to graduate school and do more research in molecular toxicology.



### Analyzing the Role of Alpha-Synuclein and Dopamine Transport in the Toxic Effects of Dithiocarbamate Compounds on Human Embryonic Kidney (HEK293) cells (Dr. Cheng)

Studies have shown that exposure to fungicides such as dithiocarbamate compounds can potentiate the effects of neurotoxin 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) on dopaminergic neurons in mice which can eventually lead to neurodegeneration and develop Parkinsonism syndrome. Dopamine transporter (DAT) is a protein known to play a role in MPTP's toxicity by transporting MPP<sup>+</sup>, the metabolite of MPTP, into dopaminergic neurons. Alpha-synuclein, a DAT-interacting protein, can mediate the recruitment or maintenance of DAT on the cell surface, and may be critically involved in the toxic effects of dithiocarbamate compounds. Our preliminary data from Cheng's lab demonstrate that maneb (MB) and mancozeb (MZ), the Mn-containing dithiocarbamates, enhance MPP<sup>+</sup>-induced cell death in Human Embryonic Kidney (HEK293) cells. However, the neurotoxic molecular mechanisms involved in the action of

these dithiocarbamate toxins are still not clear. Our hypothesis is that MB and MZ increase the interaction of DAT and alpha-synuclein followed by increasing cell surface DAT expression which in turn enhances MPP<sup>+</sup> uptake and cytotoxicity. Co-immunoprecipitation/Western blot analyses were performed to study this interaction of alpha-synuclein and the dopamine transporter on HEK293 cells. Cells were treated with 20 μM of MB and MZ and 75 μM of diethyldithiocarbamate (DDC) for 1 hour at 37 °C/5% CO<sub>2</sub>. After treating the cells with the fungicides, cell lysates were subjected for co-immunoprecipitation by anti-DAT antibody. Co-immunoprecipitated proteins were separated on SDS-PAGE and then transferred to nitrocellulose membrane for Western blot analysis. Western blot showed an increased in the interactions of alpha-synuclein and DAT after MZ treatment.

## EUGENE GONZAELES-LOPEZ

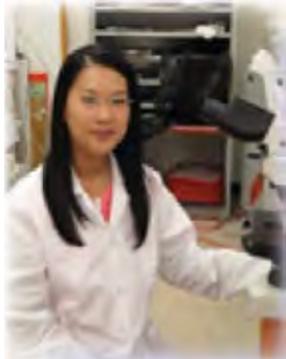
I have always been fascinated by the complexities that surround me. This fascination led me to the sciences. I couldn't believe how it branches off into an interconnected web of different specialties. Chemistry is by far my favorite. I love synthesizing reactions and figuring out how other molecules came to be. Chemistry is everywhere from the Haloform reaction which purifies our water to the way we analyze blood at a crime scene. I want to improve old techniques and create new ideas for research. A place where anything is possible and thinking outside the box is the only prerequisite.



### Zinc Porphyrin Tweezer in Host-Guest Complexation: Absolute Configurational Assignment of a Self-Assembling, Light Harvesting Porphyrin by Circular Dichroism (Dr. Proni)

In order to trap the energy from sunlight, antenna plants construct chlorophyll group from chemical self assembly in a highly ordered manner. 10,20-bis(3,5 di-tert-butyl-phenyl-15-acetyl-5-(hydroxyethyl)-porphyrin 1 is a "synthesized" compound tested for harvesting solar energy as an alternative to silicon-based photovoltaic devices. The determination of its absolute configuration is of academic and practical importance. The absolute configuration determination could be achieved by means of a supramolecular approach developed in the last decade. The protocol relies on a host-guest complexation mechanism between an opportunely derivatized chiral substrate ("guest") and

a dimeric zinc porphyrin host that acts as a "receptor." The two porphyrins in the complex adopt a preferred helicity related to the substrate's absolute configuration. The relation between the absolute configuration of the substrate and the inter-porphyrin helicity is predicted by molecular modeling studies. Specifically, porphyrin derivative 1, needs to be coupled with a bidentate carrier to form the bifunctional amide conjugate 2. Once the conjugate molecule is complexed with the achiral CD sensitive host, the Zn porphyrin tweezer, it yields a host-guest complex that exhibits intense negative or positive exciton-coupled CD in accordance to the absolute configuration of the substrate.



## CHRISTINA HUI

Christina Hui resides in New York City and came to John Jay in 2006. She is currently a senior and is studying to obtain a Bachelor's Degree in Forensic Science. Her focus in the major is the criminalistics track. Ms. Hui currently does undergraduate research with Dr. Anthony Carpi on the study of mercury emissions from sand and soil surfaces. She is also a member of the Forensic Science Society at John Jay. She was originally interested in a career as a veterinarian until she learned about the field of forensic science. When not in the lab or studying, she enjoys the hobbies of photography, drawing, and painting. Once her major is completed, she looks forward to pursuing a higher education in graduate school, specifically in the field of chemistry.

### Mercury Emissions from Sand and Soil Surfaces in Response to Precipitation Events (Dr. Carpi)

In the past, increases in mercury (Hg) emissions have been observed to occur following natural and artificial water addition to soil surfaces. To investigate the source of those increases, individual experiments were performed. Soil and sand samples were agitated with a Teflon rake and later Millipore water was added in a separate experiment. The Hg sample emissions were monitored using individual dynamic flux chambers (and a Tekran Mercury Vapor Analyzer unit). Before each experiment, samples were allowed to reach a 'steady state' of mercury flux prior to being kept in a 24hr dark period (with following light exposure). The agitation of the samples was performed to investigate a formerly suggested hypothesis that increases in Hg emissions (result of natural/ artificial irrigation) was due to the release of interstitial soil gas. The result was an increase of mercury emissions from 0.684 to 14.26 ng/m<sup>2</sup>/hr for the soil sample. The irrigation of the samples using Millipore water in the second experiment (30ml/100g sand) initially increased Hg emissions from 0.51998 to 21.730 ng/m<sup>2</sup>/hr for the soil samples within the 24hr dark period. This flux then decreased until light was introduced. Following this, an immediate increase in emission readings from 12.514 to 816.66 ng/m<sup>2</sup>/hr was observed for the soil sample. It is possible that many mechanisms including the release of interstitial soil gases contributed to the large Hg emission increase seen as a result of the water addition. Exact sources, however, cannot be concluded from the results obtained and further experiments will be necessary.

## TALI KLEPISZ

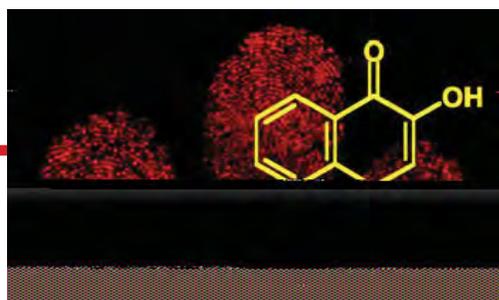
I was born and raised in Melbourne, Australia. I developed an interest in Forensic Science at a young age, when a local scientific research organization, the CSIRO, made a visit to my school and demonstrated some forensic science techniques such as latent fingerprint dusting and microscopic analysis. After graduating from high school in 2004, I decided to travel to New York for a few months' vacation, while deferring my placement in a Biomedical Science Degree in Melbourne. After hearing about the Forensic Science program at John Jay College of Criminal Justice, I decided to stay in New York, relinquish my place in the course at home and enroll in the Forensic Science program at the college, as Forensic Science courses are limited in my hometown. Currently a junior at the college, after I graduate I hope to go on to a graduate degree and work in the field of criminalistics.



### Novel Reagents to Detect Fingerprints: Preparation and Characterization of a Chemical Derivative of Lawsone (Dr. Proni)

Fingerprint comparison is still one of the most useful techniques for the identification of possible offenders. Because not all fingerprints can be detected easily, a wide range of optical, physical and chemical techniques have been presented for the detection and enhancement of latent (hidden) fingerprints. In particular, fingerprints on porous surfaces (cardboard, paper) demand a chemical development to be examined. It is known that each fingerprint contains an average of 250 nanograms of aminoacids, AAs. Research has focused in developing reagents that react with the AA residues in the print and produce colorful and/or luminescent compounds. 2-hydroxy-1,4-naphtoquinone, commonly called lawsone was proposed last year as a reagent

to detect fingerprints. It is extracted from the leaves of *Lawsonia inermis* and is usually responsible of the staining properties of henna. This very promising reagent seems to combine ease of application with a high sensitivity. The only drawback is its solubility; a high concentration of polar solvent is required to dissolve the molecule which may cause an unfavorable ink-running on documents. This research proposal has the main goals of preparing and characterizing with different spectroscopic techniques the derivative of lawsone shown. In addition, the compound will be used to stain fingerprints, and the investigator will record the fluorescent light emitted by them.



