

2012



Undergraduate Research

CHRONICLE

Program for Research Initiatives for Science Majors

Welcome

This year marks the publication of our third Chronicle of Student Research, our fifth Undergraduate Research Symposium, and the sixth year of PRISM's operation – all significant milestones. More importantly, this year marks significant milestones in the progress of our students, as 35 students were involved in research this past year and 30 are highlighted in this issue of our Chronicle. As a result of their hard work and progress, it was particularly difficult to narrow the field for our annual Outstanding Undergraduate Research award this year. A record three students were named as Honorable Mention recipients for this year's award – Eugene Gonzalez-Lopez (p12), Jennifer Teubl (p23), and Leonid Sukala (p21). Our Outstanding Student Research winner is Roselynn Cordero (p9). Roselynn has had an impressive research career at John Jay. She worked on two different research projects while at the College, collaborating with faculty at Columbia University on one of these projects. In 2010, she was awarded an American Chemical Society Summer Research Fellowship which allowed her to travel to Italy to study the NMR spectrum of organometallic compounds. She is the co-author of a publication in the journal *Chirality*, and she is in the process of applying to graduate schools to continue her studies as a PhD student. A number of our other students also have important research accomplishments. In Summer 2011, Amora Mayo-Perez and Eugene Gonzalez-Lopez completed a prestigious external internship at the Royal Institute of Technology in Sweden. Amora is now enrolled in a MS program in Biomedical Sciences at the University of South Florida. Several other students have also recently accepted admission into prestigious graduate programs. Irving Campoverde (p5) has accepted an invitation to attend the College of Pharmacy at Long Island University in the fall, Jennifer Teubl (p23) will be moving on to a PhD program at New York University Sackler School of Biomedical Sciences, and Eva Santos Tejada (p17) will be attending Teacher's College at Columbia University. They join 7 previous PRISM students pursuing PhD or medical school studies. Another PRISM graduate, Melissa Guzzetta, has just started her residency in Pathology at Winthrop University Hospital. Two students are awaiting decisions on their applications to graduate programs (as of March 15) and four more are committed to applying to PhD programs this fall. We wish all of our students luck in their future pursuits.



Anthony Carpi, PRISM Director

Undergraduate Researchers

PRISM's Undergraduate Researchers engage in projects that have practical applications in the real world. In 2012, students worked toward developing systems for detecting chemical warfare agents, building pigment databases, and studying methods of narcotic identification. From national security to disease prevention, our students are constantly engaged in research that is both timely and cutting edge.

Catherine Chamnankool



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 was sure 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, but also learn through experience, which I believe is the main key to success.



Determination of Trace Metals in Wool Samples (Dr. He)

The method of creating elemental fingerprints for a textile fiber such as wool can become an important aspect in forensic applications because textile fibers are frequently found in criminal and civilian casework. This research will establish a method that will identify and source wool fibers. The wool samples were digested by wet ashing using optima grade nitric acid (HNO_3) and hydrogen peroxide (H_2O_2). The digested samples were analyzed using the inductively coupled plasma-mass spectrometry

(ICP-MS) instrument and an external calibration method. The method was validated using a NIST multi-element standard. The trace metals that were monitored throughout the analysis were ^9Be ; ^{59}Co ; ^{75}As ; ^{82}Se ; ^{95}Mo ; ^{111}Cd ; ^{115}In ; ^{121}Sb ; ^{133}Cs ; ^{202}Hg ; ^{208}Pb ; ^{209}Bi and ^{238}U . Their concentrations were monitored to create an elemental fingerprint profile for each sample. The variation of elemental fingerprint pattern in each individual sample are studied and statistically analyzed.



TAMYKA ANTHONY

My interest in science was sparked by my need to always know why and never being satisfied with the explanations I was given. Science provided me with a way to see things for myself and to answer my own questions. When I started my undergraduate degree at John Jay, I knew I wanted to study Forensic Science but was unsure of what I wanted to focus on. During my sophomore year, some unfortunate health issues gave me insight into the world of medicine and this is what made me realize that I wanted to enter the medical field. I became intrigued by the various effects that drugs and other toxins have on our biological systems. At this point, forensic toxicology was the obvious choice! I hope to use my undergraduate and research experiences to help guide my path into the world of osteopathic or homeopathic medicine.

Exploring the Mechanism of How Zinc Supplements Reduce the Detection of THC in Urine (Dr. Lents)

Urine drug testing to determine the presence of drugs of abuse, like THC, is commonly done using an enzyme-linked immunosorbent assay (ELISA). For urine drug testing, ELISA tests for the presence of a specific drug of abuse or its metabolites. THC is the main bioactive ingredient in marijuana and thus the molecule that the ELISA will be testing for. There have been various claims suggesting ways to interfere with the detection of these drugs of abuse when using the ELISA testing, creating false negatives. Building from a previous study done testing the effects of zinc when administered using *in vitro* methods, this study will employ human subjects to test the effects *in vivo* using zinc supplements as the method of entry. This research will also investigate the possible mechanism through which zinc is able to affect the clearance of drugs of abuse in the kidneys. Additionally, other ions similar to zinc will be also tested to determine whether they also have an effect on reducing THC detection in urine analysis. Once collected from the subjects, the urine will be tested using immunoassays (ELISA). Further testing on positive samples will be done by another laboratory using GC-MS to produce quantitative data.

MOHANRAM BASSIT

Every kid has multiple dreams of what they want to accomplish in their life, and my childhood was no different. It ranged from being a doctor, to an astronaut, to a robotics engineer. As I grew up and my interests changed one thing that did not change was my interest in science. As a teen, I grew up watching shows like "Forensic Files," and had conversations about the show with my aunt, who also was an avid watcher. These things strongly piqued my interest in the forensic sciences. I learned that John Jay College offered me a chance to study forensics, so I applied. As I progress through this major, I do not regret my choice, and the one thing I especially love about this major is that it introduced me to research and gave me a glimpse of what research can truly offer – to myself, as well as the world. I am currently pursuing my degree in Forensic Toxicology as well as Molecular Biology.



DNA Damage in the Presence of Arylamines (Dr. Korobkova)

Arylamines, also known as aromatic amines, have been observed to cause bladder tumors in men, as well as tumors in numerous organs such as the liver, mammary gland, intestines, and the bladder within animals. The metabolism of arylamines is initiated by various enzymes found in the body, notably cytochrome p450, peroxidases, and flavin-containing monooxygenases. These oxidized arylamides are not reactive enough with DNA on their own, and are further covalently modified through metabolism in the body, where they effectively become carcinogens. These arylamides were found to induce arylamine substitution at C8 of deoxyguanosine in bladder epithelium in tested animals. The objective of this research is to observe the adducts formed in DNA when in the presence of an arylamine, and to observe and identify the compounds formed after DNA is digested in the presence of an arylamine, primarily covalently modified DNA nucleotides.

ANKIT BHATTA

My sister loved science. She liked to tell us how the great scientists explain and discover great things from the general things around us. Her stories intrigued me and I started a zealous scientific adventure of my own after grade 10 (in Nepal). The theories of evolution and cell biology, in addition to my self-study of 'The Selfish Gene' by Richard Dawkins got me hooked on biology, especially genetics. After coming to John Jay College, I joined the Forensic Science (Molecular Biology) program and started working in Dr. Korobkova's lab. The experience and knowledge of the abilities and limitations of real science has taught me to perform proper scientific work, and seek help and criticism whenever needed. The ability to perform properly and accept constructive criticism for betterment is the ability I have acquired from John Jay, its great professors and my friends.



Response of Mammalian PC12 Cell to Primary Arylamine (Dr. Korobkova)

Oxidative stress is increasingly recognized as a key mechanism in the toxicity of xenobiotics such as arylamines. Primary arylamines like p-Phenylenediamine (pPD) and 4-aminobiphenyl (ABP) have been reported to cause an increase in oxidative stress, to increase the production of reactive oxygen species (ROS), and to lead the cells to apoptosis. In our lab, the preliminary data has shown an increase in production of ROS by Pheochromocytoma (PC12) cells when treated with pPD and ABP. We aim to measure the increase in oxidative stress in a dose- and time-dependent manner. For this purpose, the PC12 cells will be treated with the fluorescent dye Dichlorofluorescein, followed by the treatment with pPD and ABP in differing concentration. The fluorescence generated due to the binding of Dichlorofluorescein with the ROS that is produced due to the effect of arylamine will be measured by using a Microplate reader after the lapse of various time intervals. The intensity of fluorescence is expected to rise with increase in time and dose. The fluorescence measurement assay is a very simple and effective way to measure oxidative stress by quantitating the ROS produced due to stress. Furthermore, the proteins that are upregulated in response to the arylamines will be Southern blotted, identified, and a general mechanism involved responding to oxidative stress will be studied.

Learning modern analytical methods and how to use state-of-the-art equipment is an important part of the training students receive. PRISM supports this by purchasing new and cutting-edge instruments for research labs.



Anna Stoll

IRVING CAMPOVERDE

At a very young age I became interested becoming a doctor. This idea changed as I attended high school and participated in an internship program at Coler-Goldwater Memorial Hospital. This program enabled me to intern at various departments in the hospital such as Radiology, Pharmacy, Morgue, and the Clinical Lab. It was while interning at the Morgue that I became interested in becoming a medical examiner and enrolled at John Jay College of Criminal Justice. While attending John Jay, I started working in a pharmacy and immediately became interested in becoming a pharmacist. At John Jay I became a Forensic Science major in the Toxicology track. This facilitated me getting into a pharmacy school.



NMR-based Study of Urines of Opioids-Overdosed Patients: Preliminary Data (Dr. Proni)

The goal of this research project is to understand the advantages and limitations of using nuclear magnetic resonance (NMR) spectroscopy for the identification of opioids and, in particular, morphine, in urine of patients who overdosed with morphine. This will be achieved through preparing urine samples by drying them in an Acid Resistant Centrивap Concentrator, in order to remove most of the water. The sample will then be reconstituted in methanol deuterated, MetOD, and then doped using a 2mg/1mL vial of morphine. All data will be collected on a JEOL 300 MHz NMR spectrometer (JEOL USA Inc., Peabody, MA), using a trial and error method in order to determine the degradation period of the sample. Then the doped sample will be run with a Nosy, Cosy NMR spectroscopy in order to characterize the morphine in the urine sample and be 100% certain the morphine is present.



DANIELLE CARTHORNE

I believe that deep down inside everyone wants to save the world in some way, shape, or form. Though my pursuit of the Forensic Science Criminalistics career may not “save the world” per se, it will definitely make a difference. My ultimate goal in life is to make an impact, no matter the size. I’m am whole heartedly content with helping a person or society, even though I may not ultimately work to achieve world peace. I wasn’t sure what I wanted to do within the field but after starting my research with Dr. Kubic, I realized that I wanted to specialize in trace evidence within Criminalistics. My ultimate goal after I graduate is to work with either the Metropolitan Police in Washington, DC or in the PG County Police Department Forensic Science Division.

