PRISM
at John Jay

2013

Undergraduate Research

Chronicle

Program for Research Initiatives for Science Majors

Welcome

2012 was a big year for science at John Jay. After a decade of planning, we finally moved into magnificent new labs in August. With over 36,000 sq. ft. of new, state-of-the-art space, and almost a third of that dedicated to research, the move represents an enormous leap forward in the development of our program. As our faculty and students know, it was not long ago that we had few labs and less than 1,000 sq. ft. of space for research. Despite this, our faculty and students persevered. We explored new techniques for DNA analysis in repurposed classrooms; we examined the chemistry of environmental chemicals in renovated video projection rooms; and we conducted molecular modeling studies in former broom closets. This new space will allow us to expand and continue to professionalize our program, not only providing dedicated laboratory space for all faculty, but adding a host of new specialized facilities for things including Nuclear Magnetic Resonance Spectroscopy, Electron Microscopy, Inductively Coupled Plasma Mass Spectrometry, and many other new and expanded research techniques.

Along with this renaissance in space, our program continues to expand and improve. This year marks the seventh since the official formation of PRISM, and our students continue to be the best indicators of our success. Fifty students were involved in mentored research this past year, including twelve students who graduated last June and were eligible for funding in Summer 2012. Thirty-four of these impressive individuals are highlighted in this issue of our *Chronicle.* For example, Anna Stoll, highlighted on page 27, has been working with Professor Shu-Yuan Cheng for three years now, investigating the role of alpha-synuclein and its mutants on dithiocarbamates cytotoxicity. As a result of her dedication, she was named our Outstanding Undergraduate Researcher for the 2012-2013 year. And Elliot Quinteros, awarded Honorable Mention recognition in our Outstanding Researcher competition, is highlighted on page 21. Elliot has been working with Dr. Marcel Roberts for three years on the development of a novel drug detection scanner.

As a result of their hard work and progress, an increasing number of our students are gaining access to top-tier graduate programs in science. Four PRISM students have recently been accepted to PhD programs including Richard Piszczatowski, who will be pursuing his MD/PhD at the Albert Einstein College of Medicine. Richard is the second PRISM student within four years to be accepted into an MD/PhD program. To date, we know of 18 previous PRISM students from John Jay who have obtained or are pursuing PhD or medical school degrees around the country. Lisa (Evans) DeWald, graduated from John Jay in 2004 and then obtained a PhD in molecular and cellular pharmacology at SUNY Stony Brook in 2010. In 2012, Lisa was awarded a Chemical and Biological Defense (CBD) Postdoctoral Fellowship through the National Research Council (NRC) and the Defense Threat Reduction Agency (DTRA) to conduct biological defense research in maximum containment laboratories (Biosafety Level 4) at the United States Army Medical Research Institute of Infectious Diseases (USAMRIID). Lisa is currently working as a Postdoctoral Fellow in the Virology Division where she is investigating broad-spectrum antiviral therapeutics for highly hazardous infectious agents that pose a risk to public health and national security. Lisa rejoins us this year as the Keynote speaker for our undergraduate research symposium. We wish all of our students luck in their future careers as professional scientists.

Anthony Carpi, PRISM Director

2013 PRISM Symposium

Established formally in 2006, but building on the foundations of a program that began as early as 2000, the Program for Research Initiatives for Science Majors strives to promote research achievement among John Jay students and prepare them for professional careers as scientists. By establishing and supporting close mentoring relationships between students and faculty, PRISM embraces the apprenticeship model of science. The Program not only seeks to train students in the language of science, but to immerse them in its practice. Students participate in all aspects of scientific exploration, from the formation of research questions to the presentation and publication of new research studies. Along the way, they learn from their successes, and they learn to appreciate their failures. Exposed to the culture of the scientific community, many students find themselves irresistibly drawn to the profession. To date, more than two dozen students have moved on from PRISM to post-graduate training in the sciences, a path that will lead to them becoming scientists themselves.

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

This year's Outstanding Undergraduate Researcher award has been given to **Anna Stoll**.

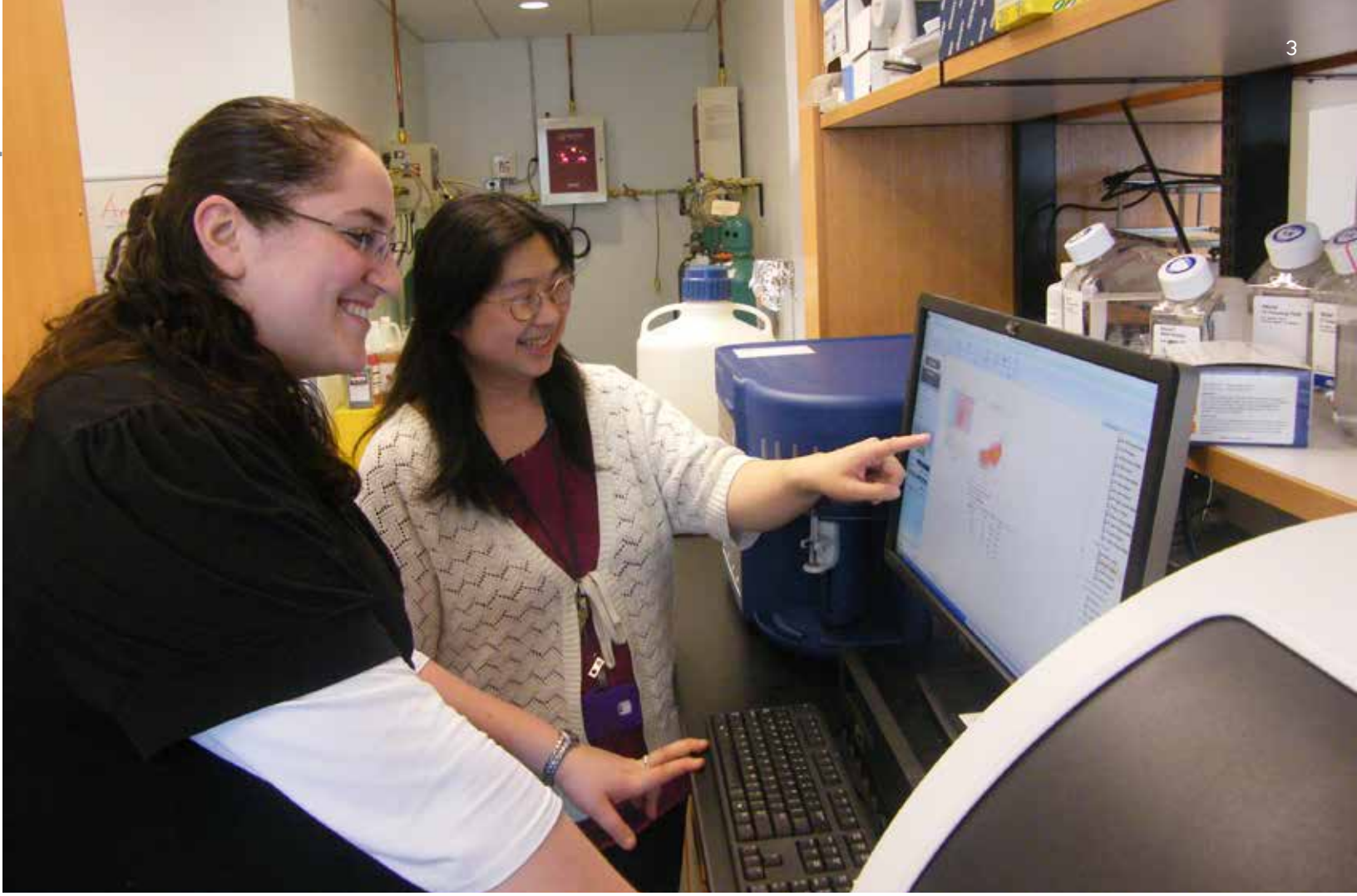
Anna has been part of PRISM for two and a half years, working with mentor Demi Cheng. Together, they have studied the mechanism behind the effect of pesticides on Parkinsin's disease – specifically, focusing on dopamine transporter (DAT) and a-synuclein, two interacting proteins responsible for dopamine transport in and out of brain cells. (Her Symposium presentation will focus on this research.)