## SANDY KONG

My father passed away due to liver cancer when I was 12 years old. My grandparents also passed away because of cancer. So cancer became my enemy since I was little because it took away three of my loved ones. I met Dr. Champeil in Organic Chemistry I. Some of my friends had begun researching with professors already and I asked Dr. Champeil if she wanted to be my mentor for research. It turned out that she was working on an anti-cancerous drug called mitomycin C which triggered my interest immediately. This project allowed me to learn lots of techniques and gain knowledge that could not be taught in a regular science class. This research project also allows me to understand how unpredictable and complex chemistry is. After this research project, I would like to dive into research that is more forensic in nature with my research partner, Elaan. After I graduate I would like to go to medical school. PRISM has helped me a lot by providing opportunities to explore the fascinating world of science.



*See shared abstract below.*



## ELAAN LUKASIEWICZ

I major in Forensic Science, in the Criminalistics track. My curiosity for the sciences started at age 7 when my grandmother bought me a toy microscope. The microscope came with blank slides which I used to examine blood and carpet fibers. Without even knowing it I was examining trace evidence and I enjoyed it. As I continue my education at John Jay, my knowledge and love for the sciences grow. For the past year I have been doing cancer research with Dr. Champeil. I am also a teacher's assistant for Organic Chemistry. I am looking forward to graduating from John Jay College in Spring 2011. After graduation I plan on attending John Jay College for graduate school.

### **Synthesis of an Oligodeoxyribonucleotide Adduct of Mitomycin C by the Postligomerization Method via a Triamino Mitosene (Dr. Champeil)**

The tert-butyl ammonium fluoride, TBAF deprotection was tested in a model system with a derivative of Mitomycin C, hydrolyzed MC. The deprotection with hydrolyzed MC was successful by adding TBAF, DMF, and DBU. However, the deprotection of the sample by TBAF generated fluoride ions in the sample. The scavenger method and sep-pak were employed to trap and eliminate the fluoride ions. The scavenger method used DOWEX (an ion transfer reagent) and calcium carbonate were added to the sample with methanol and stirred for an hour. The removal of fluoride ions was verified by thin layer chromatography with solvent of 10-17% of methanol, 3-6% of ammonium hydroxide, in dichloromethane. During the last trial to eliminate the fluoride ion, sixteen equivalents of DOWEX and calcium carbonate were added. For unknown reasons, the DOWEX trapped the sample instead. The attempt to extract the sample from DOWEX with concentrate acid and base was not successful. A sep-pak system was employed to trap the fluoride ions instead. The results from sep-pak were verified by UV-Spect. and NMR data that the correct product was generated.

However, the process of purification did not eliminate other impurities efficiently. The sep-pak system was employed in the MC derivative and on the MC drug itself with success. Prep. TLC was used to further eliminate undesirable by-products. 20% methanol in chloroform was used to separate different products due to their unique polarity. The product would separate into few bands and the desired band would be scrapped out for filtration with 18% methanol, 3% ammonium hydroxide, in chloroform. The filtrate would be evaporated by roto-vap and diluted with minimum amount of methanol and sent for MS. The results that were obtained from the above analytical techniques showed that the correct product was obtained. However, further verification through MS and CD spectrometer and purification of the product would have to be done to reach a satisfactory result.

## LIDISSY LIRIANO

I'm pursuing Criminalistics in the Forensic Science major. I've wanted to pursue this field since sophomore year of high school, and I was happy to know that CUNY offered an affordable program in John Jay College. I have a lot to be grateful for, thanks to John Jay. I'm able to participate in research with the PRISM program, an occurrence that I never thought would arise. I'm also appreciative for the active way of learning I'm provided, by applying what I've learned in the science lecture classes to the labs. My goal is to take all I've learned in this program and become a Medical Examiner.



### Developing a Simple Method to Process Bone Samples Prior to DNA Isolation (Dr. Li)

Bone tissue is often used for recovering DNA samples for the purpose of human identification. However, the initial cleaning and sampling of the bone specimen is a labor-intensive and time-consuming step, which must be completed prior to isolating DNA. To address this issue, we are developing a simple processing method using an enzymatic treatment prior to DNA isolation. The use of the enzyme-based procedure reduces the amount of labor required by a physical method. The processed bone fragment or a portion of the fragment can then be used for DNA isolation.



## MICHAEL LUGO

I entered John Jay College in 2007 within the Forensic Science major and in the Honors Program. As time passed, my interests in DNA, genetics, proteins, and biology led me into the Molecular Biology track, even though I have a strong love for chemistry. In addition, my love for studying the deceased has led me into pursuing medical school to study pathology where afterward I hope to become a Medical Examiner. Currently, I am involved in research with Dr. Lents working on biological-related projects. In addition, I tutor most science classes, and all math subjects including calculus. I am a lab technician — a position that aids students in science lab by preparing experiments, and answering questions whenever necessary. Along with two fellow classmates and good friends, we teach an Organic Chemistry recitation class in a newly formed peer-led recitation program. In terms of clubs, I am Vice President of the Pre-medical Society. Outside of academics, I enjoy making and writing music — especially playing the guitar — and am into various sports, like skating, contact sports, and martial arts. Finally, as a volunteer nurse assistant, I also aid patients in Coney Island Hospital. Overall, every aspect of my academic career will help me in reaching my ultimate goal in becoming a Medical Examiner.

### A Study of CCN2 Protein Expression as Regulated by MZF-1 Induction (Dr. Lents)

The protein, CTGF, has been found within thrombocytes, but not in megakaryocytic cells, which seems to suggest a different pathway to which CTGF is taken up by the thrombocytic cells. It is possible that megakaryocytic cells are involved in a signal mechanism in which they signal the production or excretion of CTGF from other cells, including chondrocytes. The initiation of this mechanism may possibly be from a transcription factor known as MZF-1. Using two cell lines, HeLa and 293 cells, the presence of MZF-1 and CTGF will be probed for through Western Blot Analysis. Chromatin will also be qualitatively analyzed for the presence of MZF-1. Finally, a quantitative analysis of the cDNA (retrieved from untreated and treated chondrocytes and megakaryocytes) will be performed to determine the effects of enhancers and repressors on MZF-1.



Amanda Vasquez

The PRISM Undergraduate Symposium offers students the opportunity to speak about their research, in depth, with peers and faculty. For many students, the experience of discussing their work in this Symposium provides invaluable training for communicating science, attending scientific conferences and interviewing for graduate programs.



### NAZIA MAHMOOD

I earned my bachelor's degree *Suma Cum Laude* in Forensic Science – Toxicology in May 2010. Having my basic education from Pakistan, I joined John Jay to pursue my passion for sciences and complete my education after an 8 year study break. The possibility to conduct scientific research, create my own experiments, and pursue a career as a scientist compelled me to choose Forensic Science as my major. Under PRISM, I got the opportunity to quench my thirst for research as an intern with Dr. Yi He. I worked on development of elemental fingerprints of beer samples for forensic identification and individualization and won an EAS Student Research Award in 2010. I am determined to pursue advance education and excel in my chosen career in pharmacology.