Establishing a Pigment Database Using FTIR and Raman Spectroscopy (Dr. Kubic)

As a forensic scientist, many different types of evidence can come across your lab bench. The ease and efficiency of the capability to do a library search after running a known or unknown sample on an instrument can subtract a few steps in the identification of a sample. Of course, the individual using the database should use their knowledge to make a good analytical judgment to match their sample. The ability to match a sample to a database will allow the scientist to determine the color of a pigment sample and narrow down the search to where it could have been manufactured from. The goal of my research is to establish a database of each pigment purchased for Raman and ATR spectroscopy. Thirty-eight pigments have been run on the ATR and Raman, there were new pigments, 54, that were purchased and are now being run on the Raman. It was determined that each pigment needs to be run for 128 and 1024 scans so that the best spectra will be observed. By the end of this project there should be a total of 92 pigments that will become available on a database to help forensic scientists identify and analyze the characteristics of a certain pigment.

Dr. Anthony Carpi in Brazil



CATHERINE CHAMNANKOOL

I graduated high school in 2004 and started college without a real goal in mind of what to study. I spent two years at another college feeling unfulfilled and bored and decided to transfer to John Jay to focus on sciences in 2007. Science has always been an interest of mine since an early age, but it took me a while to decide that it was the path I wanted to go on. Forensic Science was something I never thought of myself pursuing, but after taking a few courses and labs, I decided it was the path for me. Now, I will graduate in May with a concentration in Toxicology and Molecular Biology. With the help of some great mentors and a wonderful research group, I have come to enjoy my stay at John Jay, in and outside of the classroom and labs.



How Mammalian Cells Respond to Oxidative Stress: Kinetic Studies (Dr. Korobkova)

Oxidative stress is caused by the imbalance between oxidants and antioxidants potentially leading to damage when in favor of the oxidants. Oxidative stress has been proven to cause adverse effects on ageing due to it inducing mitochondrial DNA damage. An increase in mitochondrial DNA damage leads to compromised mitochondrial function and its integrity. It is believed to increase ROS production, which in turn leads to a higher chance in causing oxidative stress. It also causes oxidation of DNA bases resulting in DNA mutations. Reparation of the damaged bases occurs by the base excision repair mechanism (BER). BER is performed by glycosylases, which removes the oxidized bases by hydrolyzing the N-glycosylic bond. Two types of glycosylases are the type I enzymes, which excise the oxidized base on an abasic site on the DNA, and type II enzymes

which excise the base and cleaves the abasic site. Much of the character traits and structure of glycosylases are identified. However the mechanisms behind the glycosylase and how it expresses its inner workings to produce a response for DNA base repair is still not comprehensively understood.

The purpose of this experiment is to monitor and to develop a kinetic model of the expression of glycosylases, where the cells have been exposed to various ultra-violet radiation times and determining gene expression of 8-Oxoguanine glycosylase, otherwise known as OGG1, via gel electrophoresis analysis. OGG1 is a DNA glycosylase enzyme that is involved in base excision repair for the excision of 7, 8-dihydro-8-oxoguanine (8-oxoG) as a result of exposure to ROS.

PRISM's faculty mentors are active researchers in their own right. Students benefit from working alongside individuals regularly contributing to the scientific discourse. In some instances, students are able to work alongside their mentors in the field, as well as the lab.

SOFIA CHELIOUT DA SILVA

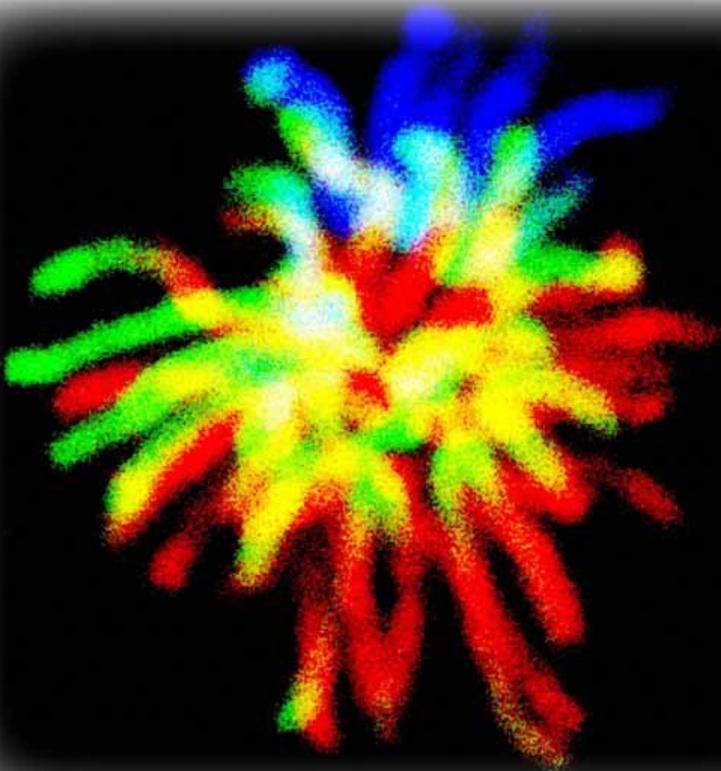
I grew up in France, but started college in Brussels, Belgium where I studied bioengineering while working as a professional dancer. My dance career took me to New York, and somehow I ended up learning accounting on the job. However, a back injury prompted me to rethink my professional goals, and I realized I missed science dearly. I decided to enroll in the Molecular Biology track of John Jay's Forensic Science program. My time at John Jay has helped fill my need for intellectual challenge and constant pursuit of knowledge. I was very fortunate to meet incredible mentors who strive to help their students lay the foundations of a successful future in science and in life. PRISM provided me with opportunities I am deeply grateful for. It gave me my first research experience, and the desire to obtain a PhD in Molecular Biology.



Fluorescence-based Study of Drug-DNA Binding Modes (Dr. Korobkova)

A possible cause of mutagenesis and disruption of proper cell operation and function is damage to the DNA molecule resulting from direct chemical interaction of diverse drugs with the DNA double helix. These interactions occur through intercalation (insertion between DNA bases) or DNA groove binding. Based on their molecular structure, numerous compounds have been suspected of having mutagenic or carcinogenic properties due to such DNA binding mechanisms. We used fluorescence spectroscopy to monitor these interactions for a set of small molecules, which included therapeutic drugs, food colorants, and DNA staining agents. Two nucleic acid dyes, TP3 and DAPI, which bind to DNA by intercalation and minor groove

respectively, were used to form fluorescent complexes with DNA. Upon addition of the compounds of interest, fluorescence quenching was observed, demonstrating that the compounds studied displaced TP3 or DAPI. A C_{50} value was measured for each compound as well as the TP3-DNA and DAPI-DNA binding constants. The preferential binding mode of each molecule was determined based on the data. The results were correlated with the calculated partition coefficients of the molecules. The fluorescence method developed in the present work has a lot of promising applications. These include combating infections and manipulating gene expression for the treatment of various diseases.



Human chromosomes in a cancer cell



MIRCEA COMANESCU

I am currently a junior in the Criminalistics track of Forensic Science. I am from Romania, and I moved here almost four years ago. Because I attended only the senior year of high school in the US, I was rushed into applying to college; given my previous intensive science training in Romania (a focus on math, physics and programming), I applied to most CUNY science degrees. The focus of Forensic Science intrigued me and, after some research, I decided that it was my primary choice. Luckily, I enjoy it quite a lot. After graduating I intend to continue my education and get a PhD in either Criminal Justice – with a Forensic Science focus – or in Physical Anthropology. My research experience has been very enriching giving me more motivation to pursue higher knowledge and education.

Quantifying Molecular Damage in Both Human and Non-Human Ancient Skeletal Remains for the Purpose of Genotyping and Evolutionary Studies (Dr. Corthals)

The study of evolutionary trends throughout populations by use of DNA is often impeded by the quality and quantity of extracted genetic materials. DNA stability and survivability can be highly affected by environmental factors, such as heat, moisture, acidity, or micro-organism activity. This becomes an issue when the available samples belong to ancient specimens, as the longer exposure to the environment will have higher effects on DNA damage. Protocols for ancient DNA extraction from skeletal materials have been developed to quantitatively improve the extracted materials, as well as reduce the possibility of contamination. In an effort to assess the evolutionary history of South American and Caribbean Chiropterans (specifically, the Phyllostomidae family), DNA was extracted from sixteen specimen bone samples. Two aspects of the extraction protocol were varied (use of carrier RNA and incubation time) in order to assess effectiveness and simplification of the protocol. The samples that presented with usable DNA yield after NanoDrop analysis were used for PCR and Gel Electrophoresis analysis, using a total of nine Chiropteran specific primer pairs. The final step of the analysis involves sequencing of the obtained genetic material. Preliminary results indicate that carrier RNA may not be a vital component of DNA extraction, although its use does increase DNA yield; furthermore, incubation time variation indicates that a four hour incubation period is as closely efficient as the standard overnight incubation.

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 future. 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 majoring in Forensic Science. Bright eyed and bushy tailed, I waltzed into my first college chemistry class, and a year later I joined Dr. Gloria Proni's research group. Research is such an important part of my college success because there are so many skills that I learned throughout my research that I would have never learned in a class setting. It has also opened so many doors for me, including traveling to Italy to work on a project and learning new techniques. I am currently a senior and will be applying for graduate school next year.



Helical Molecular Programming Via Supramolecular Complexation of Bis-Porphyrins (Dr. Proni)

The transfer of chirality from a guest molecule to an achiral host is the subject of noteworthy interest. The ability to induce supramolecular chirality as well as to control the twist-sense and the degree of helicity plays a vital role in the frontier of biomolecular recognition, material science and information storage. Although helical-induction of single-stranded helices has been performed in the past, for example, by covalently adhering enantiopure chiral additives to foldable polymers^{1,2}, the induction of double-stranded helices is rare.

SHORONIA CROSS

For as long as I can remember, I loved science and I loved problem solving. A career in Forensic Science, I figured, would allow me to do both and help others at the same time. I was in the health sciences program at Dawson College, in Canada, for 1 year, before transferring to John Jay College in 2003. In 2004, I took a 5-year break from school to serve in the U.S. Navy, as a gas turbine systems mechanic, where I further developed my problem solving, troubleshooting, and leadership skills. I am currently an upper sophomore, and I find that as I advance through my studies, I am drawn more towards applied chemistry and physics. Although my ultimate goal is a PhD, I have yet to determine in which field I will specialize.



Development of a Novel Fingerprint Scanner with Explosive Metabolite Detection Capabilities (Dr. Roberts)

Our research aims to develop a fingerprint scanner capable of detecting explosive metabolites in the sweat of a fingerprint. Currently, we are attempting to modify a surface such that it can detect urea nitrate (UN), a common compound used in improvised explosive devices, and record a fingerprint. We will attempt to apply p-dimethylaminocinnamaldehyde (p-DMAC), a chemical used for the colorimetric detection of UN, to a glass surface through either direct-application, fuming, dipping, or application of a mixture with paraffin or polydimethylsiloxane (PDMS). We are also exploring molecular imprinting techniques through the use of periodic mesoporous organosilicas (PMO), modified so as to accommodate only the target analytes in their pores. Test results will be verified by infrared spectroscopic analysis. If we can successfully modify a surface to make an inexpensive, yet reliable, device for ultrasensitive detection of UN in fingerprints, then we can apply those techniques to other common explosives, such as RDX and TNT, and their metabolites.