Currently, Anna is looking at graduate schools with the hope to study either immunetoxicology or continue with her studies of neurodegenerative diseases. She was recently awarded an Undergraduate Toxicology Education Award at the Society of Toxicology conference in San Antonio, Texas.

Dr. Lisa DeWald
2013 Keynote Speaker

Lisa DeWald earned her Bachelor's of Science Degree in Forensic Science from John Jay College of Criminal Justice in 2004 where she began pursuing her interest in scientific research under the mentorship of Dr. Anthony Carpi and Dr. Morris Zedeck. Her research focused on studying the phytoremediation efficiency of Hordeum vulgare *in removing heavy metals from soil. Lisa went on to receive her Doctoral Degree in Molecular and Cellular Pharmacology in 2010 from Stony Brook University (State University of New York). While at Stony Brook, she conducted her dissertation research in the laboratory of Dr. Joel Levine investigating the role of transcription factors in progenitor cell differentiation and cell fate determination. In 2012, Lisa was awarded a Chemical and Biological Defense (CBD) Postdoctoral Fellowship through the National Research Council (NRC) and the Defense Threat Reduction Agency (DTRA) to conduct biological defense research in maximum containment laboratories (Biosafety Level 4) at the United States Army Medical Research Institute of Infectious Diseases (USAMRIID). Lisa is currently working as a Postdoctoral Fellow in the Virology Division where she is investigating broad-spectrum antiviral therapeutics for highly hazardous infectious agents that pose a risk to public health and national security.*

Dr. DeWald's Keynote presentation is entitled: "Identification of Broad-Spectrum Therapeutics Against Filoviruses"



2013 Outstanding Undergraduate Researcher, **Anna Stoll**, with mentor **Shu-Yuan Cheng**.

Former PRISM Symposium Speakers and Outstanding Undergraduate Researcher Awards

2012

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

2011

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

2010

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

2009

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

2008

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

Undergraduate Researchers

"Having had the opportunity to work on an independent research project while an undergraduate at John Jay College was such a valuable experience. PRISM was an exciting opportunity to learn something new that was pertinent to both my studies and my community, while helping prepare me for graduate school." (Olivia Orta, 2007 Alumna)

"Being the first in my family to attend college, I was very unaware of the many opportunities available in science. I had always thought that I'd graduate and get a job, but had no further plans for my career. It was my PRISM mentor who first introduced me to the idea of attending graduate school to further my education and gave me the confidence to pursue it." (Zuly Peralta, 2009 Alumna)

Marleny Cabral

Chantal Adlam

I am that classmate with the funky multi-colored scarf and the sly grin on her face that shows she enjoys the subtleties of life and science. Dating back to my years of growing up in the lush island of Jamaica, where herbal medicine was the order of the day, my grandmother would often prepare tea using an assortment of plant leaves in order to "purge our bodies," as she often described. I became curious. The potency of these plants in eradicating or subsiding the effects of the flu virus, fever, and other ills was indeed mind-boggling for a seven-year-old – this was the beginning of a lasting sense of curiosity that served as the fuel which propelled my interest in the sciences. I was thrilled about my acceptance into both the Forensic Science – Toxicology program and PRISM. I see these as opportunities that will challenge me as well as provide the professional guidance I seek as I continue to pave the avenues needed to lead a successful career in medicinal chemistry.

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

Soil-bound mercury undergoes a cycle of reduction and emission that can lead to its distribution in the environment. The presence of water has been shown to effect this process; however, the mechanisms of this interaction are unknown. In an effort to better understand this interaction, this project will examine chemistry of hydrated mercury species, specifically $Hg(OH)_2$ and $HgOH^{-1}$ using Gaussian® molecular modeling software and laboratory based studies. These techniques will help in establishing the ground state configuration of the molecule, the bond energies associated with the molecules, and the possible dissociation pathways.

Keisha Alexander

In St. Lucia – which is where I am from – there are limited resources available to pursue a career in Forensic Science. This is what pushed me to apply to John Jay College. When I first enrolled, I chose Forensic Science as my major and remained in the default Criminalistics track. My initial career goal was to become a Forensic Pathologist or Medical Examiner; however, after completing my first year of general biology courses, my interest shifted to biomedical research. Specifically, I was intrigued by host-pathogen interactions for human diseases such as the hepatitis and herpes viruses. As a consequence, I was motivated to pursue laboratory research opportunities on campus. As a lower senior, I am truly appreciative of the many classes and faculty members who have helped shape my career goal. After the completion of my undergraduate degree, I plan to apply for a PhD in pathology or immunology.

Identification of Upstream Activators for Yeast Cell Wall Damage and Osmotic Stress Signaling (Dr. Rauceo)

Fungal survival greatly depends on their ability to detect environmental changes. Under environmental stress, the pathogenic yeast *Candida albicans* activates various stress-response pathways such as the Hog1, Psk1 and Sko1 pathways. *C. albicans* activates the Hog1-Sko1 pathway which transcribes genes that protect the cell from osmotic stress. My project is to identify genes that are required to initiate the response to hyper-osmotic stress. I conducted a qualitative screen of 67 insertion mutant yeast strains encoding potential plasma membrane proteins, and to date have identified five potential candidates. Currently, I am confirming these findings by synthesizing null-mutant strains and complemented strains. This will enable me to determine whether these genes activate SKO1.

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 almost seven years later. Ever since then I knew science was a field I wanted to get into. After enrolling in a forensic science course in high school I was assured 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 into a laboratory, but also learn through experience, which I believe is the main key to success.

Analysis of Elemental Fingerprints by Using ICP-MS (Dr. He)

The method of creating elemental fingerprints for a textile fiber like 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 ^{9}Be; ^{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. The variation of elemental fingerprint pattern in each individual samples will be studied and statistically analyzed. In order to obtain an elemental fingerprint, the raw data will be analyzed and the concentration for each element will be reported.

Joshua Angeles

The madness all began at the age of 10 when my parents finally bought me a beginner chemistry set (which I still own today). Basic experiments included indicators with litmus solution, using chromatography on markers to reveal their color components, as well as experiments using up all my mom's sugar and other household ingredients. I was fascinated with just this basic foundation in chemistry and it left me with so many questions for these mysterious chemical phenomenons. These unanswered questions led me into a chemistry major in High School, followed up by enrolling into the Forensic Science program at John Jay. What a coincidence that my first lab here ended up being very similar to my first chromatography 13 years ago. I wasn't surprised how much of a delight I got out of it. PRISM has given me the opportunity to really venture out into some of the deepest depths of chemistry. I'm extremely grateful for getting the opportunity to do real research, and being offered a positive look into obtaining a PhD in Medicinal Chemistry.