### Determination of Trace Metals in Beer Using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) (Dr. He)

Determination of trace metals in beverage samples is important in forensic toxicology analysis since essential "fingerprint" information can be derived for unknown identification and individualization. Beer is a popular and largely consumed alcoholic beverage all over the world. This study was designed to quantify eighteen common trace metals in commercially available beers purchased in New York City. These metals are Arsenic (As), Antimony (Sb), Beryllium (Be), Bismuth (Bi), Cesium (Cs), Cobalt (Co), Cadmium (Cd), Indium (I), Molybdenum (Mo), Mercury (Hg), Lead (Pb), Selenium (Se), Uranium (U), Barium (Ba), Chromium (Cr), Nickel (Ni), Vanadium (V), and Zinc (Zn). Forty beer samples were categorized into alcoholic and nonalcoholic groups based on their alcohol content and analyzed. Beer samples were digested with optima grade nitric acid ( $\text{HNO}_3$ ) and hydrogen peroxide prior to analyzing by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). All the elements were quantified by external calibration method and a NIST multi-element standard (SRM 1643E) was frequently checked to validate the analysis.



## AMORA MAYO-PEREZ

Amora Mayo-Perez is a Forensic Science student graduating in May 2011. Amora comes to John Jay pursuing a second undergraduate degree, a Bachelor of Science. Her first degree is a Bachelor of Arts from University of Massachusetts–Amherst in Psychology and Sociology. Amora has been working on Mercury-related research in Dr. Anthony Carpi's lab since 2008. She is also a College Laboratory Technician for the Science Department. In addition to being a PRISM and CSTEP research recipient, Amora is also an Executive Member of the Forensic Science Society. In her final year at John Jay, Amora will study both Toxicology and Molecular Biology.

### The Potential Role of Silicon Dioxide as an Oxidizing Surface in Strong Sunlight: Studies on Mercury Behavior (Dr. Carpi)

As part of an ongoing multi-year study at the Blackrock Research Forest in Cornwall, NY we have identified an atypical response of mercury deposited to pure silicon dioxide sand surfaces in strong sunlight. Pure laboratory sand was pre-cleaned by baking the surface to 300°C and then placed outdoors under a transparent Teflon roof to study the dry deposition of mercury to this surface. Typically, mercury from natural surfaces demonstrates increased emission to the atmosphere in strong sunlight, with the response trending toward deposition after sunset (Carpi & Lindberg, 1998). Over a 30 day period during March and April 2007, our sand surface displayed ten days of irregular flux patterns. The study shows consistent negative fluxes until mid afternoon and positive fluxes from approximately

sundown until midnight. The process is not fully understood. Negative fluxes are attributed to greater mercury concentrations in the environment compared to the surface of the sand. Positive fluxes are representative of mercury emissions from the surface of the sand compared to the surrounding mercury concentrations. The irregular flux patterns occur on ten separate days with corresponding trends at the same times-of-day. Data from The International Research Institute of Climate and Society, which monitors atmospheric trends in the Blackrock Forest, is being used to determine the association between barometric pressure, precipitation, temperature fluctuations, sunlight, and uncharacteristic mercury fluxes.

## DOMINIKA MUCHA

I am a Forensic Science Toxicology/Molecular Biology student at John Jay College. After obtaining my Forensic Science degree, I intend to pursue a PhD in pharmacology. I inherited my fascination with science from my mom, an inorganic chemist, when I was only 5 years old and living in Poland. Throughout my undergraduate career, I have worked towards nourishing my understanding of science as demonstrated by my academic accomplishments. In order to advance my studies, under Dr. He's supervision, I began a research project of my own. I am currently conducting research on the determination of trace level residues in natural water samples. My academic and research experiences have allowed me to pursue numerous educational pathways on my road to personal fulfillment.



### Pharmaceutical Pollutants in Water Samples (Dr. He)

A method was proposed using High Performance Liquid Chromatography (HPLC) coupled with Ultraviolet (UV) Detection for the detection of eight acidic, over the counter drugs. The analysis of ibuprofen, naproxen, meclizine, acetyl salicylic acid, omeprazole, clotrimazole, loratadine, and doxylamine succinate were all confirmed according to their literature  $\lambda_{max}$  values on the Ultraviolet (UV) instrument. Concentration samples of 1ppm dissolved in methanol were analyzed for the above acidic drugs: ibuprofen (263 nm), naproxen (260 nm) meclizine (232 nm), ace-

tyl salicylic acid (295 nm) omeprazole (290 nm) clotrimazole (252 nm) doxylamine succinate (265 nm) and loratadine (278 nm) respectively. The results obtained demonstrated a  $\lambda_{max}$  which were successfully applied to the HPLC's parameters for the corresponding drugs. A liquid-liquid-liquid micro-extraction (LLLME) will be optimized for enrichment purposes. The method will be further applied to water samples from rivers, lakes, and sewage plants for the determination of drug contamination.



### TEESHAVI NARAYNE

At 23 years old, I am proud to be pursuing my dream of being a part of the wide field of forensic science. At first the college experience was a struggle and I fought to find myself during the first two years. It was only during my instrumental analysis class that I discovered my deep love and appreciation for the field of Forensic Toxicology. Following that I decided to pursue research with my instrumentation professor and now my mentor Dr. Yi He. Research with Dr. He has given me a great sense of achievement, knowing that our research projects can actually impact and benefit the world. Now as a senior in the Forensic Science program, I feel that I have begun to see the light at the end of the long and winding tunnel of my academic dreams. My hopes are that over the next few years I will be able to emerge from this tunnel with my Masters Degree and a deeper sense of accomplishment.

#### Quantitative Determination of Gamma-Butyrolactone in Beverages by Colorimetric Method (Dr. He)

Gamma-butyrolactone (GBL) is determined quantitatively in beverages by colorimetric method. A UV/VIS spectrometer is used to analyze the purple ferric ion complex that was the product of the reaction of GBL with hydroxylamine-HCl and ferric chloride in samples. The main goal of the research will be to quantitatively determine the concentrations of GBL in each sample using the generated calibration curve. A stock solution of the wine beverages will be at 1500mg/l using 33ul of GHB solution in 25ml of ultra high purity water. From this stock solution there will be various serial dilutions made from 1400mg/l to 300mg/l or 400mg/l depended on the relative standard deviation

values for the lowest concentration created. A relative standard deviation of the lowest concentration should be above 10% to ensure a proper R-squared value, and above 5% for the preceding concentrations. The stock solutions of the wine have been altered from the original procedure due to various interferences due to the deep rich color of red and some white wines. The values of the concentrations versus the absorbance averages will be plotted on a linear curve and the R-squared values will be calculated to ensure efficiency and accuracy of the method. The analysis results showed good linearity ( $R^2 \geq 0.995$ ) and precision ( $RSD \leq 5\%$ ) sensitivity of the method.

### WILLIAM NG

My name is William Ng. I am an undergraduate upper senior pursuing my Forensic Science degree in Criminalistics. My collegiate career has been an interesting and long journey. After attending Clarkson University and Kingsborough Community College, I took a break from school to figure out what I really want to do with my life, professionally. However, the short break became a five year hiatus from school. With the decision that the field of forensic science is the right path for me, John Jay became my third college. After graduation, I hope to obtain a position in the crime lab of the NYPD or FBI and eventually earn my Master's Degree in Criminalistics.



#### *In-vitro* Studies of DNA Damage Caused by Tricyclic Antidepressants; Role of Peroxidases (Dr. Korobkova)

The root causes of depression include genetics, the environment and chemical imbalance. Chemicals called neurotransmitters send messages through the synapse, which is a gap between the neurons. The onset of depression occurs when the improper amount of neurotransmitters are released. Antidepressants are used to correct the abnormality by increasing the brain chemicals or enhancing the strength of the receptor sites to process signals. Mild side-effects are associated with most medications, like dry mouth, drowsiness, and loss of appetite. This research focused on DNA damage caused by more serious effects of the medications. We studied the potential DNA damage caused by imipramine, amitriptyline, opipramol, and protryptiline. Agarose gel electrophoresis experiments indicated that reactions between DNA and imipramine catalyzed by horseradish peroxidase (HRP) in the presence of hydrogen peroxide have led to complete disappearance of the DNA band. This effect was due to the displacement of ethidium bromide from the DNA double helix. Incubation of HRP in the presence of excess of  $H_2O_2$  led to the formation of purple color and the absorption spectrum with the maximum wavelength at 522nm. The spectrum grew with time. We suggest that this spectrum is due to the presence of imipramine radical formed during HRP catalysis. No DNA band disappearance or purple color was observed in the case of the three other drugs. This reactive intermediate species probably forms covalent complexes on DNA, which may prevent DNA from normal functioning.