Szilvia Tobak and
Leonid Sukala



JAMES FIELD

Like most students in the major, I breezed through high school with straight A's without applying any effort. The classes that were supposed to be "challenging" ended up being just another boring class that was just there to take up time between lunch and study hall. When I reached my final year I took a class that actually held my interest, which was both fun and interesting: Forensic Science. This class was not exactly science based, but it was a very broad class studying drugs, fingerprints and DNA. This is what really got me into the course, and the teacher pointed me in John Jay's direction. When I took the freshmen orientation I was told that the challenge that I desired could be found in the forensic science major. It was through this major where I met my mentor and my enrollment in Prism began. For the future I am looking into new possibilities in school and career fields. Many life changes have already been successfully met in the past two years and there are going to be more to come.

Index of Freshness Analysis of Tuna Sushi and Sashimi Gathered from New York City (Dr. Proni)

The objective of the study is to determine the freshness of the sushi and sashimi sold in New York City markets. Recently there have been a number of published newspaper articles that have publicized studies on raw fish sold in New York City. One study tested the levels of mercury in sushi and found that they were alarmingly high (Burros, 2008). The study revealed that 5 out of 20 restaurants had mercury levels so high that the FDA could use legal force to remove the fish. Another study analyzed the genetic profile of fish samples sold in markets around the city (Schwartz, 2008). It was shown that one quarter of the fish was improperly labeled and was not the species advertised. The quality of the fish and more precisely its freshness is of paramount importance due to bacterial pathogens and parasites that may cause food poisoning.

Because of the potential dangers associated with the consumption of raw fish, the freshness of the raw tuna in the form of sushi and sashimi from 12 restaurants in New York metropolitan area will be investigated. The determination of the index of freshness (K coefficient) and consequently the biochemical age of several fish samples will be achieved by using a technique that extracts and quantifies the products of the ATP breakdown and the formation of biogenic amines during fish aging. The biochemical ages of the samples obtained from the restaurants, determined through a comparison with opportunely prepared calibration curves of aged tuna samples, will provide an idea regarding fish spoilage.

EUGENE GONZALEZ-LOPEZ

Science has always provided me a way to understand the phenomena around me. However, my particular fascination in science is in biomedicine. Within this field, I feel that I am better equipped to understand the causes of medical disorders and can actively participate in curing them as well. Half of the United States population has some illness that can be treated or even cured by biomedical research. John Jay's Forensic Science program has allowed me to finely tune my techniques and abilities to be able to help me accomplish my goals in hopes of improving old techniques and creating new ideas for biomedical research. Through John Jay and its research programs I have experienced research in a plethora of fields both international and domestic from studying thermoelectrics in Sweden to working on fungicides and identifying their relation to Parkinson's disease prevalence here in John Jay. I had no idea that once I entered John Jay that I would one day be able to participate in conferences, be published, travel abroad, and have access to so many opportunities. I am so grateful for all John Jay has provided me.



The Role of Microtubules on Dithiocarbamate Cytotoxicity (Dr. Cheng)

Environmental factors have been associated with the pathogenesis of neurodegeneration. Specifically, exposure to dithiocarbamates such as maneb (MB), mancozeb (MZ), and diethyldithiocarbamate (DDC), which are fungicides widely used in the United States, has been related with sporadic case reports of Parkinsonism. These compounds can potentiate the presence of the dopaminergic neurotoxin 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) in vivo. However, the exact mechanisms for those effects are not clearly determinable. The dopamine transporter (DAT) is a protein known to play a role in MPTP toxicity by transporting MPP⁺, the active metabolite of MPTP, into dopaminergic neurons. A preliminary study from Cheng's experiment shows that MB and MZ increase the interaction of DAT and alpha-synuclein followed by increasing cell surface DAT expression which, in turn, enhances MPP⁺ cytotoxicity by increasing MPP⁺ uptake. The cytoskeleton is very important for DAT trafficking between the cell membrane and cytosol. The disruption of the interaction of alpha-synuclein with microtubules has been showed to enhance cell surface recruitment of DAT.

The aim of this study is to elucidate the role of microtubules in dithiocarbamate synergistic toxic effects. The hypothesis of this toxic mechanism is that dithiocarbamates disrupt the cytoskeleton network leading to the interference of DAT trafficking. Rat pheochromocytoma (PC12) cells were used for this study. Immunocytochemistry for the microtubule network was performed after PC12 cells were treated with DDC (75 μ M), MB (20 μ M), and MZ (20 μ M) for 4 hours. The fluorescent images showed that DDC, MB, and MZ all disturbed the cytoskeleton network, with MZ having shown severe depolymerization on PC12 cells. Moreover, to confirm these results, a Multi-Target Tracking (MTT) assay was used to show that there was a significant reduction in cell damage when the cells were treated with the microtubule stabilizer, Taxol, before being treated with the three dithiocarbamates. These results indicate that these compounds directly influence the microtubules. However, the dithiocarbamates might also display interactions with other parts of the cell, resulting in decreasing cell viability.



MICHAEL HANNON

I am a Computer Information Systems undergrad with a focus on Criminal Justice. As of now I am aiming to continue my education with a Masters in Forensic Computing here at John Jay. I am a driven learner who takes pride in self-learning and not depending on what schools or teachers attempt to teach. I know a variety of programming languages and computer systems including C/C++, C#, MySQL and Perl as well as systems knowledge in Debian Linux, Microsoft Window XP through 7 and Apple OSX 10.5 and later. Aside from school I enjoy tinkering with computers at home with my wife of 2 years (also a Computer Science major).

Investigating Spectrum-Agile Security Vulnerabilities in Wireless Networks (Dr. Sengupta)

My research regarding Dynamic Spectrum Security is two-fold. The first study regards the possibility of detecting Sybil attackers. Sybil attacks are those in which involve impersonating a trustworthy source in order to receive information from nearby users that could allow the attacker into a network. The research explores whether such an attacker could be discovered through signal strength indicators. By identifying Sybil attacks, important wireless networks could block and perhaps find the offender. The second study regards using honeypots, attractive traps, to divert attackers. By taking apart a packet, and then creating our own with a false message that could be sent out, an intruder would believe to have succeeded only to have received false information. If honeypots can be used to mislead attackers, this could increase the time a network has to protect itself as well as provide opportunities for catching and reporting offenders.

ALANDRA MITCHELL

I first began my journey at John Jay College as a Forensic Psychology major and quickly fell in love with the Science laboratories. Upon changing my major, I realized that the Sciences gave me so much to offer my home country of Trinidad and Tobago. I chose the path of Toxicology with an interest in the affects of toxic substances on the body and environment. With the help of PRISM, I was able to join a molecular biology research laboratory led by Dr. Rauceo. This experience has given me the opportunity to grow in two very different fields of science. I am now confident that my research training and course work will provide me with the best foundation to move on to my graduate studies.



Synthesis of *Candida albicans* ALS1 Mutant Expression Vectors (Dr. Rauceo)

Candida albicans is the fourth most common cause of nosocomial infections in the United States. Although this fungus exists as benign yeast in healthy humans, it can be pathogenic in immuno-compromised individuals. Adhesion to host surfaces and yeast cell-cell aggregation are the initial critical steps in the pathogenicity of *C. albicans*. The *C. albicans* ALS family of glycoproteins mediate adhesion and aggregation by forming amyloid domains. Amyloid formation was already shown to play an intrinsic role in the Als5p protein. Our long-term goal is to determine whether the Als1p forms amyloids. Our objective of was to construct a yeast plasmid that will express mutant Als1p protein fragments. A site-directed mutagenesis was targeted to the ALS1 Threonine Conserved region (TC). This region,

specifically the hydrophobic amino acid valine (V326) of the heptapeptide sequence I325VIVATT331, was shown to mediate amyloid formation in Als5p. We replaced V326 with a hydrophilic asparagine in the ALS1 Ig-TC mutant gene to create the plasmid pCRS02. Our DNA sequencing analysis verified successful mutagenesis. We transformed *Saccharomyces cerevisiae* with pCRS02, and protein expression was confirmed via immunoblotting. Directional cloning was also employed to prepare an ALS1 Ig-TC-TR mutant gene fragment. It is hypothesized that these Als1p mutant proteins will form amyloids similar to that of the Als5p mutant proteins, and will display aberrant cell-cell aggregation when compared to the Als1p wild-type protein.



STEVEN PINEMAN

All of my life I have been interested in science and law enforcement. At John Jay, I was able to find the best of both worlds. I will be graduating this spring with a degree in Forensic Science specializing in Criminalistics. The number of skills I have come to acquire from the program are tremendous, ranging from blood type determination to forensic photography. I have been conducting research under Dr. Angelique Corthals, since the summer of 2011. I cannot thank her enough for the guidance and knowledge she has given me. She inspired me to consider pursuing a graduate degree in Physical Anthropology and ultimately a career in Forensic Anthropology.

Quantifying Molecular Damage in Both Human and Non-Human Ancient Skeletal Remains for the Purpose of Genotyping and Evolutionary Studies (Dr. Corthals)

The study of evolutionary trends throughout populations by use of DNA is often impeded by the quality and quantity of extracted genetic materials. DNA stability and survivability can be highly affected by environmental factors, such as heat, moisture, acidity, or micro-organism activity. This becomes an issue when the available samples belong to ancient specimens, as the longer exposure to the environment will have higher effects on DNA damage. Protocols for ancient DNA extraction from skeletal materials have been developed to quantitatively improve the extracted materials, as well as reduce the possibility of contamination. In an effort to assess the evolutionary history of South American and Caribbean Chiropterans (specifically, the Phyllostomidae family), DNA was extracted from sixteen specimen bone samples. Two aspects of the extraction protocol were varied (use of carrier RNA, and incubation time) in order to assess effectiveness and simplification of the protocol. The samples that presented with usable DNA yield after NanoDrop analysis were used for PCR and Gel Electrophoresis analysis, using a total of nine Chiropteran specific primer pairs. The final step of the analysis involves sequencing of the obtained genetic material. Preliminary results indicate that carrier RNA may not be a vital component of DNA extraction, although its use does increase DNA yield; furthermore, incubation time variation indicates that a four hour incubation period is as closely efficient as the standard overnight incubation.

PRISM students often have the opportunity to speak about their research in depth, including visits to area high schools. For many students, the experience of discussing their work in this environment lets them take on the role of mentor for an afternoon.



Elliot Quinteros and Danielle Carthorne



ELLIOT QUINTEROS

My academic career so far has been long and arduous. I have faced many challenges which have tested me in numerous ways. Yet I don't regret my choices at all. I have always had a love for science which has pushed me into working hard and looking for ways to overcome the challenges I have faced. As a Forensic Science student, I have been taught to always look at things in a different perspective as well as thinking in new and different ways. Having this type of mentality has been an invaluable tool in not only my classes and undergraduate research but also in life. I will use the skills and tools I have learned as I progress in my academic career and hopefully they will help me to achieve my goals and aspirations for the future.

Surface Modification for the Development of a Novel Drug Detection and Fingerprint Scanner (Dr. Roberts)

Advances in the detection of illicit drugs now potentially allow for the use of an individual's sweat to determine if that person has had any contact with drugs. The way this is determined is through the use of metabolites produced in the liver, such as the metabolite benzoylecgonine, an indicator for the presence and use of cocaine. We propose to use immunogenic binding to determine the presence of the biomarker. Initially the principle for the modification of the surface and the detection of benzoylecgonine will be proven. This will be executed using spectroscopic methods such as ultraviolet light and surface plasmon resonance, as well as electrochemical methods. The overall goal will be to create a fingerprint scanner which will be able to use the same principles.