Molecule Sensor Synthesis for Spotting of Fluoride Anions (Dr. Champeil)

The purpose of this experiment is to synthesize Fluorine molecular sensors containing an acid-base pair which act as a mechanism for designed on-off switches. Similar synthesis will be made with only the substitution of a single electronegative atom. With this substitution we will be comparing physical properties (e.g., U.V., IR, Phosphorescence, quantum yield) and the influence of the heteroatom. Currently with Nitrogen as our heteroatom, we afforded a yellow oil in 74.3% yield. H NMR and C NMR coupled with a mass spectrum was calculated to be the exact formula for our product. The next step is to replace the current Pyridine ring with a Thiophene ring and compare the two product properties.

Tamykah Anthony

As graduation nears, I reflect on the path that brought me to this milestone. The science courses I have taken at John Jay together with the experience that the PRISM program has given me have transformed me. Instead of always questioning why, I now have the scientific understanding and confidence to figure it out on my own. I have been given all the necessary tools to be as successful in medical school as I allow myself to be.

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

The ELISA method of detecting drugs of abuse, including *Cannabis*, is very unambiguous because it exploits the high specificity of antibodies. In a previous study, it was found that solutions of Zinc, when added to urine samples, can obscure the presence of drugs, as detected by ELISA kits. Further, it was found that the consumption of Zinc supplements can similarly result in the failure to detect THC in urine samples from human subjects. In this study, additional human subjects were used to further probe the *in vivo* mechanism of zinc supplements in masking the presence of drugs in the urine. Once collected from subjects, the urine was tested using THC immunoassays (ELISA) and a microplate reader was employed to read the absorbance values. The results from the *in vivo* part were variable, where one subject did show a reduction in THC detection after the ingestion of the zinc supplements, while the other subject produced a different result. Going forward, research will focus on reproducing the *in vitro* results from the previous study of the zinc supplements and investigating what other ions may have the same effect on the ELISA test. Also, more *in vivo* testing will be done.

Anum Azhar

I am a Forensic Science student at Borough of Manhattan Community College, which has a collaboration with John Jay College of Criminal Justice. I love science because in my family, my mom, my uncles – all of them are doctors and specialize in different fields. Therefore, I grew up in a surrounding where every one talked about science. From childhood, I loved to listen to them. PRISM gives me the opportunity to pursue my research at BMCC.

Optimizing Conditions for Preserving Sea Urchin Eggs (Dr. Jayant – BMCC)

This study is to optimize conditions for maintaining viable sea urchins eggs in the laboratory for extended periods of time so that they are more readily useful for research and for classroom experiments. After spawning, sea urchin eggs have an average shelf life of 24 to 36 hours. Previously, we have shown that 0.3 mM of empty liposomes and liposomal glutathione (L-GSH) at a concentration of 1.08 mg/mL glutathione can preserve the integrity of spawned sea urchin eggs for up to seven days (8). In addition, eggs incubated in these agents could be fertilized by fresh sperm for up to 24 hours. Although both L-GSH and empty liposomes were shown to maintain the integrity of the eggs, the liposome concentration and the type of liposomes in each case was not directly comparable. The aim of the experiments outlined here is to determine optimal conditions using L-GSH and empty liposomes at uniform concentrations. We will use (1) custom prepared empty HSPC-chol liposomes (98-103 nm diameters) at 0.3 mM and (2) custom prepared liposomal glutathione (L-GSH) with HSPC-chol liposomes (98-103 nm diameter) at 0.3 mM of liposomes with a concentration of 1.08 mg/mL of GSH. Using these agents for incubation, eggs will be observed and counted each day for the duration that they remain intact. Viability will be confirmed by observing the elevation of a fertilization membrane following exposure to live sperm. In a separate experiment, we will also determine optimal incubation temperature for extended preservation.

Mohanram Bassit

I graduated with a degree in Forensic Toxicology and am currently working on finishing a second degree in Molecular Biology. An interest in Forensic Science, from watching shows such as "Forensic Files", is what initially brought me to John Jay. Gaining a better understanding of the sciences, as well as invigorating my interest in science further, is what kept me in the program. Being in PRISM really opened my eyes to the world of science that awaits me and also gave me the opportunity to perform research, which has broadened my horizon's extensively. I hope to continue my education through a PhD program in the near future, as well as continue research that will hopefully benefit the larger community.

Cytochrome C/Cardiolipin Peroxidase Complex, and its interaction with flavonoids (Dr. Korobkova)

Flavonoids are a group of plant secondary metabolites, introduced into humans by ingestion of plants. *In Vitro* studies of flavonoids reveal that they have anti-diarrheal, anti-cancer, anti-microbial, anti-inflammatory, and anti-allergic actions in the human system. Flavonoids are also known to have largely non-polar structures, which assist them in crossing cell membranes. The objective of this research is to study the interaction of formation of cytochrome c (cyt c)/cardiolipin (CL) peroxidase complex selective toward peroxidation polyunsaturated CLs as a prerequisite for mitochondrial membrane permeabilization. So far, the flavonoids of interest have been prepared, and run through SDS-PAGE.

Nyeisha Brathwaite

My home country is Trinidad and Tobago and I am currently a Forensic Science major at Borough of Manhattan Community College. In fall 2013, I will be attending John Jay College of Criminal Justice, where I plan to delve into the Criminalistics track, and participate in scientific research. So far, my actual exposure to forensics has been fairly minimal, but most, if not all of my hands on experience has been through PRISM events. Currently, my physics professor and I are working on scientific research that relates to forensic science, by use of quantum dots. I hope to help improve the overall justice system, by providing quicker and more accurate techniques for forensics analysis. I have always had a strong love for science and disdain for injustice, and know that forensic science, is the career path for me.

Three Body Schrodinger Equation for the Kratzer Pair Interaction (Dr. Tsiklauri – BMCC)