## RICHARD PISZCZATOWSKI

I began my undergraduate studies at John Jay College in 2007, pursuing a degree in Forensic Science with a focus on Molecular Biology and a minor in Anthropology.

Towards the end of my first year, it became evident to me that my place in life was as a physician, helping those in need. Participating in numerous extra-curricular activities

throughout my undergraduate career has exposed me to many people, places and points of view. Volunteering at my local hospital, serving on the John Jay Pre-Medical Society board, and shadowing physicians has given me first hand experience of, and newfound respect for the medical field. Partaking in undergraduate research through PRISM, mentored by Dr. Nathan Lents, has taken my passion for the sciences to a new level. All of these activities along with my studies have helped me develop into a dedicated student, with an aspiration to pursue a degree in medicine, and eventually become a surgeon.

### The Role of MZF-1 as Part of a Signaling Mechanism for the Endocytosis of CTGF by Thrombocytes (Dr. Lents)

Connective Tissue Growth Factor (CTGF) is a protein encoded by the CTGF gene. CTGF plays a critical role in cell adhesion and proliferation, which explains its abundance in thrombocytes, also known as blood platelets. Blood platelets are created by megakaryocytes located in the bone marrow, and have been found to contain abundant amounts of CTGF while in the blood. However, current research shows that when blood platelets are created by megakaryocytes, they do not initially contain CTGF, nor do the megakaryocytic cells produce CTGF. Thus, blood platelets must acquire CTGF from an external source via endocytosis, and the megakaryocytes must provide some sort of signaling mechanism to initiate the production and excretion of CTGF by nearby cells.

This research project will attempt to show that MZF-1 (Myeloid Zinc Finger-1), a protein made by megakaryocytes that acts as a transcription factor to affect the production of various genes, affects the fabrication of CCN2 at the transcription level of cells in the vicinity of megakaryocytes. MZF-1 may be a possible contributor to the communication between megakaryocytes and other bone marrow cells to produce and provide the CTGF protein to thrombocytes. Identification and confirmation of MZF-1 as a transcription factor of the CCN2 gene may open the door to a new look at the development of blood platelets, as well as the entire blood clotting cascade. Results from this research project may have clinical implications as well, as MZF-1 may provide a new outlook on how to approach poorly acting blood platelets as well as a possible factor in the maintenance of proper hemostasis.



## JASON QUIÑONES

Doing undergraduate research has opened an array of opportunities to elevate my skills and knowledge as a promising scientist who has the potential to continually be at the forefront of my field. The Forensic Science major and its rigorous curriculum has exposed me to a taste of the major branches of science, allowing me to gain a feel for where I want to be positioned in the future. Hopefully I can use my research at SUNY—Stony Brook in order to hone my scientific skills and become a cutting edge scientist in the pharmacological/ toxicological fields.



### Understanding the Depth Profile of Elemental Mercury Emissions from Sand and Soil Systems and Its Relevance to Long-Range Environmental Effects (Dr. Carpi)

Mercury emissions from natural and anthropogenic sources pose a global problem. As a result, mercury contamination is the number one cause of fishing advisories in the United States. Once emitted to the environment, mercury enters into a complex biogeochemical cycle. Elemental mercury ( $Hg_0$ ) can be oxidized in the atmosphere and deposited to soil and aquatic systems after being transported over long distances (Novoa-Munoz, et al., 2008). Mercury in soil and water surfaces can be reduced to  $Hg_0$  and re-emitted to the atmosphere (Wood, 1974; Schlüter, et al., 1998). One major factor that appears to play a dominant role in the soil reduction process is light energy (Carpi & Lindberg, 1997; and Gustin, et al., 2002). Because the penetration of light into soil systems could have a significant effect on how much mercury is reduced to its volatile form, understanding the

depth profile of mercury reduction is critical to understanding its mechanisms. Mercury treated sand samples and untreated soil samples of varying depths (2 mm – 15 mm) were measured under a dynamic flux chamber to determine the affect of surface depth on mercury emissions. Mercury emissions showed an increase with depth for sand samples between 0.5 mm and 1.3 mm, but increasing depth had no affect on mercury emissions above 2 mm. No relationship between depth and average flux was found with soil samples, with all samples showing equivalent emissions regardless of depth (1.97 mm- 15.51 mm). This work suggests that the mercury emissions process is limited to the upper surface of soil systems, thus supporting the role of light as a dominant factor in the reduction process.

### Investigating the Synergistic Effects of Pesticides on 1-methyl-4-phenylpyridinium (MPP+) Cytotoxicity and Evaluating Their Effects on Cell Surface Dopamine Transporter Protein Expression in Rat Pheochromocytoma (PC-12) Cells (Dr. Cheng)

MPP+, the active metabolite of neurotoxin 1-methyl-4-phenyl-1, 2, 3, 6-tetrahydropyridine (MPTP), is known to induce toxic insult to dopaminergic neurons located in the Substantia nigra region of the midbrain. Dopamine transporter (DAT) required for dopamine (DA) re-uptake is important for MPTP toxicity. When DAT is expressed on the surface of neuronal cells at physiological levels, MPP+ follows dopamine entry into the cytosol where it then causes oxidative stress via disruption of Complex I in the electron transport chain of mitochondrion leading to cellular apoptosis. Several pesticides such as maneb (MB), mancozeb (MZ) and diethyldithiocarbamate (DDC) have been shown to be neurotoxic as well, resulting in the characteristic depletion of dopaminergic neurons observed with MPP+ toxicity. The deleterious effects on dopaminergic neurons posed by these

pesticides are consistent with physiological manifestations seen in the CNS of individuals with Parkinson's disease. In this study, several pesticides were evaluated for their potential to combine synergistically after treatment with non-toxic dose of MPP+. Cell viability and cytotoxicity were determined using trypan blue exclusion and MTT assay. Protein isolation was conducted with collected cell lysates followed by biotinylation of cell surface proteins. After isolation of biotinylated proteins, Western Blotting was performed to detect differences in the cell surface DAT expression for DDC, MB and MZ treated samples. Results showed that all three pesticide administrations were synergistically cytotoxic with non-toxic dose of MPP+ and lead to an increased expression of cell surface DAT, with MZ treated groups displaying the highest degree of cell surface DAT expression



### KATHERINE REYNOSO

It seems like destiny that I pursue a science career. In junior high school, I won two science fairs, one during the sixth grade in which I compared the abilities of different detergents on different fabrics, and the other during the eighth grade in which gravity based on weight and height was tested. Moreover, as an incoming student at the Gateway Mathematics and Science Program at Bayard Rustin High School for the Humanities, I was required to attend a summer session prior to the commencement of my ninth grade experience. It was extremely exciting for me to be in an actual cell biology lab. In one experiment performed in the lab, students extracted cheek cells from their mouth. It was the first time that I ever used a microcentrifuge. I was astonished by how we extracted the DNA from our cheek cells. That was

an incredible time for my early scientific experience, and even now I still have those cheek cells in a centrifuge tube somewhere in my house. Afterwards, I voluntarily signed up for scientific research during the tenth grade, in which I did research on DNA analysis on blood, semen, fingerprints, and urine samples in Forensic Science

### The Characterization of the Various Forms of Pokeweed Antiviral Protein (PAP) (Dr. Friedland)

This study aims to characterize the differences in the various Pokeweed Antiviral Protein's (PAP) isoelectric, SDS, and Native polyacrylamide gel electrophoretic behavior. Different forms of PAP are produced by *Phytolacca americana*, the plant from where PAP is extracted. These various forms of PAP are produced in numerous plant compartments of *Phytolacca americana*, such as in the stems, seeds, leaves, and the roots, during diverse stages of its growth cycle. Several forms of PAP are also seen when Pokeweed undergoes preprocessing cleavage in order to become fully functional and acquire its toxicity to cells, and as these toxins are being stored in cell walls and P-bodies in order to be allowed into the plant cells of *Phytolacca americana*. It is hypothesized that even within a single compartment, at any stage of the plant's development, PAP is expressed in diverse forms depending on what type of pathogen the plant has been exposed to. These pathogens include fungi, bacteria, virus, and/or pests. The physical characteristics of each form of PAP will be explored in purified mixtures since these may vary even within the same year's harvest. Once the isoelectric behavior of PAPs have been completed, their equilibrium binding properties with RNA caps and mRNA such as the Tobacco Etch Virus (TEV RNA) structural variants, which may be capped or uncapped will also be examined. These are known ligands for PAP.