BAIBHAV RAWAL

I was born and raised in the Himalayan nation Nepal, where its rich bio-diversity always intrigued me. My obsession for forensic science flourished when the country lacked enough forensic examiners to investigate burial and cremation sites of the people who were killed or disappeared during the decade-long war against the Maoists rebels. After the completion of high school, the next step in my life was to enroll in a Forensic Science Program with a strong focus on Molecular Biology, and this was when I discovered John Jay. As a budding scientist, I got the opportunity at the end of my sophomore year to participate in a research program with Dr. Korobkova on fluorescence studies of cytochrome c and its role in apoptosis. My participation in this research program was vital to bring about the intellectual change in my approach to becoming a member of the scientific community and preparing me for the graduate program.

Cytochrome C in Apoptosis (Dr. Korobkova)

Cytochrome C has a prominent role in apoptosis, a programmed cell death that occurs in multicellular organisms. Specifically, apoptosis is the phenomenon of cell suicide during the development of cell or in response to infection or DNA damage. One of the biggest challenges the scientific world has been facing is dealing with cancer cells, in which the process of apoptosis is obstructed by oncovirus, mitochondrial dysfunction, caspase inactivation and several other factors. Different studies were performed to further develop the understanding of the role of Cytochrome C in apoptosis and to examine the effect of food dyes on the activity of Cytochrome C. Efforts are being made to develop biophysical and biochemical strategies to initiate Cytochrome C for promoting the death of the cancer cells. Cytochrome C is also an important component of the electron transport system embedded in the inner mitochondrial membrane. We will conduct fluorescence studies of Cytochrome C in its reduced and oxidized states in order to reveal the role of its electron transport properties in the initiation of apoptosis.



ANDREA SAENZ

I entered John Jay College in 2007, enrolled in the Criminology major. I have always been interested in knowing why crime occurs and I thought following a career which specializes in the study of crime would be just what I was aiming for. After my first year I realized that I was not being challenged enough and sought a new path. I decided to change my major to Forensic Science-Toxicology track. In all my science courses I found myself at the edge of my seat amazed at what I had not known and excited to learn and expand my knowledge in these different areas. I am currently doing research with Dr. Champeil and work as a lab technician for instrumental analysis at John Jay. After graduation I plan on continuing my education in graduate school in order to specialize in pharmaceutical chemistry.

Sequence Selectivity Determination for Decarbamoyl Mitomycin C DNA- β Monoadduct (Dr. Champeil)

Mitomycin C (MC), a DNA alkylating agent, is a cytotoxic anticancer drug in use today for cancer treatment. 10- Decarbamoyl mitomycin C (DMC) is a chemically modified monofunctional MC derivative. Both DMC and MC react with DNA forming similar DNA monoadducts and interstrand cross-linked adducts, of which the latter is the primary cause of cell death. DMC is known to produce a higher yield of DNA adducts than MC in human cancer cells and causes more DNA damage. More importantly it induces cell death more rapidly than MC in both the presence and absence of p53 protein, a tumor suppressor protein frequently mutated in human cancer cells. This research aims to determine the sequence selectivity of the DMC

β -monoadduct when it alkylates DNA in vivo. No information is available on the sequence selectivity of DMC β -monoadduct but based on the differentiating chirality and how this may affect the alignment of the drug with DNA it has been hypothesized that a GC sequence will be favored. DNA has currently been treated with DMC and has undergone enzymatic digestion using a protocol which allows the dinucleotide derivative of the DMC β -monoadduct to remain intact. HPLC analysis has indicated the possibility of sequence selectivity but requires further testing. Both HPLC and Mass Spectroscopy will be employed in order to isolate and determine its sequence selectivity.



**EVA MARIA
SANTOS TEJADA**

As a little girl my favorite program was “Unsolved Forensic Cases by the FBI”. However, the thought of studying forensic science was only a dream! After having received a government funded scholarship from the Dominican Republic in 2006, the journey started at Queensborough Community College (QCC). After my graduation from QCC, I transferred to John Jay College of Criminal Justice. I was very encouraged, yet intimidated by this new experience. In the fall of 2009, I found myself sitting in Dr. Carpi’s office – convinced that the world I had so longed for was falling away. Dr. Carpi, my research mentor and academic advisor, gave me what he seemed to have least of: “time.” He focused not on my academic failures, but on an array of possible solutions for me not to give up. Today, I thank God for people like Dr. Carpi and many others who, despite their busy schedules and full agendas, took time to motivate and encourage me while the world around me seemed to be crumbling into pieces. If my teachers and mentors had not taken the time to believe in my ability to finish successfully, I probably would have returned to my home country and may not have discovered this life-changing passion – to teach.

Decomposition and Flux of Mercury Species from Water (Dr. Carpi)

Mercury has a complex biogeochemistry in which different species of the metal participate in different transport processes depending on the chemical properties of the constituent in question. Several environmental reactions influence this process by driving the reduction or oxidation of mercury, and inter-conversion between mercury complexes. While the reduction of HgCl_2 , HgO and HgS play important roles on land surfaces, Hg^{+2} salts hydrolyze in water to form HgClOH (in the case of mercuric chloride), Hg(OH)_2 , Hg(OH)_3^- , or even Hg(OH)_4^{-2} . Mercury hydroxide compounds exhibit different reduction/oxidation potentials than other salts. The goal of this work is to examine the kinetics of the formation and the decomposition of mercury hydroxide complexes in water, and the subsequent emission of this elemental mercury from these systems.



SARAH SEDA

My journey to the Forensic Science program at John Jay was an unexpected one. I went to Frank Sinatra School of the Arts High School for Instrumental Music where I played upright bass for three years. All my life my heart was set on going to college for music and being a music teacher. One summer I was reading a novel, *The Cradle Will Fall* by Mary Higgins Clark, which is about a doctor who kills his patients. The role of the Medical Examiner immediately caught my interest and I saw myself working in a similar field one day. While my high school wasn't big on the sciences, my desire to study Forensic Science grew. I decided to come to John Jay and study to be a Forensic Toxicologist. I look forward to going to graduate school and afterwards working in a crime lab helping to bring justice.



Novel Molecular Sensors for the Detections of Both Fluoride Anions and Mercury(II) Ions (Dr. Champeil)

Fluoride anions play an important role in biological systems. Fluoride anions are also involved in dental care as well as clinical treatment for osteoporosis. Although fluoride is beneficial in some ways, too much of it can be harmful. Large intake of fluoride or even small consistent intake of fluoride lead to gastric and kidney disorders, dental and skeletal fluorosis or sometimes death. For these reasons, scientists have been in pursuit of developing sensitive methods for detecting and monitoring fluoride concentrations. While a few methods have been developed to detect fluoride there is one that is of particular interest which is the fluoride-induced cleavage of tert-butyltrimethylsilyl ether. Upon addition of fluoride, the Si-O bond is cleaved and the deprotected oxide anion is now part of a conjugated system. This causes the compound to fluoresce. The detection of the mercury(II) ion is of interest to scientists as well. In the past few years, traces of mercury have been found in the organs of fish. Mercury is highly toxic and can cause nerve, brain and kidney damage. One method of interest in detecting mercury ions involves molecular receptors based on the high affinity between mercury and thiols. We plan to design and synthesize a molecular sensor which will allow the detection of both fluoride and mercury ions. The design of this sensor will be based on the previously described methods.

Andrea Saenz



KELLY SONG

Growing up in a fairly traditional family, a career in laboratory science was never taken into consideration. My parents' ideal career for me was the typical doctor, teacher, computer engineer, or lawyer, but these professions did not, and still don't, appeal to me. Many of my family and relatives are in fields they do not enjoy nor find interesting. I want to break free from this trend and set my own path. I plan to be the first in my immediate family to pursue a career that I actually enjoy. There is always something new to learn and discover in science that will continue to keep scientists on their toes. That's what fascinates me about science; it never gets old. Whether it is toxicology, microbiology, or even health sciences, I do not see myself, nor do I intend on, leaving the field of science.



A study in Visual and Linguistic Cognition Regarding Galileo's Principle of Relativity: That all (unaccelerated) reference frames are physically equivalent (Dr. Yaverbaum)

Permeating countless strong and fundamental arguments in classical mechanics is inertial reference frame equivalence. Neither the Earth nor any sun is characterized by inherent velocity. This profound recognition represents both how we solve terrestrial problems and why we find them celestially significant. First, internalization of Galileo's *Principle of Relativity* is central to a command of the comparatively concrete curriculum: Classical (Newtonian) mechanics. Second, it is central to an appreciation of the comparatively abstract curriculum: modern (Einsteinian) mechanics. Third and finally, the recognition of distinct yet equally valid perspectives is helpful, if not crucial, for development past a cognitive stage of egocentricity (Piaget and Inhelder, 1958). Unfortunately, however, relativity tends to be emphasized to a small extent (Haliday, Walker & Resnick, 2010, pp. 73 – 75) and grasped to an even smaller extent in contemporary introductory physics courses.

The study instrument is a series of animations depicting simple motions involving three bodies. Each animation is accompanied by a question regarding the motion of one of the three objects as viewed from the perspective of another of the three. Identical questions are posed using different (but equivalent) wordings. While the participant is engaging with the animations and questions, s/he is connected to eye tracking equipment. The participant's responses (correct or incorrect) are correlated with both the wording choices and the eye movements. In addition to the animation-based questions, metacognitive Likert Scale questions are asked of the participant. These qualitative questions concern the nature of the participant's mental model of the Principle itself. They probe the extent to which the participant "understands" and/or "agrees with" explicit statements and specific implications of the Principle.



Mohanram Bassit



ANNA STOLL

Sir Cyril Herman Hinshelwood states “[Science is] an imaginative adventure of the mind seeking truth in a world of mystery”. I have always had the desire to be in the thick of the adventure that is science and through research I feel that I have taken my first steps in the life long journey. I began my studies at John Jay in 2008 as a Forensic Science major. After many courses I became more interested in applying what I was learning to real life. Research with Dr. Cheng has allowed me to apply my classroom knowledge to real life as well as provide me with a desire to learn how the human body works. My research which hopes to contribute to what is known about Parkinson’s disease has introduced me to human biology and toxicology and has inspired me to pursue the Molecular Biology and Toxicology tracks of the Forensic Science major. I hope to use my experiences at John Jay will to contribute to the further understanding of human biology.

Role of Alpha-Synuclein and Its Mutants on Dithiocarbamates Cytotoxicity (Dr. Cheng)

Mn-containing dithiocarbamates, such as maneb (MB) and mancozeb (MZ), have been known to increase the toxicity of neurotoxin MPTP on dopaminergic neurons which can lead to cell death and Parkinson-like symptoms. Dopamine transporter (DAT) is a key protein in MPTP’s toxicity by transporting the active metabolite (MPP+) into dopaminergic neurons. Increasing the cell surface expression of DAT increases uptake of MPTP. Alpha-synuclein can regulate DAT trafficking by interacting with DAT. Alpha-synuclein (wt) and its mutants (A30P and A53T) have been associated with Parkinson’s disease. The aim of this study is elucidate the role of the alpha-synuclein and its mutants on dithiocarbamate cytotoxicity. HEK cells transfected with DAT and either alpha-synuclein or its mutants were treated with

dithiocarbamates. Cell lysates were used for co-immunoprecipitation using anti-DAT antibody. The co-immunoprecipitated proteins were subjected to Western blot analysis probed with alpha-synuclein and DAT antibodies.