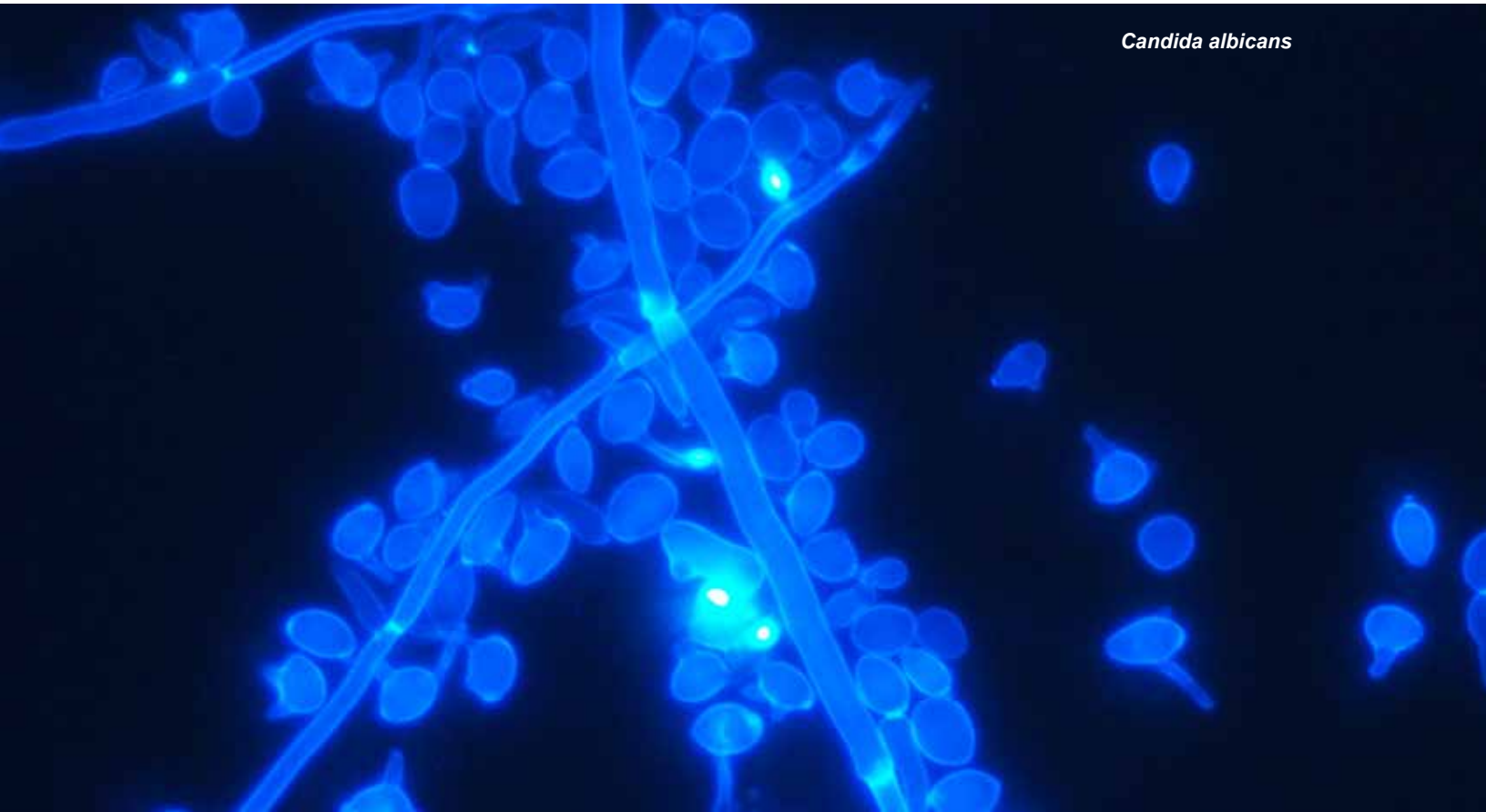
The two dimensional solution of the three body Schrodinger Equation is investigated for a tri-exciton (in Quantum Dots) using the Kratzer Potential. This investigation is performed with and without the presence of a constant harmonic confinement using the Hyperspherical Functions Method. Under a strong confinement, the energy eigenvalues are analytically obtained. However, in the presence of a weak confinement, the energy eigenvalues can only be calculated numerically. Results are obtained for different strengths of confinements, and potential parameters. These are compared to the results found using the same potential parameters, but in the absence of the trap (ω=0). The effect of the confinement on the energy eigenvalues of the Kratzer potential is accurately presented.

Marleny Cabral

About three years ago, I transferred to John Jay College from SUNY New Paltz to pursue a degree in Forensic Science with a concentration in Criminalistics. After attending an autopsy, I realized that I was more passionate about Forensic Toxicology, thus I decided to switch my track. I am currently working with Dr. Rauceo on identifying the mechanisms that help *Candida Albicans* adapt to environmental stress. I love doing research because it has given me the opportunity to use equipment I've never used before, to contribute my ideas into future experiments, and to be more confident with myself when it comes to trying new things. My future goal is to get a PhD in Forensic Toxicology. With this degree, I plan to engage in pharmacological research that can contribute to the development of the field.

Role of *Candida albicans* Transcription Factor Sko1 in Combinatorial Stress Signaling (Dr. Rauceo)

The survival of the pathogenic yeast *Candida albicans* is highly dependent on the way it responds to environmental stress. When *C. albicans* is exposed to various environmental stresses, it activates signaling pathways for adaptation. Recent studies determined that exposure to one form of stress may lead to protection against a different type of stress. In Dr. Rauceo's lab, we found that the transcription factor Sko1 plays an important role in osmotic stress and the cell wall damage response. Therefore, we hypothesized that osmotic activation of Sko1 may confer resistance to caspofungin-induced cell wall damage. We utilized a cytological approach to qualitatively determine the effect of treating a *C. albicans* wild-type strain and a *C. albicans* sko1Δ/Δ mutant strain with sodium chloride (NaCl), and the antifungal drug caspofungin. Our preliminary results showed that *C. albicans* pre-treated with salt prior to caspofungin treatment survived better compared to strains treated with caspofungin alone. This phenotype is dependent on Sko1. Therefore, Sko1 is important for *Candida's* survival in hyperosmotic stress. Our goal this spring semester is to quantitatively confirm our findings using Fluorescence-Activated Cell Sorting (FACS). In addition, we will use FACS to identify additional transcriptional regulators of hyperosmotic stress that may confer protection against caspofungin treatment.



Alyssa Calderone

In high school, I was the one taking more math and science classes than required. Choosing Forensic Science as my major seemed like a no-brainer. I entered John Jay in 2008, double-tracking in Criminalistics and Toxicology. In my junior year, I realized that Toxicology was it for me. I loved going to class and expanding my knowledge. Now whenever I take any type of medicine, I find myself thinking about how it's absorbed and distributed. Doing research with Dr. Cheng has only deepened my interest in the field, especially in neurotoxicity. While my undergraduate career has been long and difficult, I believe I made the right choice. Graduating in May makes me believe that I can accomplish any goals I set for myself in the future. I plan to pursue a graduate degree in toxicology or pharmacology in the near future.

The Role of RTP 801 in Regulation of NF Kappa B Activation Induced by MB and MZ (Dr. Cheng)

The study of pesticides and neurodegenerative diseases is an area of great importance to humans. While a large amount of important data has been gathered, many details are still unknown. This is especially true for Parkinson's disease. Data has shown that the gene RTP801 is induced by MPP+ in a cellular model of Parkinson's and that the NF-KB pathway that is involved with the pesticides maneb (MB) and mancozeb (MZ) influenced the toxicity of MPP+. However, the relationship between RTP801 and the active NF-KB pathway is unknown. It was hypothesized that RTP801 regulates the activation of NF kappa B triggered by maneb and mancozeb. In order to test this, RTP801 shRNA was introduced into PC12 cells to study the involvement of RTP801 in NF kappa B activation caused by maneb and mancozeb. Four samples were used as a control and did not have any shRNA present, while the other eight samples did. NF kappa B-responsive element driven Dual-Glo Firefly luciferase reporter plasmids were also co-transfected into cells, using the Renilla luciferase vector as a control. The samples were treated for one or four hours with the pesticides maneb, mancozeb, and DDC. The results obtained from the Dual-Glo® Luciferase assay system indicate that the presence of RTP 801 shRNA attenuated the activation of NF kappa B induced by pesticides.

Danequa Carter

You know that you are passionate about something when you find yourself literally dreaming about what it is you love to do. This passion is what drives me to come to John Jay Monday through Saturday to keep striving and never stop learning and exploring. My fascination with science had beginnings deeply rooted in forensics because I always wanted to help catch the "bad guy." I chose to walk the criminalistics path. I feel obligated to say, it is not what I expected at all. It's so much better! You put in hard work and long hours but it's so worth it when you realize that you've gained a new understanding of scientific terms and life occurrences.