### DANIELLE SCIMECA

In 2010, I began an MD/PhD program at the University of Miami, with a concentration in pharmacology. While at John Jay, I participated in two student-faculty research projects. One project was with Dr. Petraco, studying methods of statistical pattern recognition applied to the analysis of toolmark evidence. The other project was with Dr. He, involving the use of ionic liquids in analytical toxicology. Through my undergraduate research, I gained laboratory experience and learned to develop experimental protocol. I also had the opportunity to present my work at conferences and symposiums which has given me experience communicating scientific ideas to my peers as well as other scientists.

#### Determination of Nitroaromatic Explosives Using Ionic Liquid-based Solid Phase Microextraction (SPME) Coupled with Gas Chromatography-Mass Spectrometry (GC-MS) (Dr. He)

Ionic liquid-based Solid Phase Microextraction (SPME) fibers were prepared and used to extract thirteen nitroaromatic explosives from headspace of water samples. The target analytes were nitrobenzene (NB); 2-nitrotoluene (2-NT); 3-nitrotoluene (3-NT); 4-nitrotoluene (4-NT); 1,2-dinitrobenzene (1,2-DNB); 1,3-dinitrobenzene (1,3-DNB); 1,4-dinitrobenzene (1,4-DNB); 2,6-dinitrotoluene (2,6-DNT); 2,3-dinitrotoluene (2,3-DNT); 2,4-dinitrotoluene (2,4-DNT); 1,3,5-trinitrobenzene (1,3,5-TNB), and 2,4,6-trinitrotoluene (2,4,6-TNT). The ionic liquids used were 1-ethoxyethyl-3-methylimidazolium bis(trifluoromethane)sulfonylimide; 1-benzyl-3-methylimidazolium bis(trifluoromethane)sulfonylimide; and 1-butyl-3-methylimidazolium bis(trifluoromethane)sulfonylimide. Ionic liquids were immobilized on the surface of a fused silica fiber through cross linking IL impregnated silicone elastomer. Important extraction parameters including temperature, salt concentration, and extraction time were investigated and optimized.



### LEONID SUKALA

I am a transfer student at John Jay College enrolled in the Forensic Science – Molecular Biology track. I have always wanted a career in the sciences but found it difficult to focus on one of the many interesting fields available today. Being part of PRISM has helped me immensely in narrowing down my goals. I found that working with DNA has been both intensely challenging and rewarding, not to mention fun. I've gained a greater appreciation and respect for the living world by directly working with these tiny building blocks of life. It is this inspiration that will greatly help me in my plans to go on to graduate school.

#### Construction of Expression Vectors for the *Candida albicans* Cell Wall Protein Als1p (Dr. Rauceo)

The opportunistic fungal pathogen *Candida albicans* can exist as a benign yeast in healthy humans, as well as a deadly pathogen in immunocompromised individuals. Adherence and colonization of *C. albicans* to host surfaces is the initial critical step in pathogenesis. Our broad interest is to understand the roles of adhesion proteins in *C. albicans* survival and pathogenesis. The ALS family of cell-surface glycoproteins mediate adhesion and yeast cell-cell aggregation between *C. albicans* and host surfaces. Further, ALS adhesins are involved in pathogenesis, biofilm formation, and also co-aggregate with other microbial pathogens to mediate polymicrobial infections. Our previous studies showed that ALS5p-mediated microbial adherence and cellular aggregation on mammalian surfaces has amyloid-like properties. Here, we seek to address whether such mechanisms are consistent in ALS1p. To meet this goal, we are creating a series of plasmid expression vectors that will produce various domains of ALS1p. We have successfully amplified the ALS11-1325 gene fragment using PCR. Several attempts to clone ALS11-1325 into the yeast expression vector pYes2.1-His-TOPO (Invitrogen) showed that the ALS11-1325 insert is unstable, despite the fact that ALS5 is stable in this vector. We were able to subclone ALS11-1325 into the non-expression vector pYES- TOPO blunt (Invitrogen) to create plasmid pSR01. We are currently, using pSR01 as a template to shuttle ALS11-1325 into the stable expression plasmid vector pYF5 using directional-based cloning. Future studies will functionally characterize ALS1p1-431 in adhesion assays.

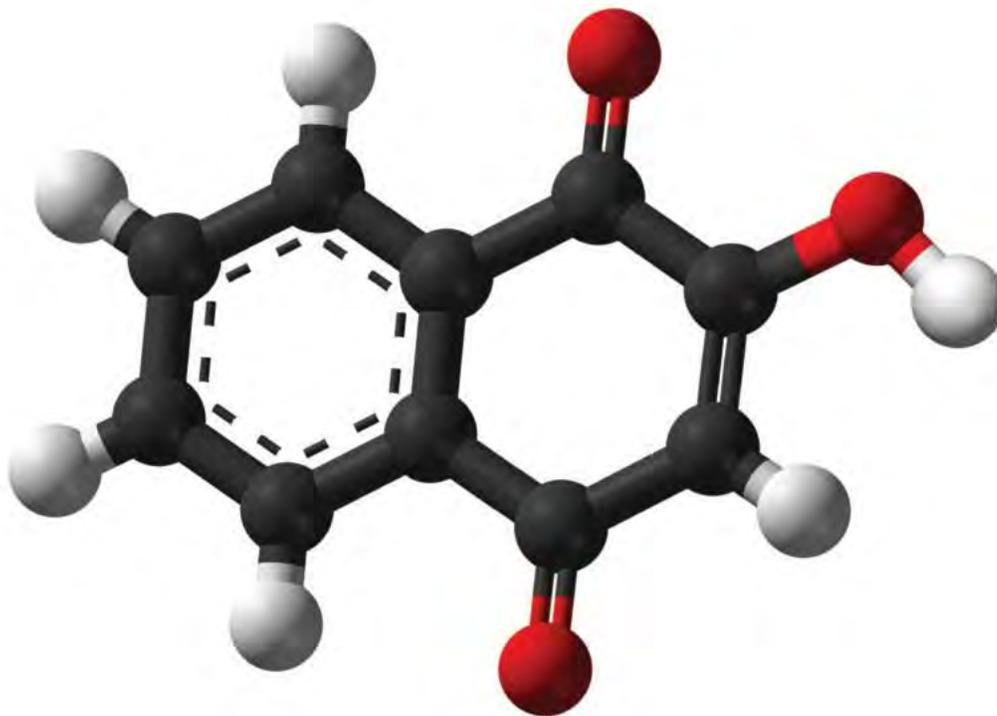
## AMANDA VASQUEZ

I have lived in New York my entire life and was home-schooled for ten years. High school was where I developed a passion for forensic science. I am currently a Research Assistant at John Jay College, doing research in the laboratory of Dr. Gloria Proni. The objective of this research is to prepare highly fluorescent compounds that could be used to detect latent fingerprints. Additionally, during Summer 2009, I interned at the Westchester County Crime Laboratory, where I was able to explore several aspects of the field of forensic science. I consider myself a diverse and secure young woman who loves science just as much as I love life. I've achieved most of my accomplishments by epitomizing this self-motivational quote by Keith Harrell: "Attitude is everything and everything is mental."



### Preparation of Lawsons' Derivatives and the Analysis of Their Fluorescent Properties and Application to Fingerprint Detection (Dr. Proni)

Fingerprints have been utilized for identification going back several thousand years. The difficulty in detecting latent fingerprints is choosing the right reagent to visualize them. Ninhydrin has been used since 1954 for the development of latent prints; it reacts with the amino acids left on the fingerprint forming an intermediate known as Ruhemann's purple. The major disadvantage with using this reagent to detect latent prints is that they need to be treated with zinc and cadmium salts and cooled to  $-1960^{\circ}\text{C}$ . Several derivatives of ninhydrin with improved fluorescence properties have been reported, in particular 5-methoxyninhydrin which showed remarkable fluorescence at room temperature. Recently in literature a new reagent, 2-hydroxy-1,4-naphthoquinone commonly called lawsone has been studied. It is extracted from the leaves of *Lawsonia inermis* and it is usually responsible of the staining properties of henna. The difficulties in using this compound as a fingerprint detector are its solubility and inability to detect compounds that are themselves photoluminescent. The objective is to chemically derivatize lawsone at the hydroxyl functional group with several fluorescent chromophores. This project includes the chemical preparation of the derivatives of lawsone, analyzing their fluorescence characterization, and collecting latent fingerprints on filter paper for comparative analysis.