The results showed there is about a 30% decrease in the DAT/alpha-synuclein interaction in the presence of the A53T mutant versus wild-type, but not in the present of A30P mutant. With dithiocarbamates the interaction of DAT and alpha-synuclein (wt) was enhanced, with increases ranging from 50% to 200%. Pesticide treated A53T mutants respond more dramatically than A30P mutants in increasing the interaction between the DAT and the alpha-synuclein.

LEONID SUKALA

I'm very proud to be a senior at John Jay College. Over the years I have been lucky to be part of the PRISM program here, and I can't imagine what I would have done without that opportunity. I've gained invaluable experience working in a very active Yeast lab which helped me form a much better idea as to the type of work I would like to pursue: academic research. I first started working on the pathogenic yeast *Candida albicans* and its cell-surface proteins - making various mutant strains by learning how to manipulate genetic material and introduce that material into a living cell. I increasingly became excited both on and off the bench by thinking about future experiments, researching published scientific articles and optimizing assays towards our research goals. I've learned that good science is anything but static; ideas are constantly formed and re-formed as fresh new data comes in and pre-conceived notions go out (hopefully). My hat goes off to all the hard-working staff and fellow students that made my PRISM experience not just memorable, but invaluable towards reaching my goals in life.



Functional Conservation of *Candida albicans* Transcription Factor SKO1p in Baker's Yeast (Dr. Rauceo)

The leading opportunistic fungal pathogen, *Candida albicans*, can cause superficial mucosal infections as well as life-threatening systemic infections. In most healthy individuals exhibiting normal immune function, *C. albicans* exists as a benign, commensal yeast. However, when the immune system has been compromised, or when certain conditions are permissive, *C. albicans* enters a pathogenic state that can exhibit these life-threatening infections. This state is characterized by a complex transformational process that includes hyphae growth, biofilm formation and, as recent discoveries indicate, amyloid-formation brought on by cell-wall adhesins. These functions preclude a dynamic, responsive cell wall that mediates such phenotypic switching as well as general life processes and demands of the cell. Additionally, adaptation to a continually stressful micro-environment, which can include encountering wide ranges of osmotic pressure and pH, as well as host defenses, is an emphasized trait for an invasive species such as *Candida*. Signaling pathways play a very important role in such organisms. The HOG (High Osmolarity Glycerol) pathway, a major signaling cascade used by yeast cells to counter osmotic shock,

lacks a robust and detailed description of its underlying circuitry. The zoo of kinases, phosphatases and transcription factors that talk to each other in order to regulate relevant genes have yet to be fully mapped. Our lab uses molecular genetic methods to generate data (by virtue of monitoring RNA levels as well as other techniques) to flush out key proteins during the cell's encounter with high salt environments. We have been creating mutant strains (who lack or harbor specific genes) and record their transcriptional profile after stress. This, along with growth assays, biochemical assays and bioinformatics is used to generate data that we interpret and fit into a cohesive, high resolution circuitry model. We are exploring the functional conservation of CaSKO1p (an orthologue of ScSKO1p) in *Scsko1* mutants. Our data suggests that the *Scsko1* mutants significantly restore their wild-type phenotype when undergoing salt-induced stress, arguing for a surprising conservation of transcription factor activity despite being far apart phylogenetically. Elucidating such signaling pathways allows researchers to find new target genes for development of therapeutics against this invasive and potentially deadly yeast.

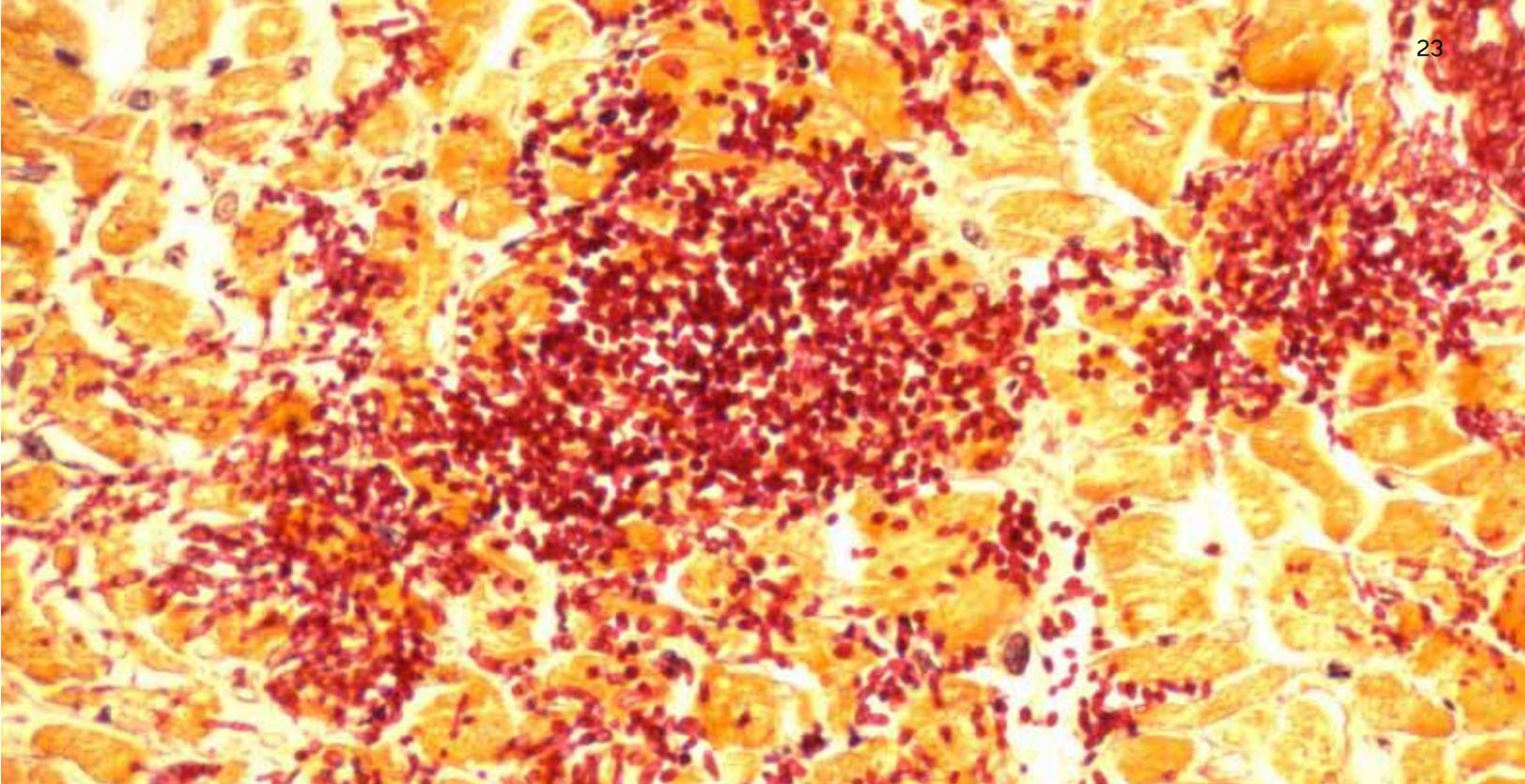


DAVILENYS TAHAN

Guess Who? was a board game I enjoyed playing when I was younger. It involved giving clues of your character's physical features to your opponent, which they would guess according to the faces on the cards staring back at them. I've always enjoyed being challenged to uncover the identity of something unknown through concrete clues. After taking a forensic science course during high school, I knew that forensic science was a career that would challenge me. Here I am in John Jay College, pursuing a degree in Forensic Science in the Toxicology track; which is a dynamic environment where I manage to hold on to my sanity every day, and I love it. Toxicology is appealing in that the poison can derive from an unknown compound, and then it becomes my job, my challenge, to discover its identity, its target site, and its hostile effects based on the response or clues from the organism. Those are the challenges I look forward to accomplish as a future forensic toxicologist with the initial guidance that PRISM and my research mentor, Dr. Yi He, provided.

Determining Trace Metals in Wool Samples Using ICP-MS (Dr. He)

In the forensic world, detecting trace metals in evidence is like finding fingerprints in a crime scene. Detecting trace metals in criminal evidence is still a new technique waiting to be further developed. The purpose of this research is to identify and quantify the metals (elements) of high concentration in wool samples using the inductively coupled plasma mass-spectrometer (ICP-MS). The elements that will be used are Zinc (Zn), Barium (Ba), Aluminum (Al), Iron (Fe), Chromium (Cr), Nickel (Ni), Magnesium (Mg), Manganese (Mn), vanadium (V), and Copper (Cu). An analysis of the low concentration elements was done during the Fall of 2011. The elements analyzed were Indium (In), Antimony (Sb), Cesium (Cs), Lead (Pb), Bismuth (Bi), Uranium (U), Mercury (Hg), Beryllium (Be), Cobalt (Co), Cadmium (Cd), Molybedemum (Mo), Arsenic (As), and Selenium (Se). The detection of the elements was accomplished by using the internal standard method. The wool samples were prepared by digesting them with Optima Grade Nitric Acid (HNO_3) and with hydrogen peroxide. The samples were then diluted with 2% nitric acid, and Germanium was added as the internal standard. The concentrations of the elements in the wool samples were determined by creating five-point calibration curves and using the linear regression equations to calculate the true concentration values. It was determined for the low concentration calibration range that the ICP-MS is able to detect low concentrations of Indium (In), Cesium (Cs), Antimony (Sb), Lead (Pb), Bismuth (Bi), and Uranium (U) in samples containing wool. The obtained data will be further analyzed using principle component analysis (PCA) to investigate the importance of each element on sample differentiation and comparison.



JENNIFER TEUBL

This will, sadly, be my last semester here at John Jay. Over the last several years I have pursued my interest in genetics and molecular biology. Through PRISM I have developed the skills necessary to succeed in a lab. I will be attending graduate school in the fall, where I will pursue a PhD in the biological sciences. My research at John Jay focused on the pathogenic organism, *Candida albicans*. A combination of molecular biology techniques and in silico analysis has allowed us to successfully explore signal transduction pathways vital to *C. albicans*' survival. Under the mentorship of Dr. Rauceo I've had the opportunity to discover the fascinating world of genetics, as well as expand my inquiry into the world around me.



***In silico* Analysis of Putative *Candida albicans* SKO1p Binding Site (Dr. Rauceo)**

The ability of an organism to respond to stress in its environment is critical to its survival. The focus of the following months will be to confirm the importance of stress signaling pathways in the pathogenic yeast, *Candida albicans*. The HOG1- SKO1 pathway has been shown in previous studies to respond to osmotic shock in the bakers yeast *Saccharomyces cerevisiae* and recently in *C. albicans*. Here, we will determine the cellular phenotype for *sko1* Δ/Δ and *hog1* Δ/Δ mutant strains following osmotic stress. Growth rate kinetics will be determined in the presence or absence of Sodium Chloride (NaCl) for *sko1* Δ/Δ and *hog1* Δ/Δ mutant strains and will be compared to a wild type strain. We will determine whether salt treatment causes aberrant cell morphology by observing the mutant strains under light microscopy. By using these mutant strains, we hope to illustrate the importance of the HOG1-SKO1 pathway under osmotic stress in *C. albicans*. In addition, we will introduce the Ca SKO1 into a *S. cerevisiae* *sko1* Δ mutant and test for functional conservation.