Isolating DNA from Bone Samples for Forensic Analysis (Dr. Li)

Forensic analysis of DNA from bone can be vital and very reliable in investigating various cases involving violent crimes and missing persons. To eliminate contaminants and residue that may interfere with forensic DNA analysis, the outer surface of the bone fragment must be cleaned. In this study, a method involving the application of the enzyme trypsin was used to clean bone fragments so that DNA may be isolated. This study was completed with bone fragments likely to be found in forensic cases. The two methods of mechanical sanding and the usage of the enzyme trypsin were compared as well as the mitochondrial DNA isolated and that of the hyper variable regions. The comparable data of the mitochondrial DNA was observed between the two methods. The paired sample t test indicated no vital difference between the two methods, overall. It can be decided that from our data the trypsin method can be an alternative to the mechanical method. The advantages lie in the fact that this method will require less labor and time in relation to the common physical method, it can become a staple for automated processing for extraction of DNA from bone, which improves the throughput, it can further prevent and possibly eliminate the risks of cross-contamination between samples, and lastly, exposure to bone particles due to the physical method becomes limited.

Danielle Carthorne

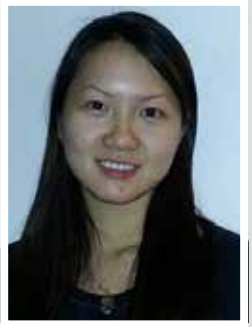
This past summer I gained a great appreciation for my education here at John Jay. I obtained an internship with Maryland State Police Forensic Science Division Trace Evidence Section. I acquired a lot of hands-on experience within the field in the section that I would love to work in. A lot of the instrumentation that I had to use at my internship I was taught to use with the courses offered at John Jay. This internship opportunity has allowed me to expand my search for a career within the field of forensic science to places outside of the United States. An internship or research is required to graduate from this program, and I can understand the importance of having the hands-on experience. This semester I will be graduating as a proud John Jay Alumna pursuing a passion with the appropriate tools and resources attained from my education.

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

Pigments are around us everywhere; in our clothing, in the paint on the wall, paint on vehicles, and mostly anything with color. Pigments aren't just simply red, white, blue, or green; but vermillion red, cadmium orange, oxide of chromium, venetian red and etc. Most pigments may not be chemically composed of the same compounds so this database will serve just as an addition to many that are within the field of forensic science. 19 of the 79 pigments provided were either oil or water based which were analyzed in their filler and without its filler after being separated. All 79 pigments and 19 separated pigments have been analyzed on the ATR/FTIR spectrometer, baseline corrected, normalized, and averaged. Most of these 98 pigments have been analyzed on the Raman spectrometer. Due to the nature of the Raman many dark colored pigments; green, brown, blue and etc., have not given good spectra. The plan is to eventually test the database with "unknown" samples to determine the quality of the analysis done. If all unknown samples result in positive identifications the database will then be uploaded and established. This project has no set end point; it can be picked up from students after me, with the addition of pigments that can be added once analyzed.

Sea urchin embryos

Mei Lan Chen



Science is a subject I have enjoyed learning since I was a child. As the years progressed from junior high school through college, I found myself wanting to learn more about the world and how science affected it. Forensic Science was a great choice as a major; I enjoyed the variety of science classes that were offered, and it gave me an opportunity to explore the different fields. Research was a great opportunity for me, as well. I gained hands on experience and it gave me a head start for graduate school. After I graduate, I plan to obtain a PhD in Cancer Biology and hopefully find a cure for cancer in the future.

Organophosphates: Separation and Spectroscopical Characterization (Dr. Proni)

Chiral organophosphorus compounds are usually used as insecticides in their racemic form for economic reasons. However, enantiomers are known to interact stereospecifically with biological systems and in many cases, the exposure to the racemic mixture leads to selective microbial degradation of one of the two enantiomers. Moreover, the two enantiomers may degrade or accumulate in the environment differently, or may be toxic in different ways toward other species. We have isolated the enantiomers of three different organophosphate compounds (thrichloronate, profenofos, leptophos) by HPLC chromatography and will determine their absolute configuration through the concerted use of three different spectroscopic techniques such as optical rotatory dispersion (ORD), electronic circular dichroism (ECD), and vibrational circular dichroim (VCD). To arrive to the definitive stereochemical assignment of the derivatives, we have considered both experimental and TD-DFT predicted ORD, ECD and VCD responses. For all compounds we will investigate the biological activities of the racemic mixture and of the single enantiomers through ND50 (neurotoxicity) and enzymatic activity on EE-AChE studies.

Robert Connolly

I came to John Jay in 2010 because I was fascinated with the idea of social justice. I had been out of school for over eight years running an after school program that catered to an underserved community. I graduated *summa cum laude* in Spring 2012 with a Bachelors of Science in Economics specializing in economic analysis. My area of academic focus was primarily centered on potential methods of eliminating food and healthcare deserts in urban and rural America and the economics of underserved and repressed communities around the world. While pursuing this degree, I developed an intense love of mathematics and science. As such, I am currently pursuing my second Bachelors in Forensic Science and working as a research assistant in the lab of Dr. Nathan Lents. I am particularly interested in pursuing academic study in fields relating to trauma surgery, emergency medicine, and rural medicine as well as methods of expanding access to medical care and information in underserved populations.

The Regulation of Hematopoietic Potential Via the Retinoic Acid/ MZF-1/ CCN3 Pathway (Dr. Lents)

It has been demonstrated that the Nephroblastoma Overexpressed gene, also known as NOV/CCN3, regulates hematopoietic potential in hematopoietic stem cells (HSCs) and their progeny. As such, upregulating CCN3 may increase blood cell formation and help to maintain a competent immune system. Recent research in our lab has indicated that the transcription factor Myeloid Zinc finger-1, hereto referred to as MZF-1, binds to the CCN3 promoter region and thus promotes hematopoietic potential. MZF-1 has been shown to be responsive to Retinoic Acid or Vitamin A. It is our intention to document a pathway in which Vitamin A promotes MZF-1 to upregulate CCN3 resulting in increased hematopoietic potential and increased differentiation of HSCs and their progeny.

Shoronia Cross

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

Electrochemical Detection of Explosive Compounds and their Metabolites Using Molecularly Imprinted Polyaniline Films (Dr. Roberts)

The illegal production and transportation of explosives poses a constant threat to public safety and national security. Those individuals involved in the production and transportation processes are routinely exposed to these explosive compounds, which are inevitable absorbed into the body, metabolized, and subsequently excreted through matrices such as sweat. A method of detecting the minute quantities of these compounds within the sweat of a fingerprint requires high specificity and sensitivity. The electroactive properties of polyaniline (PANi), as well as its ability to be molecularly imprinted when synthesized in the presence of a template molecule, made PANi an ideal polymer for testing this concept. A method of coating glass surfaces with a thin film of PANi to obtain a uniform coating of high electrical conductivity is in development. Electrical testing using cyclic voltammetry has shown that the current through the PANi films is about four orders of magnitude greater than that of plain glass (10^{-4} A vs. 10^{-8} A), but is poor, likely due to uneven coating or air pockets. PANi films will be synthesized in the presence of caffeine in order to optimize the molecular imprinting process. Detection will be achieved by oxidizing/reducing the target molecules adsorbed on the imprinted film, by use of cyclic voltammetry. A glass slide coated in a film of caffeine-imprinted PANi, capable of trace detection of caffeine in the sweat of a fingerprint will serve as our proof of concept. Subsequent testing will seek to imprint these films with explosives and their metabolites.