### STEPHANIE WATSON

When I look back at all the hurdles and setbacks that I had to overcome in order to be exactly where I am today, I am grateful and more determined than ever to continue on this path. Attending John Jay was a complete coincidence for me. After Hurricane Katrina, I relocated back to NYC in hopes of completing the requirements for medical school. Becoming a doctor has been a lifelong dream because of the great respect I have for the doctors who've cared for me my entire life and my desire to care for other patients. Through the PRISM / CSTEP programs I have been fortunate enough to be exposed to research over the past two years. I now see research as additional outlet to enhancing the treatment and care for patients worldwide. At this point in my life I am working towards applying to MD and PhD programs and incorporating my new passions into my old goals.

*See shared abstract with Samantha Sellers, no photo available.*

### SAMANTHA SELLERS

From my seventh grade career fair, I gained an interest in becoming a Medical Examiner. Of course at that age I did not know the depths of what accomplishing this goal would require, but I strived to the best of my ability to overcome the necessary obstacles and disadvantages placed in my way. People may look at science and assume it is difficult, but its complexity is determined by your passion for it. Beginning in Summer 2009, I began research with Dr. Champeil. As time passed, being in the lab and working on my research was something I came to deeply enjoy. To know that I can possibly change science and what we know as true today is my drive to do research and see results – that I can possible change someone's life by what I can do in my research. My ideal career objective is to work in a morgue, where I can test specimens taken from patients. I definitely believe my lab research now is a small but accurate representation of how hands on and precise I must be with my work.

### DNA Adducts Formed by Activation of Mitomycin C with Thiols (Dr. Champeil)

The alkylation of calf thymus DNA by Mitomycin C involves the analysis the DNA treated with Mitomycin C (MC). MC is an antitumor antibiotic. It has been used in the United States since the mid 1970s to treat breast cancer, rectal cancer and bladder tumors. One distinctive property of MC is its ability to alkylate DNA both mono- and bi-functionally to create monoadducts and cross linking. When MC does either of the two with DNA it creates six major MC Deoxyguanosine adducts of known structures both *in vitro* and *vivo*. Several methods have been used to create these MC DNA adducts in the past such as borohydride or sodium dithionite which are reducing agents. Recently a safer and more direct assay for these adducts were discovered which involves the use of thiols. Dr. Paz (Professor of Organic Chemistry, University of Scurtioger de Compostella, Spain) has developed a new way to activate MC using the thiols. Dr. Paz has prepared samples of the DNA treated with MC under various conditions where the concentrations and nature of the thiols varied. Each sample sent in from Spain had to be prepared for analysis on the HPLC. To prepare the samples an enzymatic digestion was done. Using HPLC analysis, the amount of DNA which was successfully alkylated could be measured. The peak area percent values were calculated and each varied as follows among the nucleosides: dC (3.44% - 6.2%), dG (0.0439% - 2.815%), dT (0.0513% - 3.2525%) and dA (0.0308% - 2.0441%). The results obtained allowed for conclusions to be made about the concentrations used for the sample preparation and for improvements for the future.

## ALICIA WILLIAMS

I was born in South America, Suriname, and am currently a junior at John Jay College of Criminal Justice, studying Forensics Science with a concentration in Criminalistics. The reason I chose to study Forensic Science was because of my interest in chemistry, and since the Forensic Science program builds a solid foundation in the sciences, especially chemistry, the program was ideal for me. In Fall 2009, I began doing a research project with Professor Korobkova. I currently am continuing my research and plan to do so until I graduate. The research topic that I am working on is based on studies of drugs that may be associated with high suicide risks. My plans after I graduate is to apply for graduate school and obtain my Masters in Forensic Science, and in the future obtain my PhD.



### Fluorescence Studies of Suicide Drugs Interactions With DNA (Dr. Korobkova)

Statistical studies over the last three decades have shown that psychiatric drugs are responsible for a significant percentage of death cases when taken in overdose. Drug related death reports in the USA, Canada, and Scotland have identified some antidepressants and analgesic as the highest percent suicidal drugs. However, psychiatric drugs taken in low doses under normal therapies may already influence cellular processes and cause various side effects, such as, for example, DNA damage. The interactions of drug molecules with DNA were detected through changes of fluorescence intensity of a blue dye, TO-PRO-3 (TP3). TP3 is an intercalator for double-stranded DNA (dsDNA). In the presence of DNA, TP3 fluoresces significantly. ( $\lambda_{\text{exc}} = 642\text{nm}$ ,  $\lambda_{\text{em}} = 661\text{nm}$ ) Binding of a drug molecule to dsDNA displaces TP3 molecule from the double helix, which leads to the decrease in fluorescence intensity of TP3. Monitoring the decrease of the TP3 dye fluorescence intensity with different concentration of the drug molecule allows assessing the binding affinities of the drugs to dsDNA. We performed experiments, which demonstrated that tricyclic antidepressant, such as imipramine, quenches fluorescence intensity of TP3 bound to DNA. This result indicates that imipramine has a significant potency for DNA binding, and may cause DNA damage.



## AYAKA YAMADA

After graduating from the State University of New York, Mohawk Valley Community College, I transferred to the City University of New York, John Jay College of Criminal Justice for the Forensic Science major in Fall 2009. Soon after, I started working in the Friedland laboratory. The main topic of our lab is Pokeweed Antiviral Protein (PAP), which depurinates the large ribosomal RNA and prevents protein synthesis by stopping translation. So far, I have learned basic techniques that are essential in the lab and been involved in three projects. As an undergraduate research student, I will continue to devote myself to further analysis of PAP.

### A Study of Physical and Chemical Co-Factors for PAP's Recognition of mRNA Elements (Dr. Friedland)

Pokeweed Antiviral Protein (PAP) extracted from Pokeweed is one of the Ribosome Inactivating Proteins (RIPs) that depurinates the large ribosomal RNA and prevents protein synthesis by stopping translation. It is a protecting system in the plant against a variety of insect, fungi, and viruses. Equilibrium binding properties of PAP to the cap analog m<sup>7</sup>GTP were analyzed in buffers of different pHs and different salt concentrations by measuring the native protein fluorescence at the emission

maximum wavelength of 347nm. It had been hypothesized that the smallest dissociation constant of PAP would be observed in the buffer with pH 6.5 and the salt concentration of 100mM. The results showed that the cap bound to PAP most strongly in the buffer with pH 3.0 and the salt concentration of 200mM. In this fall, the same experiments will be performed again to take the average for more precise results.

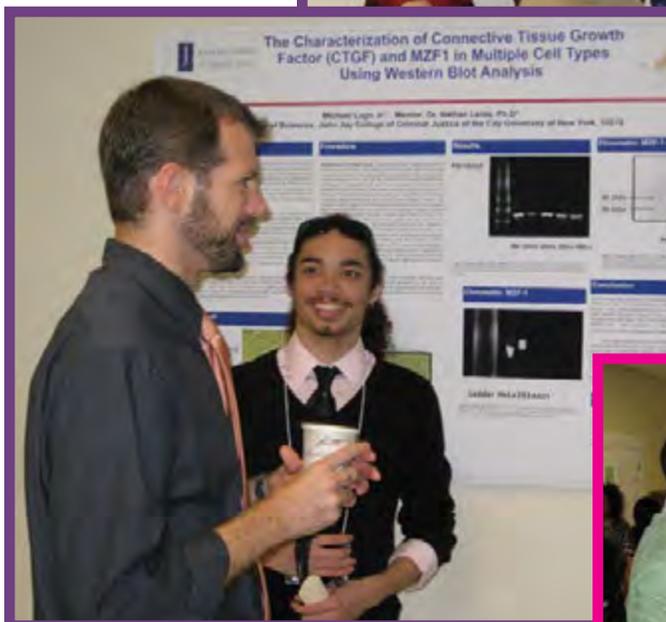
The hands-on experience students gain in the laboratory is invaluable to their training in the sciences. As part of the entrance criteria for PRISM, all students must successfully complete a Research Training Workshop. Offered twice each year, the workshop teaches students the importance of research, how to write scientifically, and necessary laboratory techniques and etiquette.