SZILVIA TOBAK

I began my college experience at Monmouth University with the prospects of receiving a degree in criminal justice with a concentration in forensic science. Although I enjoyed learning about the criminal justice system and its various components and ideologies, I was always most interested in and intrigued by my science classes. Having always been an exceptional student, I decided to take on the challenge of receiving a degree strictly based on the sciences as applied to forensics at John Jay. In the three years that I have spent here I have learned a great deal about biology, chemistry and physics and have developed a new way to process life and gauge what I want to do with my future. Despite my interests in all sciences and the ways in which they compliment each other, I have been most affected and engaged by molecular biology and biochemistry. My experiences with PRISM and the research I conduct with Dr. Lents involving a transcription factor known as myeloid zinc finger-1 (MZF-1) of the protein connective tissue growth factor (CTGF) has only amplified my appreciation for the beauty, sophistication, complexity and significance of biological based sciences. Based on this I hope to further my education and ultimately find a career in either the medical field or the pharmaceutical industry.

Identifying and Defining the Specific Regulation of Myeloid Zinc Finger-1 (MZF-1) as a Transcription Factor for the Protein Connective Tissue Growth Factor (CTGF) (Dr. Lents)

In this research project, the members of Dr. Lents' laboratory have been able to demonstrate that Myeloid Zinc Finger-1 (MZF-1), a plentiful protein made in the bone marrow, acts as a transcription factor to affect the production of Connective Tissue Growth Factor (CTGF) of cells in the locality of megakaryocytes. MZF-1 is a contributor in the communication between megakaryocytes and other bone marrow cells to produce and provide the CTGF protein to thrombocytes, a vital role in the process of blood clotting. The identification and confirmation of MZF-1 as a transcription factor of the CTGF gene initiates research in order to classify the specific regulation of these players. In order to investigate this correlation between MZF-1 and CTGF, RNA level translational regulation will be quantified based on controlled external cell conditions. Treatment with stimulants such as Vitamin D3 and inhibitors of this drug should provide information on the role of CTGF's translation and MZF-1's regulation in the cell. In addition to inducing transcription with Vitamin D3, our laboratory will soon stimulate expression via retinoic acid (Vitamin A) and suppress expression via a Vitamin A inhibitor in a similar fashion. Another aspect of this more extensive investigation involves the synthesis of a micro RNA knockdown of MZF-1, producing a knockdown plasmid with a retrovirus used to transfect the cell lines of interest. In this attempt to alter MZF-1 expression at the RNA level through this knockdown, we hope to observe a decreased effect on CTGF regulation such that the interaction between the two genes is more eloquently defined through this experiment.

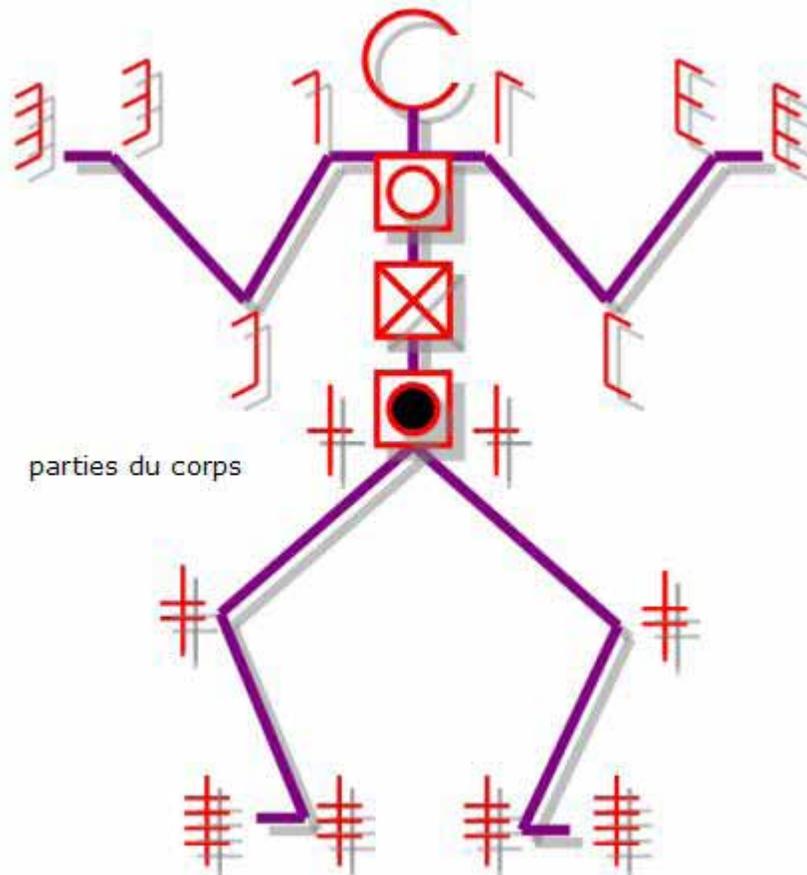


SUDIP ULAK

I am majoring in Computer Information Systems (BS). In the near future I plan to become a programmer. The computer has always been my subject of interest. After I started studying at John Jay, I have seen many possible specializations in the field of computer studies. I believe that there are still many things that need to be explored in the computer field which could raise the degree of efficiency in our work lessening time with an increase in security. Since the spring 2012 I have become research assistant under PRISM. I hope to make the best out of my research abilities with the opportunities I will have under PRISM.

Classification of Human Movement Using Kinetography Laban (Dr. Johnson)

This project is an attempt to automatically attach semantic significance to bodily movement. We collect depth-image data of human movement through a 3d imaging device, the Microsoft Kinect. The images are processed, and converted into a mathematical model in which the human form is represented parametrically. Then, using statistical techniques from the theory of machine learning, we classify the movement according to the conceptual system of Kinetography Laban, a well-known system of dance notation.



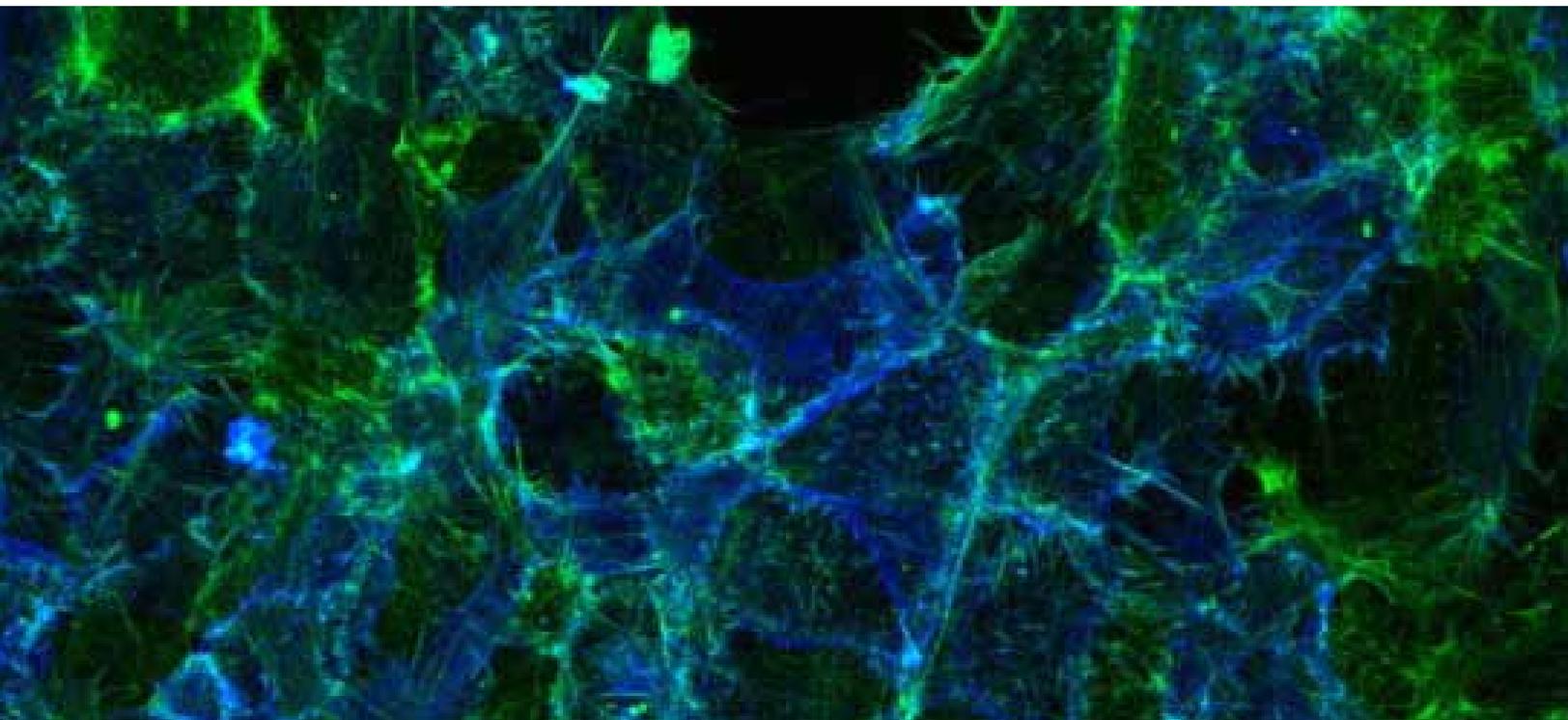


JUSTIN WALTERS

In my third year in high school I was influenced by a television show hosted by a pathologist. I developed an interest in the field of forensic pathology. Upon acceptance to John Jay I thought this was a dream come true. After my first two years I realized I wasn't into forensics at all but I knew I wanted to go to medical school. In spring of 2010, I was sent to Colorado State University in Fort Collins Colorado by the late Dr. Friedland to conduct research on *Phytolacca Americana* (Pokeweed plant). During this time I realized I liked the teamwork aspect in the lab and further confirmed my passion for medical school. In the following year I started doing research with nanoparticles then VMAT2 with Dr. Cheng. In the fall of 2011 I joined Mentoring in Medicine and was accepted to the Medical Pathway Program. During the spring of 2012, I became a Community Health Ambassador and plan to volunteer in many community health events while preparing for medical school. Upon graduating from John Jay, I plan on possibly teaching high school science or math and continuing to be an advocate for health in the community.

The Toxic Mechanism of Dithiocarbamates and Vesicular Monoamine Transporter 2 in HEK-DAT Cells (Dr. Cheng)

Vesicular Monoamine Transporter type 2 (VMAT2) is a channel within neuronal cells that is responsible for the uptake of cytosolic dopamine as well as newly synthesized dopamine into vesicles. With idiopathic Parkinson's disease being the second most common neurodegenerative disease in the nation, the mechanism of VMAT2 is definitely worth investigating. It has been reported that the loss of VMAT2 before any DAT contribute to early signs of Parkinson's disease (PD) (Chen, 2008). The enhancement of VMAT2 activity could have neuroprotective effects by decreasing the cytosolic dopamine levels. VMAT2 also interacts with many clinically relevant drugs, including the psychostimulants 3,4-methylenedioxymethamphetamine (MDMA), amphetamine and MPP+. Expression of VMAT confers resistance of mammalian cells to MPP+, and this resistance is accomplished by transport and storage in intracellular acidic compartments, thus removing it from its presumed target. VMAT2 is an important component of the early events of MPP+ toxicity. Reducing VMAT2 expression could enhance MPP+ toxicity. It is unknown whether MB and MZ potentiate MPP+ toxicity through down-regulating VMAT2 expression. The aims of this study are (1) to elucidate the role of VMAT2 in PC12 cells in Parkinsonism and (2) to evaluate the effect of dithiocarbamates on VMAT2 expression.