Melissa Dalia

I am in my final semester at John Jay College and have found my time here both educational and enlightening. While my time in the PRISM program has been brief, I have enjoyed my research and the other opportunities the program offers. I became involved in PRISM after spending this past summer doing my internship with Dr. Kubic. After my internship ended, Dr. Kubic offered to continue working with me doing research as part of the PRISM program. Dr. Kubic's research focuses on the criminalistics aspect of forensic science, which is my chosen track within the forensic science program. My research involves analyzing transfer smears of cosmetic liquid foundation with ATR-FT/IR. Working with Dr.Kubic has taught me valuable lessons that will stay with me throughout my career. Working in the lab has helped me learn the importance of being detail-orientated, as well as giving me confidence in my own abilities.

Analyzing Cosmetic Liquid Foundation Transfer Smears with ATR-FT/IR (Dr. Kubic)

Fourier Transform-Infrared spectroscopy is used in forensic science to analyze a wide variety of sample types including cosmetics and makeup. Cosmetic smears can be easily transferred to clothing and other objects by direct contact during the event of a crime. One of the most common cosmetics that can be easily transferred, and is therefore most commonly encountered by forensic scientists, is foundation makeup. The ability to identify cosmetics by infrared spectroscopy could be greatly aided by the development of a library database which would allow forensic scientists to identify these cosmetics quickly and easily. The purpose of this research is to first establish a spectral library database using 8 to 10 different shades of 10 to 12 different brands of liquid foundation which is currently in progress. After a database has been created, I will attempt to match dried samples of the foundations that have been transferred to a cotton cloth with the spectral database.

Vida Ho

Jenny Fong

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

Anticancer Properties of Kaempferol and Its Interactions with Cardiolipin and Cytochrome C (Dr. Korobkova)

Cytochrome C is an important protein of the electron transport chain. Upon binding with cardiolipin to form the Cytochrome C peroxidase complex, cardiolipin peroxidases are formed which change the permeability of mitochondrial membrane and subsequently, cause cell apoptosis. Flavonoids are known to reduce oxidative stress and lower the amount of damaging free radicals. Flavonoids, such as kaempferol, may interact with cardiolipin and Cytochrome C. The flavonoid was added to a mixture of liposomes, hydrogen peroxide, and Amplex Red. When Amplex Red is oxidized, a product called resorufin is formed. Resorufin is fluorescent and a fluorimeter was used to assess the amount of Amplex Red oxidized. So far, we observe an overall decrease in fluorescence in the presence of flavonoid. We hope to identify what the flavonoid is interacting with through subsequent experiments. Binding with cardiolipin unfolds Cytochrome C and expose the tryptophan (trp-59). The fluorescence of tryptophan was taken at 293 nm to observe whether there an increase in the unfolding of Cytochrome C when the flavonoid, kaempferol, was added. Additional experiments will be performed before we can identify what is occurring with the unfolding of Cytochrome C.

Vida Ho

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

Mutant Analysis of the Cell-surface Glycoprotein Als1p from the Pathogenic Fungus *Candida albicans* (Dr. Rauceo)

Candida albicans is the most common human fungal pathogen. Adhesion to host surfaces is the initial step in *C. albicans* pathogenesis. The *C. albicans* genome includes the ALS family of cell-surface glycoproteins. Als proteins mediate adhesion and aggregation to host surfaces and were shown to play a role in *C. albicans* infections. One Als family member, Als5 was shown to form amyloid structures to mediate attachment to host surfaces. Amyloids are insoluble fibrillar protein aggregates, and they are commonly associated with human neuropathological diseases such as Parkinson's disease. The goal of my research project is to determine if the Als1 forms amyloids. I am using a molecular biological approach in order to design two Als1 expression vector: The first will express Als1 containing a mutation in the amyloid-forming amino acids and the second will express wild-type Als1.

Bik Tzu Huang

In my family there are many accountants and so therefore it was also expected of me to do something in finance. However, I knew that I didn't want to sit behind a desk all day in front of a computer. Other than math, science was the only subject that I enjoyed. Around senior year of high school when it was time to pick colleges I decided that I wanted to do something interesting. After a suggestion from a friend I ended up with forensic science. At first my family opposed it because they thought I was a coward and too clumsy to go through with it, but in the end I went ahead to prove to myself and to them what my capabilities are.

Analysis of Over-the-counter Effervescent Drugs through NMR (Dr. Champeil)

Over-the-counter drugs (OTC), which at first seem harmless, can easily become an issue for drug abuse when used outside of the prescribed dosage and use. NMR spectroscopy, one of the tools used in drug analysis, is an easy and useful tool to analyze samples. No preparation is required and it allows for direct observation, greatly reducing signals from outside sources. This research focuses on using ^{1}H NMR spectroscopy for drug analysis of OTC drugs to quantitate and detect the active ingredients of the drug in urine samples as a way to calculate the amount of drug intake. Bruker 500MHz and 300 MHz have been used to examine the OTC drug, Amoxicillin, in a water solvent and also urine. Currently, we are in the process of choosing the peaks of interest in order to do T1 measurement and integration necessary to accurately quantify the amount of drug.

Stacey Ishmael

I was born in Guyana and moved to the United States at 13-years-old. I am currently pursuing a Bachelor's degree in Forensic Science with a specialization in Criminalistics and a minor in Police Science. I fell in love with Forensic Science at 8 years old, at an age when it was only a dream. It was the popular television shows such as "Forensic Files," "The New Detectives," and "FBI Files" that inspired me the most. At 16-years-old when I started John Jay, dreams became bigger and my love for forensics flourished. My ultimate goal after I graduate is to pursue a Masters and PhD in Forensic Science. As of my desire to become a future forensic scientist, I someday hope to use the skills that I have learned at John Jay to identify the guilty, to exonerate the innocent and continually improve and protect our society free from crime.

The Effects of Precipitation on the Dispersal of Gunshot Residue (Mr. Diaczuk)

In the United States, firearms are used in a large percentage of homicide crimes and the use of firearms during the commission of a crime has significantly increased. An important emphasis is placed on gunshot residue evidence in firearm crimes because it helps to establish a link between a suspect, crime scene, and victim. Gunshot residue is produced after a projectile has been launched from a firearm. Propellant frequently referred to as "gunpowder" varies in different colors, shapes, and sizes. Located in the firing chamber is a cartridge which consists of this propellant as well as the projectile, casing, and primer. The primer consists of lead styphnate (initiator), barium nitrate (oxidizer), and antimony sulfide (fuel) in which these three components play an important role in the formation of gunshot residue. As a bullet exits the muzzle of a firearm, it is accompanied by high pressure gasses, primer residues, burned and unburned propellant particles that gives the term gunshot residue. This research aims to investigate how precipitation effects the dispersal of gunshot residue by examining how gunshot residue is dispersed on a target when a firearm discharges a projectile in weather conditions such as fog and rain. After performing a series of test shots in controlled conditions of rain and fog, an image analyzing software *imageJ* will be used to analyze particles found on the target.