Stephanie Watson

# 2010 PRISM Symposium

Now in its third year, the annual PRISM Undergraduate Research Symposium provides students the opportunity to present their work to the wider John Jay College community. Each year, one undergraduate is selected and presented with an Outstanding Undergraduate Research Award, and this year's winner was Jason Quiñones (page 13). In addition, a former John Jay undergraduate student who has since obtained a PhD or MD is invited back as a keynote speaker. This year's speaker was Dr. Julie Layshock.



## DR. JULIE LAYSHOCK

2010 PRISM Symposium Keynote Speaker

Julie began her scientific training at John Jay College, where she majored in Forensic Science with a focus on Toxicology. During her studies, Julie worked as an undergraduate researcher with Dr. Anthony Carpi investigating factors that affect the transport of mercury in the environment, and as an intern in Toxicology at the Office of the Chief Medical Examiner in New York City. Julie received her B.S. in 2005 and moved on to graduate studies at Oregon State University where she majored in Environmental and Molecular Toxicology. As a graduate student, Julie conducted international research on air quality and studied pesticide metabolism as an intern at Pacific Northwest National Lab, Washington. At Oregon State, Julie was mentored by Dr. Kim Anderson and earned her PhD in 2010 for her research on the fate and distribution of airborne carcinogens. Julie will begin her professional scientific career as a postdoctoral researcher at Los Alamos National Lab, New Mexico in Fall 2010.

During the 2010 PRISM Symposium, Julie shared her doctoral research with undergraduates, faculty and guests. As she explained, polycyclic aromatic hydrocarbons (PAHs) with a molecular weight (MW) of 302 g/mol and oxygenated- PAHs (OPAHs) have demonstrated toxicity beyond that of more frequently monitored and known carcinogenic PAHs. The goals of her research were to identify the potential exposure to and risk from these infrequently monitored PAHs. Air samples were collected from two locations: the remote atmosphere of Mt. Bachelor, Oregon and the urban atmosphere of Beijing, China. Results demonstrated that MW 302 isomers were highly abundant in the urban atmosphere of Beijing, China. Although toxicity information was not available for all MW 302 isomers, for those with available carcinogenic potency, the combined potency of MW 302 isomers contributed to a significant portion of carcinogenic risk for PAHs in Beijing. Identification of numerous OPAHs confirmed that they are environmentally abundant and more concentrated than PAHs from Mt. Bachelor. OPAHs were predominately distributed on the smallest, most respirable particulates from both Mt. Bachelor and Beijing. Results further conveyed the importance of an expanded characterization of PAHs for air quality assessments. Julie also discussed the training she received as an undergraduate at John Jay and the impact her experience had on her professional development as a scientist. As she explained, she felt well trained upon entering graduate school and her undergraduate experience was a significant factor in her deciding to pursue a PhD in science.



# Research Mentors

All PRISM students work with a faculty mentor throughout their research projects. Most of these projects relate to the mentor's own research, and they allow students to build personal relationships with these role models in the sciences. Under this guidance, students learn all aspects of research – from literature searching to design, implementation, experimental sampling, data analysis, and scientific writing and presentation. Research training experiences go beyond the traditional training students receive in the classroom, helping to demonstrate that science is not exact, but an iterative process of questioning the world around us. Research experiences provide students with the skills necessary to succeed in science beyond the classroom and join in the community of researchers across the globe.



Drs. Carpi and Roberts, with student Amora Mayo-Perez

**Anthony Carpi, PhD** (Cornell University)**Professor of Environmental Chemistry and Toxicology**

Areas of Expertise: Environmental and forensic toxicology

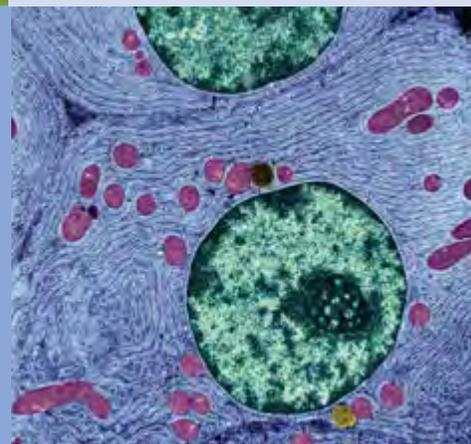
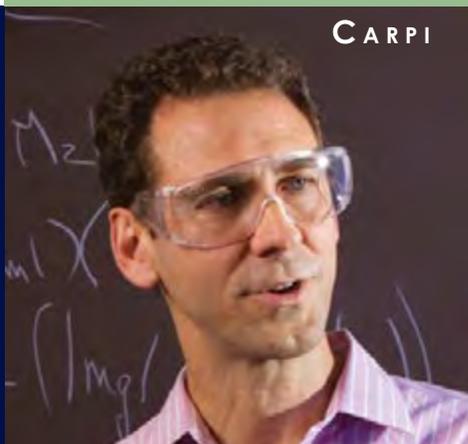
My research interests broadly fall into two categories: 1) the chemistry and transport of heavy metals, and especially mercury, in the environment; and 2) the teaching of scientific reasoning skills. Regarding 1, mercury has a complex environmental chemistry that, in part, accounts for its status as the leading cause of pollution advisories on fishing resources in the United States. My laboratory studies the mechanisms of reduction, and subsequent emission of mercury from environmental surfaces such as soils. Specifically, we have demonstrated that mercury reduction and transport is associated with incident light, and especially ultraviolet radiation; and inversely correlated with the humic concentration of soils. We are currently using a combination of laboratory and field studies to further investigate these processes toward understanding the potential effects of global climate change on the environmental mercury cycle. Regarding 2, we are currently developing resources for teaching science as a process of investigation instead of a collection of known facts, and we are studying the impact of these resources on student understanding of science.

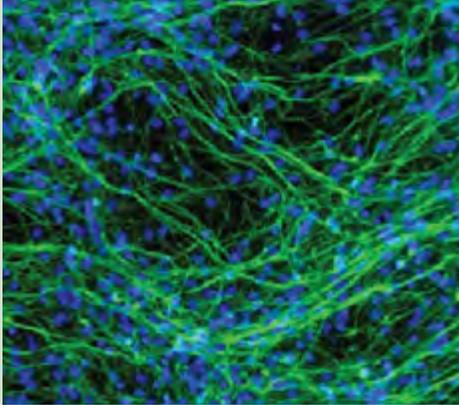
**Elise Champeil, PhD** (Univ. of Ireland, Trinity College)**Assistant Professor of Chemistry**

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 which 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 is an anti-cancer agent. We are interested in synthesizing various DNA adducts of mitomycin C, particularly the beta cross-link adduct. This adduct has been shown to trigger cell death via a different pathway than traditional chemotherapeutic agents; 2) Analysis of drugs of abuse by NMR spectroscopy. We are interested in using 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- $\pi$ -acceptor kind which can be used to detect the presence of fluoride anions and glow in the dark at the same time!





 FRIEDLAND


 CHENG

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

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

Dr. Cheng's research interests include: 1) Studying the roles environmental toxins (dithiocarbamate compounds) play in neurodegenerative diseases, such as Parkinson's disease, eg. altering protein-protein interaction ( $\alpha$ -synuclein, dopamine transporter, and others); 2) Identifying the target genes and proteins which are affected by these environmental toxins; 3) Elucidating the possible signaling transduction pathways (such as NF-kappa B and Akt/mTOR) which are regulated by these environmental toxins; 4) Elucidating whether antioxidants (such as green tea extracts) can reverse this toxic effect; 5) Studying the effects of psychostimulants (such as cocaine and amphetamine) on the dopamine transporter expression.