CINDI-ANN WILLIAMS

My participation in undergraduate research has been an unimaginably fulfilling experience. I was born and raised in Grenada and decided to come to John Jay to pursue a Bachelor's degree in Forensic Science after discovering my interest in science as it applies to the law. I could never have imagined the possibilities that the future held. Working with my mentor, Dr. Shu-Yuan Cheng has provided a supportive environment for scientific inquiry and for learning the skills necessary to become a successful scientist. Although conducting research while pursuing my major has been challenging, I feel that I am well prepared for my graduate education. As a graduating senior, I hope to continue on to graduate education in the biomedical sciences.

Maneb and Mancozeb Activate the NF-Kappa B Signaling Pathway (Dr. Cheng)

Infantile parkinsonism-dystonia (IPD) is a severe neurological syndrome that usually presents in early infancy with hypokinetic Parkinsonism. The disease locus was mapped to chromosome 5p15.3 with SLC6A3 gene mutations, c.1103 T>A (p. L368Q) and c.1184 C>T (p. P395L). Functional studies revealed that both mutations led to a reduction in the level of mature dopamine transporter (DAT). These mutants have been shown to link with Dopamine Transporter Deficient Syndrome (DTDS), an inherited early-onset IPD. However, the pathogenesis of DTDS is not well established. Previous research has shown that the dopamine metabolite 3-MT (3-methoxytyramine) is an active neuromodulator that causes a complex set of abnormal movement in dopamine deficient DAT knockout mice. These behavioral effects induced by 3-MT in a dopamine-independent manner are partially mediated by the trace amine associated receptor 1 (TAAR1). This research project examines the pathological mechanism of DTDS. Initial steps involve the elucidation of the involvement of oxidative stress in the DTDS by using MTT assay to measure the cytotoxicity and dichlorodihydrofluorescein or difluorofluorescein to monitor the production of reactive oxygen species (ROS) and reactive nitrogen species (RNS). It also investigates the in-vitro response of dopaminergic cells to oxidative stress induced by dithiocarbamates in the presence of TAAR1 mediation of dopaminergic activity as a possible secondary mechanism of pathogenesis. The response will be primarily measured using the MTT Assay. Additional confirmation may utilize ELISA, immunocytochemistry and co-immunoprecipitation to confirm the direct interaction between TAAR1 and DAT by using HEK cells.

Student Publications and Presentations

PRISM students are regularly engaging with the scientific community through both presentations and publications. Below are a few of the many accomplishments students achieved before finishing their studies at John Jay.

Publications

- Grimley K, Peralta Z, Kobilinsky L, and Lents NH (2010) "Analysis of the Suitability of the iPrep DNA Purification Instrument for Routine Forensic Applications" *Journal of Forensic Identification*, 60(2): 656-681
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- Gonzalez-Lopez E, Cheng S (2012) "The Role of Microtubule on Dithiocarbamate Cytotoxicity," Experimental Biology conference, San Diego, CA, Apr 21-25, 2012
- Hui C, Carpi A (2011) "Mercury emissions from soil in response to simulated precipitation events," Poster Presentation at the 10th International Conference on Mercury as a Global Pollutant, Halifax, Nova Scotia, July 24-29 2011
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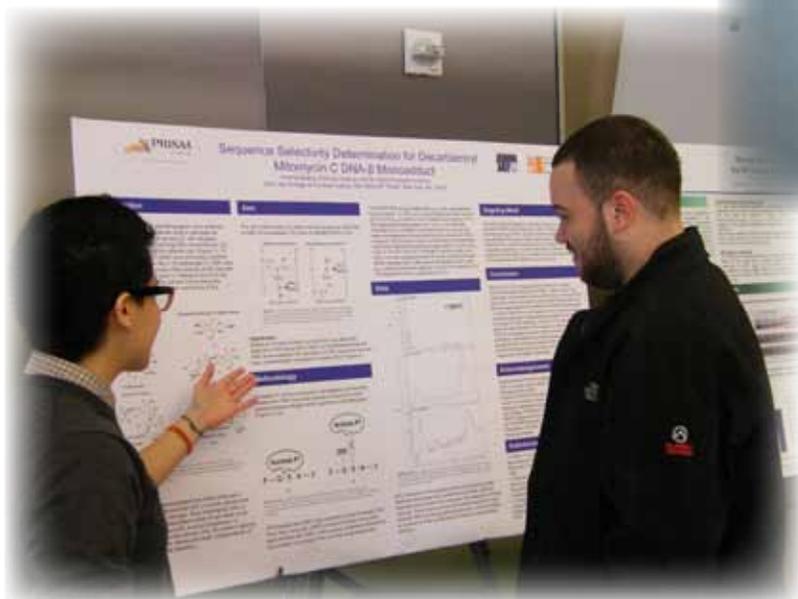




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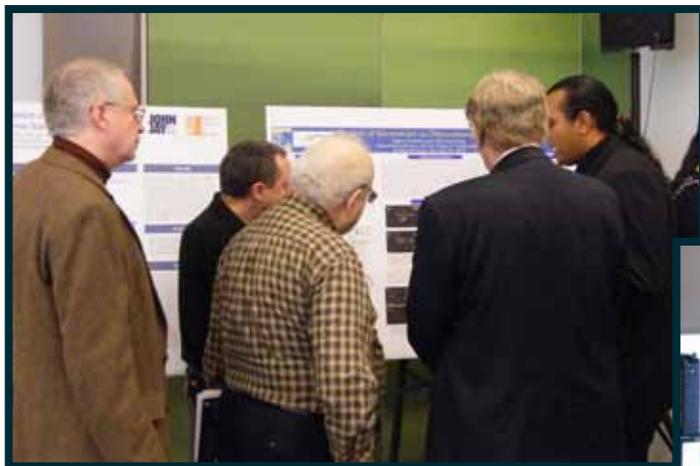
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Williams C, Cheng S (2011) "Dendritic Cell Therapy: An investigation of IL-12p70 production and maturation in Dendritic Cells" American Biomedical Research Conference for Minority Students (ABRCMS) 2011, St. Louis, Missouri, November 9-12, 2011



2012 PRISM Symposium

The PRISM Undergraduate Research Symposium celebrates the highest level of student achievement. This year's Outstanding Undergraduate Researcher, Roselynn Cordero, discussed her novel work creating molecular scale tweezers and then using these tweezers to determine the chemical conformation of molecular complexes. Her work can



Eugene Gonzalez-Lopez, one of two Outstanding Poster winners, explains his research to a rapt audience of faculty members.



Leonid Sukala, one of two Outstanding Poster winners, discusses his research with mentor **Dr. Rauceo** and fellow students.



Drs. Kobilinsky, Lents and **Carpi** cut the cake, celebrating PRISM's 5th Annual undergraduate Research Symposium.

(Bottom) **Mohanram Bassit** chats with **Dr. Cheng**.



Former PRISM Symposium Speakers and Awards

2011

Keynote: Kimberly Papadantonakis, PhD (California 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 (State University of New York – Buffalo)

John Jay: Graduating Class of 2002.

Award Recipient: Kana Noro

2008

Keynote: Marcel Roberts, PhD (Boston College)

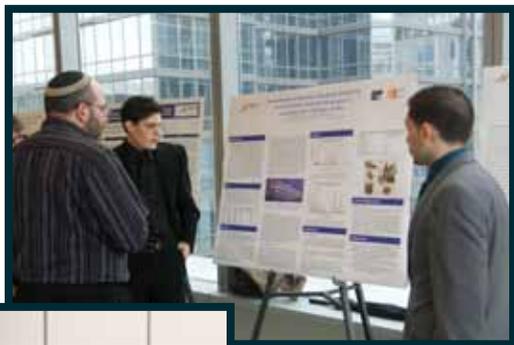
John Jay: Graduating Class of 2002

Award Recipient: Nicole DeLuca

have implications for biomolecular recognition, material science, and information storage. Keynote Speaker, and John Jay graduate, Dr. Damon Borg followed with guidance on preparing for graduate school, and shared some of the techniques he used for success. He then discussed his research into the toxicity and bioaccumulation of marine biocides on brook trout, as well as the projects being undertaken at AFTS Labs, where he works.



Roselynn Cordero (second from right), the 2012 Outstanding Undergraduate Researcher, along with Honorable Mention awardees (left to right) **Leonid Sukala**, **Eugene Gonzalez-Lopez** and **Jennifer Teubl** (far right).



Dr. Damon Borg
2012 Keynote Speaker

Dr. Borg completed his Ph.D in Pharmaceutical Sciences - Toxicology at St. John's University College of Pharmacy and Allied Health Professions in 2009. He received his Bachelor of Science in Forensic Science, Summa Cum Laude, from John Jay College of Criminal Justice in 2005 after completing the toxicology track. He is currently the Director of Scientific Research and Development and Lab Supervisor at AFTS Labs in East Northport, New York.

Dr. Borg gave a tri-part presentation entitled *Keys to Graduate School & Research in the Toxicology Field*, in which he discussed the benefits he gained from his coursework at John Jay, the areas he needed to develop while pursuing his Ph.D., and his reaserch both as a graduate student and at AFTS Labs.



Dr. Ana Petrovic, from the New York Institute of Technology and co-mentor to Roselynn Cordero, introduced her and highlighted the qualities that make her an outstanding researcher.

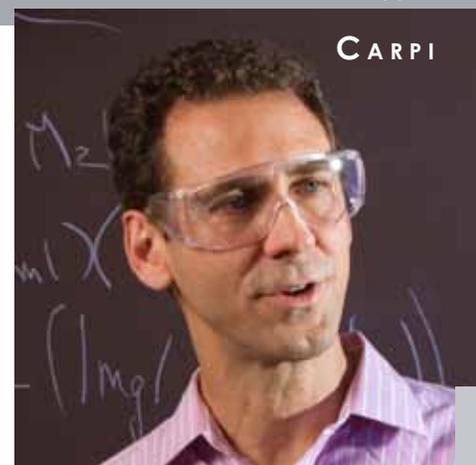
Research Mentors

PRISM is about more than simply teaching students how to conduct research. The faculty mentors supervising student projects are invested in each student's progress and act as important role models, representing the diverse paths down which a degree in science can lead. Our students and mentors form important personal and professional relationships that carry well on after graduation.

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.

Dr. Li working with students Sofia Cheliout da Silva and Ankit Bhatta in his lab





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 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 3 years later decided to go to graduate school. Not one to be confined to 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.

My current research interests broadly fall into two categories: 1) the chemistry and environmental transport of mercury; and 2) the teaching of scientific reasoning skills. Mercury has a complex environmental chemistry that, in part, accounts for its status as the leading cause of 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. We've 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, modeling, and field studies (New York and Brazil) to investigate the kinetics of these processes and their impact on human health.

I've also been interested in improving students' understanding of the methods and skills used in science. While science is an incredibly exciting and interactive field, we often convey it as a series of facts and figures to be memorized. In this respect, I have been involved in developing techniques to teach about scientific process and the perspective we gain by understanding the place we hold in the universe and our relationship to the environment.