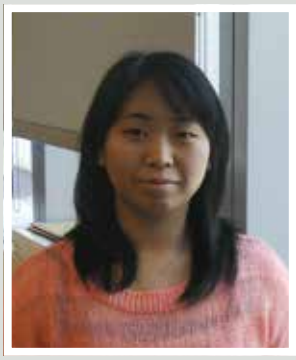
Tasheda Kelly

I was born on the Caribbean island of St. Christopher (St. Kitts) in the Federation of St. Christopher & Nevis. In my federation, there is no one in the field of forensics, and I would like to be the first expert in that field. I chose forensic science as my major because I wanted a challenge. School has always come easy for me and when it came to choosing a major, I needed one that would not only be new and interesting, but challenging and stimulating as well. For this major, John Jay College of Criminal Justice came highly recommended. I got my first taste of the sciences here at John Jay, and I was not only good at them, but I was also really fascinated by them. I have had professors whom I have found to be truly inspirational and now, I do not only want to be the first forensics expert for my island. I want to be an inspiration and a leading example to at least one person in my small Federation.

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

Glutathione peroxidase (GP) is a metalloenzyme, specifically a selenoenzyme, which is known for its antioxidant properties. The major function of GP is to catalyze the reduction of organic hydroxyperoxides. Peroxides are reactive oxygen species, and these have been found to be a major factor of influence in several diseases and the aging process. In a system in which GP, peroxide and NADPH are components, the enzymatic activity of GP will be determined based on UV/Vis spectrophotometric data of the NADPH species. This project will be done alongside the Cytochrome C experiments. Cytochrome C and glutathione peroxidase play opposing roles. Whereas Cytochrome C enhances cell death, glutathione peroxidase helps to prolong cell life by reducing the reactive oxygen species that damage the components of the cell. Cytochrome C plays an important role in the process of apoptosis, which is programmed cell death. Flavonoids have recently gained worldwide attention due to the health benefits associated with them. There have been numerous studies that suggest flavonoids play a key role in the prevention of numerous diseases including age related diseases and cancer. Fluorescence experiments were done to observe the interactions between Cytochrome C and different flavonoids. Fluorescence readings were taken for liposomes with Cytochrome C and several flavonoids at the respective excitation wavelengths of each of the flavonoids. The fluorescence readings obtained for each flavonoid differed in intensity. Of the six flavonoids of interest, catechin and epigallocatechin-3-gallate (EGCG) had the highest intensities, indicating that.

Xiao Shan Law



Forensic Science, I choose you! I chose Forensic Science because it not only offered excitement but also encouragement that I knew would keep me running forward. To me, forensic science does not expire. The encouragement I get from this is what I'd like to think of as unlimited knowledge. Every day, the field is continuously renewed by new information discovered and developed through raw data. This is more than just advancements; this is what I want my life to be. I would like to know that as I walk down my career path, there is always something that will be catch my attention and that will motivate me to learn more about. This way I am always fascinated and will remember that my collection of knowledge does not have to stop. Forensic Science was my answer to this expectation and it has not failed me.

Analysis of DNA Fragments Using the Agilent 2100 Bioanalyzer (Dr. Li)

The Agilent 2100 Bioanalyzer is used to separate DNA or biochemical fragments using density and migration by electrical charges in a polymer solution. A new device recognized as lab-on-a-chip is used to replace gel plates traditionally used in gel- electrophoresis. Because this new system allows detection of fragment quality and quantity in as short as 30 minutes, this instrument has potential in improving the efficiency of case solving and medical research. The objective of the research is to produce a more efficient and effective method for analysis of biological materials. By producing a protocol that limits human error and also increases the quality of the sample analyzed, more accurate results can be yielded to solve the problem in question. These problems can range from finding ratios of biological composition to cases which involve DNA analysis.

Herold Menier

As a child, I was taught to respect and to treat others in the same manner as I would like to be treated myself. That, along with my rather strict upbringing, has resulted in me becoming a very objective person. I also loved math, found science extremely interesting and held equality and fairness with the highest regards. Thanks to those, as well as some unaddressed factors, one could say that I was inevitably steered toward the path of Forensic Science. So, when I graduated from my high school I enrolled at John Jay and I have been struggling ever since. But I do not regret my decision of pursuing this career. In fact I am glad, because not only is Forensic Science quite possibly the most interesting career available, it is also the most fitting for my personality, it will be the most awarding accomplishment for myself when I am qualified to be one of the select few to help preserve the safety of others by helping to put criminals behind bars.

Environmental Corrosion of Firearm Casings (Mr. Diaczuk)

The scientific research that I am performing is a microscopic experiment based on the degradation of tool mark evidence, more specifically on the environmental degradation of the indented markings left by firearms on a bullet casings' primer. This experiment is designed to determine how long it would generally take for the indented tool marks on the primers to become unmatchable to known standards that were fired at the same time. I will be using these microscopic techniques on the LEICA FS M comparison microscope, along with numerous attachments to analyze my samples. I will also be recording the weather when the bullet casings are in the ground as well as a pH test of the soil throughout the course of this experiment.

Elliot Quinteros

My academic career so far has been long and arduous. I have faced many challenges which have tested me in numerous ways. I have always had a love for science which has pushed me into working hard and looking for ways to overcome the many 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.

Thania Ramirez

I never thought I would end up in science until I took biology in high school. I had finally found a class where curiosity was not only allowed but it was strongly required. I always wondered and questioned how life works. Biology and chemistry and the other higher-level sciences helped me answer some parts of this question. To further my knowledge I decided to come to John Jay College of Criminal Justice for Forensic Science. That is where I decided that my future was set in science. My goal is to one day make more students get involved in science, to inspire them, like all my teachers and professors have inspired me, to pick a career in science. I want to be able to share my knowledge of science with others. I hope to one day get my PhD.

Effects of Eukaryotic Translation Initiation Factors (eIFs) on Pokeweed Antiviral Protein (PAP)-RNA Interactions (Dr. Domashevskiy)

The goal of the experiment is to determine the extent of eukaryotic initiation factors (eIFs) participation and to identify the required mRNA structural elements required for PAP affinity and enzymatic activity. Pokeweed Antiviral Protein (PAP) is a ribosomal inactivating protein (RIP). RIPs are RNA N-glycosidases that remove specific purine residues from the universally conserved sarcin/ricin (S/R) loop of the large rRNA. It is believed that PAP binding to eIFs provides a mechanism for PAP to access both capped and uncapped viral RNAs for depurination. To study the effects exerted by eIFs on PAP, steady state fluorescence will be used. The absorbance of the samples will be measured using UV-Vis spectrophotometer, and the normalized fluorescence difference between the protein-protein and protein-RNA complexes and the sum of the individual fluorescence spectra will be used to determine the disassociation constant Kd. This data will better elucidate the mechanism of PAP. The information obtained can be used by researchers to help them develop effective treatments against viruses for both plants and animals.

Baibhav Rawal

Being born in the Himalayan nation Nepal, I was able to explore the utmost bio-diversity, which intrigued me towards biological science. I developed a fascination for forensic science during my childhood when I saw DNA extraction performed by forensic scientists in the burial and cremation sites. As my journey through life continued, my enthusiasm drove me to the United States to pursue higher level education and eventually got me enrolled in John Jay. At the end of my sophomore year, I enrolled in Dr. Korobkova's research team where we are studying the role of different proteins in cell-death phenomena and their potential use to target cancer cells. I am very thankful to PRISM and my mentor for their generous contribution to create a pathway for a reputable scientific career.