**Diana Friedland, PhD (City University of New York)**  
*Assistant Professor of Chemistry and Biochemistry*

Areas of Expertise: Protein Purification, RNA Purification, Steady State Fluorescence Spectroscopy (Thermodynamics and Equilibrium), Stopped-Flow Fluorescence Spectroscopy (Kinetics)

I am interested in the amazing way in which plants protect themselves from various pathogens (e.g. viruses, fungi and bacteria). The extension of this interest is the application of this to biosecurity, crop protection, crop production enhancement, and biomedical applications as we (more than) frequently co-opt plant defense systems for drugs against human cancers, viruses, etc.

The long term goal of my research is to understand how viral infections and pathogen attack affect protein synthesis and plant anti-viral strategies as well as other defense mechanisms in plants. Plant pathogens (viral, fungal, bacterial, or pest) affect a significant number of food crops worldwide, often indiscriminately. The impact is considerable and far-reaching, particularly as these agents have numerous invasion strategies.

The current objective of my laboratory is to characterize the mechanism by which PAP selects RNA targets for depurination. We employ a combination of biophysical and biochemical approaches to answer this question. This research will increase understanding of viral infections and how they affect protein synthesis, potentially leading to new anti-viral approaches. Such insight into plant defense mechanisms will guide practical strategies to reduce crop losses due to pathogen infection.

Outside of research, I love to cook – particularly baking...and am a confirmed chocoholic.

**Yi He, PhD** (City University of New York)

**Associate Professor of Chemistry**

Areas of Expertise: Analytical chemistry and environmental forensic toxicology.

Dr. Yi He studied applied chemistry and environmental chemical engineering at Shanghai Jiao Tong University in China and analytical chemistry in National University of Singapore before completing her PhD in analytical chemistry in 2004 at the Graduate Center of the City University of New York (CUNY), USA. She joined the Science Department at John Jay College of Criminal Justice of CUNY in Fall 2004, and the chemistry doctoral program at the Graduate Center of CUNY in 2007. Her 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. The major instruments involved in her research include GC, GC-MS, HPLC and ICP-MS.

**Ali Kocak, PhD** (City University of New York)

**Associate Professor of Analytical and Physical Biochemistry**

Areas of Expertise: Analytical chemistry specializing in infrared and Raman spectroscopy techniques.

Dr. Kocak's research interests focus on the use of Attenuated Total Reflectance infrared and Raman (FT-Raman and Confocal Raman microscopy) spectroscopy techniques to study the structure of fibers, hair and other forensic evidence. He is also interested in forensic evidence analysis developing more sensitive sampling techniques such as Transflectance infrared spectroscopy to study of minerals and plant matter.

**Ekaterina Korobkova, PhD** (University of Chicago)

**Assistant Professor of Chemistry**

Areas of Expertise: biochemistry, biophysics, physical chemistry

My current project of interest focuses on the side effects of psychiatric agents. I am particularly interested in the DNA damage produced by these drugs. Psychiatric drugs are prescribed for the treatment of depression, migraines, and insomnia. However, studies show that many of these drugs are potentially very reactive to cellular macromolecules, including proteins, lipids, RNA, and DNA. The drug molecules with their aromatic structures can bind DNA in various ways. Their metabolism can produce reactive intermediates that destroy DNA. Covalent modification on DNA produced by certain reactions with the drugs can be used as markers of the medicines and employed in forensic studies.



**Nathan Lents, PhD** (St. Louis University Medical School)

**Assistant Professor of Molecular Biology**

Areas of Expertise: Cell biology, forensic biology, genetics, and molecular anthropology

My research lab studies gene expression control and cellular signaling. Specifically, we combine bioinformatics and computational biology with standard bench molecular biology techniques in order to reveal new regulatory networks of gene regulation. We also frequently work on side projects in the larger field of forensic biology. Beginning in Summer 2011, I am also preparing to take the lab in a new direction – forensic anthropology. Specifically, I plan to use DNA analysis to trace the shared ancestry of indigenous populations of Central America and how these populations are related to pre-Columbian populations of the region.

**Richard Li, PhD** (University of Wisconsin–Madison)

**Associate Professor of Forensic Biology**

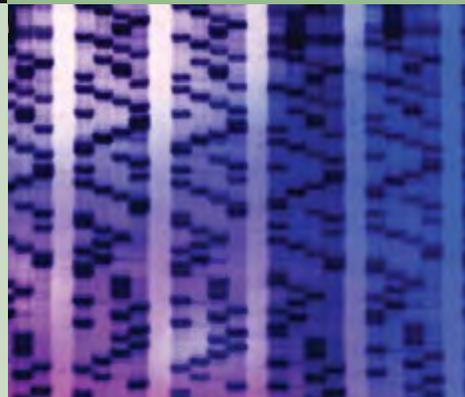
Areas of Expertise: Forensic DNA analysis, forensic molecular biology and forensic genetics

My laboratory studies the forensic analysis of biological evidence. The research includes two aspects. The first aspect, a 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, the study is working on the extraction methods of controlled substances from complex matrices, including biological fluids and solid tissue samples.

LENTS



LI



**Gloria Proni, PhD** (University of Bologna)**Associate Professor of Organic Chemistry**

Areas of Expertise: Organic chemistry, spectroscopy, supra-molecular chemistry

I received both my "Laurea" (*cum Laude*) in Pharmaceutical Chemistry and Technologies in 1995, and PhD in Molecular and Cellular Biotechnologies in 2000, from the University of Bologna under the supervision of Prof. G. Gottarelli. I joined Dr. K. Nakanishi's and Dr. N. Berova's group, at Columbia University, in 2001, and was awarded a National Institute of Health postdoctoral fellowship in 2002. In 2003, I started my independent career in the Science Department at John Jay College of Criminal Justice. My research interests span from optical spectroscopy to organic chemistry applied to forensic science. Currently I am involved in four main projects:

- 1) Development of new reagents for latent fingerprint detection derived from lawsone, responsible of the staining properties of henna;
- 2) Use of NMR spectroscopy and other spectroscopic techniques for detection of drugs of abuse in biological fluids such as urine, blood, etc;
- 3) Stereochemical determination of organophosphorus pesticides by means of electronic and vibration circular dichroism and optical microscopy in polarized light;
- 4) Determination of the absolute configuration of diamines and aminoalcohols via host-guest complexation of dimeric porphyrin tweezers and the chiral substrates.

In my spare time I love outdoor activities, travelling, and Harry Potter.

**Jason Rauceo, PhD** (City University of New York)**Assistant Professor of Biology**

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

I pursued a scientific career mainly to understand the mechanisms underlying clinically relevant diseases. Fungi have served as a model organism in which extraordinary biological processes were elucidated. Thus, mycology lies at the core of my biomedical research career. I earned my doctorate degree from The Graduate Center of The City University of New York, specializing in molecular biology and fungal pathogenesis. I continued to explore fungal pathogenesis and molecular genetics during my post-doctoral appointment at Columbia University.

Our current research focus is the major fungal pathogen, *Candida albicans*, which infects over 60,000 people per year in the US alone. Our research goals explore two critical aspects of *C. albicans* pathogenesis. The first is to understand stress response signaling mechanisms in *C. albicans* that promote its survival in the presence of antifungal drugs and contribute to drug resistance. Second, we seek to determine the molecular mechanism of *C. albicans* adhesin proteins that mediate attachment to host surfaces and cellular aggregation. To meet our research goals, we routinely utilize current molecular biology, molecular genetic, and microbiological techniques.



# Program Information & Staff

PRISM, the Program for Research Initiatives for Science Majors, 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 U.S. Department of Education and National Science Foundation are 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 13 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, 30 students have participated in mentored research and receive research stipends, an additional 32 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](mailto:PRISM@jjay.cuny.edu) or visit our PRISM group on Facebook®.



**Anthony Carpi, PhD**  
*PRISM Director*



**Lawrence Kobilinsky, PhD**  
*PRISM Co-Director*



**Ron Pilette, PhD**  
*PRISM Coordinator*



# PRISM Symposium Speakers and Awards

## **2010**

Speaker: Julie Layshock, PhD (Oregon State University)

Award Recipient: Jason Quiñones

## **2009**

Speaker: Bladimir Ovando, PhD (State University of New York–Buffalo)

Award Recipient: Kana Noro

## **2008**

Speaker: Marcel Roberts, PhD (Boston College)

Award Recipient: Nicole DeLuca

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