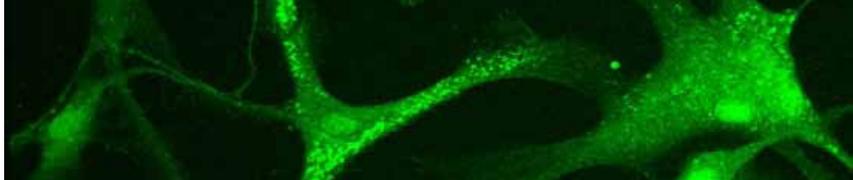
Elise Champeil, PhD (University of Ireland, Trinity College)
Associate Professor of Chemistry

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 research interests include: 1) Studying roles that environmental toxins (dithiocarbamate compounds) play in neurodegenerative diseases such as Parkinson's Disease. This includes altering protein-protein interactions between molecules like α -synuclein, dopamine transporters, and others; 2) Identifying the target genes and proteins that 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 dopamine transporter expression.

Angelique Corthals, PhD (University of Oxford)

Assistant Professor of Chemistry and Biochemistry

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

I have always been interested in archaeology. While studying at Oxford, my next door neighbor was a developmental biologist who was doing a study on the genetics of populations in the Nile Valley. She needed someone with expertise in Middle Eastern history and population genetics. As I began to help with her project, this led me to my doctoral work, looking at the relationship between art work styles of historical populations and changes in the genetic makeup of those populations.

My current foci of research are the historical ecology of infectious diseases, the history of autoimmune diseases, and protocols of recovery of genetic information for ancient or damaged specimens. In addition to teaching at John Jay, I am currently the forensic anthropologist-in-residence on the University of Brussels' TT29 excavation in the Valley of Nobles in Luxor, Egypt. I have appeared in several documentaries for National Geographic and Discovery Channel, as well as in a full length feature IMAX movie currently screening worldwide called *Mummies: Secrets of the Pharaohs*.

CORTHALS





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.

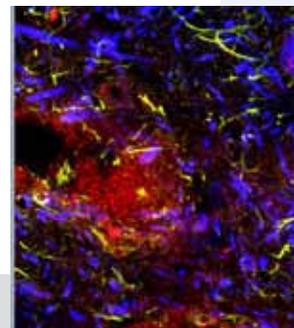
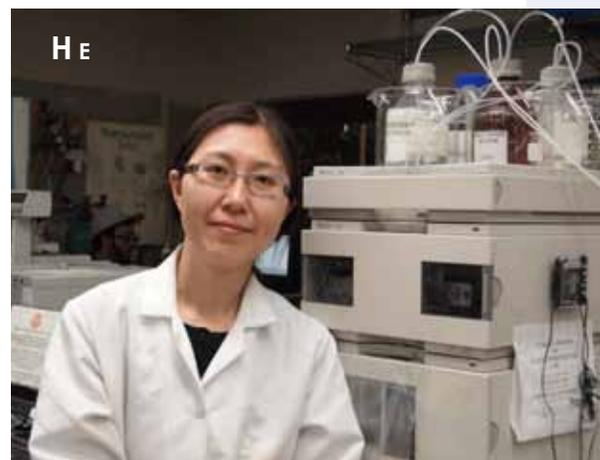


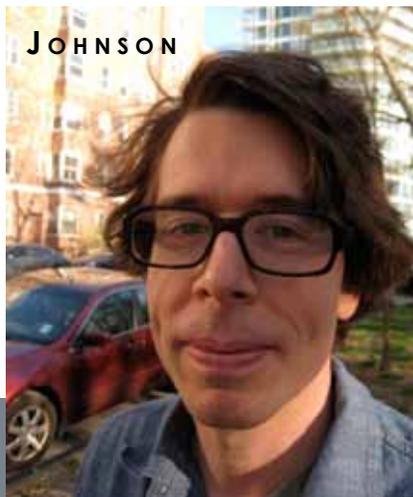
Yi He, PhD (City University of New York)
Associate Professor of Chemistry

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 a "@" 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.

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 life time 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.



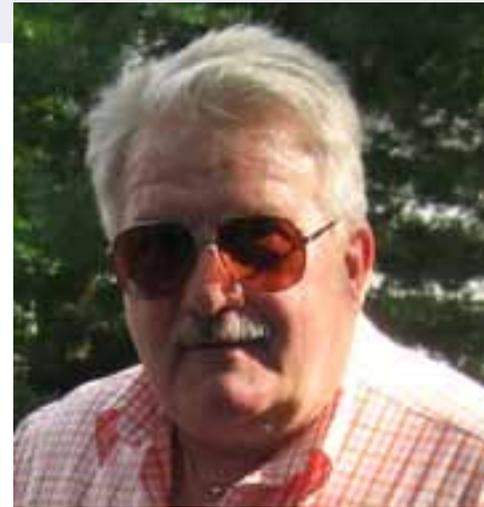
Thomas Kubic, JD/PhD (City University of New York)**Associate Professor of Criminalistics and Chemistry**

Areas of Expertise: Fight 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.

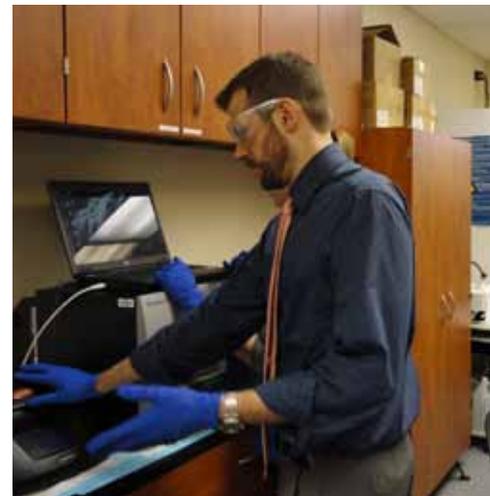
Subsequent to my retirement from law enforcement, I spent three years as the forensic application specialist for a leading SEM Company and was recruited and joined the full time faculty of the Science Department at John Jay College, where I continued my interest in Criminalistics. I was recognized by 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**

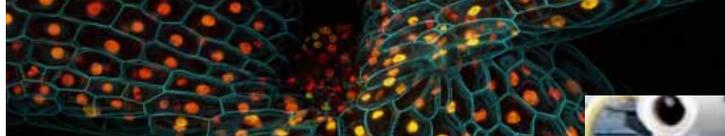
Areas of Expertise: Cell biology, forensic biology, genetics, and bioinformatics

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.

Currently, my research lab studies gene expression control and cellular signaling in physiological contexts. What that means is that we do not study the mechanisms of gene expression (transcription, et al.) per se or in vitro. Rather, we study how those mechanisms are used in specific physiological contexts to allow cells of the human body to function in the flexible, adaptive, and robust way that they do. Specifically, we combine bioinformatics and computational biology with standard bench molecular biology techniques in order to reveal new networks of gene regulation in real biological events. We also frequently work on side projects in the larger field of forensic biology, such as forensic DNA analysis techniques and factors influencing the detection of illegal drugs in urine samples.



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, 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, this study is working on the extraction methods of controlled substances from complex



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

Areas of Expertise: Organic chemistry, spectroscopy, supramolecular chemistry

My research interests span from optical spectroscopy to organic chemistry to applied forensic science. Currently, I am involved in four main projects: 1) Development of new reagents for latent fingerprint detection, derived from lawsone, responsible for the staining properties of henna; 2) Use of NMR spectroscopy and other spectroscopy techniques for the detection of drugs of abuse in biological fluids such as urine and blood; 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 chiral substrates.

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 it 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 a model organism in which extraordinary biological processes were elucidated. Thus, mycology lies at the core of my biomedical research career.

My current research focus is the major fungal pathogen, *Candida albicans*, which infects over 60,000 people per year in the U.S. alone. My 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. My lab also seeks to determine the molecular mechanism of *C. albicans* adhesion proteins that mediate attachment to host surfaces and cellular aggregation.





John Reffner, PhD (University of Connecticut)
Associate Professor

Areas of Expertise: Microscopy

The focus of my research is developing microscopy, microanalysis and imaging technology and exploring their utility in forensic science. Combining microscopy with molecular spectroscopy and applying this to the analysis of crime scene evidence is a primary interest.

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.





Shamik Sengupta, PhD (University of Central Florida)
Assistant Professor of Mathematics and Computer Science

Areas of Expertise: Wireless networks, network security, and network economics

I have been interested in math and science for as long as I can remember. My major motivation came from my parents who both are science graduates. As a child, I was always very curious to know "why" and "what" behind almost everything. At that stage, my parents and grandparents not only helped me with the answers to my questions, but they also encouraged me to think about the reasons behind such events. This scientific environment at home helped me a lot in the beginning. Later, this grew further in my schooling period at Hindu School in Calcutta, India. By then I was addicted to numbers and scientific theories and logics.

My research interests are in the broad areas of networking, communications, multimedia, security and software engineering. In particular, my primary interests include dynamic spectrum access, cognitive radio, real-time multimedia applications and their support over wireless networks, software-defined radio systems development, covert communications and network economics. My other interests are in streaming media surveillance, WiMax, ad hoc and sensor networks. I have developed testbeds, protocols, designed architectures, and proposed algorithms for various types of networks in my research. The technical approaches have also been based on applied auction and game theories, queuing theory, multi-dimension optimizations, and random graph theory.



Daniel Yaverbaum, MS (City College of New York)

Lecturer of Physics

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

Relativity is the preternatural dust from which physics comes and to which it ought perpetually to return. It is part of why we cared to look up and listen four centuries ago. (The 'Terra' is not necessarily 'Firma'.) It is part of why we care to tune in now. After twenty years in the physics classroom, I continue to derive both distress and delight from the following observation: Having constructed solar system models from grocery produce since they were in third grade, a great many American physics students can appear comfortable to the point of boredom with the notion that their floor slips—continually and super-supersonically, no less. Somehow, an ungrounded ground seems to have been internalized as a starting assumption, rather than as a mind-shattering derivation. A good joke, it turns out, loses much in the telling if it begins with the punch-line. This joke is on physics teachers: We may have thought that the moral of the archetypal Galileo tale involved the triumph of scientific skepticism over dogma, but, ironically, Galileo's finding has become the new divine right.

Permeating countless strong and central arguments in classical mechanics is an understanding that emerged with the advent of possibility that the Earth might be moving without our sensing it. The understanding is that uniform motion, unlike acceleration, is not a thing to be sensed at all. The perspective, experience and measurements of two uniformly moving observers are all equivalent—even if the magnitude and direction of the two motions are distinct. Neither the Earth nor any sun is characterized by inherent velocity or by an inherently preferred status on the stage of space and time. Ever since Einstein re-directed our attention in 1905, we refer to such equivalence as Galileo's principle of relativity. The principle makes no reference to quantity. Impediments to student comprehension cannot be reducible to struggles with numerical computation nor symbolic manipulation. My studies seek to determine the extent to which improved comprehension of the relativity principle can be fostered by improved techniques in verbal presentation, visual presentation or both.



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 24 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®.



Anthony Carpi, PhD
PRISM Director



Lawrence Kobilinsky, PhD
PRISM Co-Director



Ron Pilette, PhD
PRISM Coordinator



Frances Jiménez
PRISM Coordinator



Nathan Lents, PhD
PRISM Co-Director

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