Influence of Flavonoids on the Activity of Glutathione Peroxidase that Inhibits Release of Cytochrome C from Mitochondria (Dr. Korobkova)

Cytochrome C has a prominent role in apoptosis, a programmed cell death that occurs in multicellular organisms. During apoptosis, permeabilization of mitochondrial membrane occurs and Cytochrome C is released into the cytosol. It has been well known that Cytochrome C binds to cardiolipin (CL), a mitochondrial lipid mainly involved in energy metabolism. On the other hand, Cytochrome C does not bind to cardiolipin hydroperoxide (CL-OOH). Recent studies suggest that the production of CL-OOH in the mitochondria initiates the release of Cytochrome C, but glutathione peroxidase (GPx) inhibits the formation of CL-OOH and thus suppresses the release of Cytochrome C. We will perform fluorescence and UV-spectrophotometric studies to study the cellular mechanisms involved in the interaction of GPx and flavonoids (polyphenolic compounds having high antioxidant property) and develop further understanding of cancer-cell's acquisition of immortality. At the same time, efforts will be put to develop biophysical and biochemical strategies to suppress GPx and initiate Cytochome C release, and thus promote apoptosis in cancer cells.

Ruth Romero

I am attending Hostos Community College and will soon transition to John Jay; this is my first externship with the PRISM program. I was born in the Dominican Republic and since I can remember I have had an interest in science and all science-related topics. Once I found out about the Forensic Science major at CUNY, I knew this was what I wanted to do. I was lucky enough to meet a PRISM coordinator when I answered an email to meet with other community college students planning to attend John Jay. Once in the program I met Dr. Roberts and became fascinated with his work. I hope to be able to continue doing research during my time at John Jay. This opportunity is one of the first steps on my journey to a successful science career. I'm thankful for this opportunity.

Surface Modification for the Colorimetric Detection of Drug Metabolites in Fingerprints (Dr. Roberts)

A major effect of globalization is the transit of a large amount of travelers through numerous borders. The sheer number of bodies that need to be inspected poses a threat to public and national security. The solution for a non-invasive, expedited and reliable screening of vast numbers of people, calls for the creation of a novel device that can identify an individual but also simultaneously detect the presence of illegal or dangerous substances. One of the most smuggled illegal drugs worldwide is marijuana. Individuals involved in the production and transportation processes of drugs are routine, which leads the parent compounds or its metabolites to inevitably enter the body through inhalation, ingestion, or absorption through the skin. In turn, these biomarkers are excreted through the pores and can found in the formation of fingerprints. By functionalizing a surface with specifically reactive dies it will be possible to obtain a clean fingerprint whose color will change if the illegal substance is present.

Andre Rozado

I grew up in Brazil where I first became interested in science. I completed a basic sanitation technical program where I learned city water and sewer treatments. I was stunned to understand how bacteria are able to purify most of the waste flushed through city drains. Biology and chemistry became wonder worlds and I felt the need to learn more about them. I moved to United States in search of opportunity and education. I started an associate degree in science at BMCC – CUNY. Dr. Lalitha Jayant, a biology professor, introduced us to a new forensic science peer program with John Jay College. This program allowed me to automatically transfer to John Jay to pursue my baccalaureate degree in Forensic Science. At John Jay I learned about PRISM and the research learning opportunity it offers to all forensic science students in good academic standing. The current research conducted in this program will bring forensic science to a new level. I am currently a Forensic Science Molecular Biology senior. PRISM has been giving me an opportunity to be ready for greatness.

All-trans Retinoic Acid Pathway in Activation of Nuclear Receptors and Its Response in Myeloid Zinc Finger-1 Expression (Dr. Lents)

The goal of this research is to reveal the complete pathway of the differentiation of blood progenitor cells. The signaling in question is the expression of CCN3 and CCN2 that is initiated by the transcription factor Myeloid Zinc Finger 1 (MZF-1). It is known that all-trans retinoic acid (RA) increases MZF-1 production in some cells (1). RA works through two distinct families of receptors: the retinoic acid receptors (RAR) and the retinoid X receptors (RXR) (2). The effects of the retinoic acid in these families of receptors promote heterodimerization of those nuclear receptor families, which signals transcription of RA responsive genes (3). The cells will be exposed to specific RA agonist and antagonist for each type of nuclear receptor. The aim is to clarify the mechanism of the first step in the differentiation pathway. Our hypothesis is that if patients are being treated with vitamin A prior to surgery or donating blood or bone marrow, it could provide a faster healing process and patients will have a faster recovery. This knowledge could save lives and billions of dollars in the health sector.

Yessica Saenz

Forensic science has been a field that I have come to admire and have a passion for. It is a field where curiosity has no limits and where the need to analyze is fundamental. I have come to realize Criminalistics has a great significance in identification and individualization. Attending John Jay and entering the forensic science program made me realize that hard work and extensive research is crucial in this field. I've learned not only to think on my feet, make new hypotheses, and keep testing the same sample until a result is achieved – but also to have confidence and faith in myself. I've learned to think outside the box and to analyze certain evidence without any preconceived notion. My goal in this field is to rightfully bring justice to individuals and/or families.

Processing Bone Samples for Wildlife Forensic Investigations by Applying the Trypsin Method for DNA (Dr. Li)

The examination of bone samples obtained from crime scenes is an important aspect of Forensic Science. Bone samples may have the presence of co-mingle remains or be contaminated and therefore a good cleaning method is require prior to DNA analysis. To eliminate these interferences the outer surface of the bone fragments were cleaned. Two methods where used in this study, the usage of the enzyme trypsin and the mechanical sanding. The results of amplification of mtDNA fragments were observed between the two methods. The results showed no significant difference between the two methods. The comparable data of the mtDNA was observed between the two methods, results gave no difference between the two cleaning methods employed. The study showed that enzymatic trypsin method could be used as an alternative to mechanical methods; this would allow multiple samples to be run simultaneously, reduce the exposure to bone particles and sample contamination.

Eugenia Salcedo

Growing up, I always felt a desire to pursue science, yet I could not find a path that fulfilled me. When I graduated high school, pursuing a degree in science didn't seem like an option for me despite my curiosity because it involved spending a lot of time in school and that effected my objective of working. As graduation approached I felt truly unhappy and empty and after almost finishing my degree in Economics, I realized that science was the right path for me. After putting a lot of thought into my future, I decided to apply to the Forensic Science program at John Jay College. This program offered me the opportunity to explore the basic sciences and helped shaped what my future career path will be. After graduation, I plan to obtain a PhD in Molecular Biology/Cell Biology with the intent to focus in Cancer Research.

Modulation of the Cell Wall Polysaccharide Chitin by *Candida albicans* Transcription Factor Sko1 (Dr. Rauceo)

The fungal cell wall is a dynamic structure whose composition and structural organization is regulated during the cell cycle in response to changing environmental conditions and imposed stresses. Chitin and β(1–3 and 1-6)-d-glucan, represent the main structural components of the fungal cell wall. It has been found that the growth of *Candida albicans* and *Saccharomyces cerevisiae* is altered upon exposure to the cell wall damaging compound Calcofluor White (CFW). Mutants for the mitogen-activated protein kinase (MAPK), Hog1, and the transcription factor, Sko1– which are essential for cell survival upon osmotic stress – are resistant to Calcofluor White. However, the extent of the Hog1-Sko1 relationship after treatment with Calcofluor White is unknown. I will determine if Sko1 is phosphorylated by Hog1 upon exposure to Calcofluor White. In addition, the various strains will be analyzed using a fluorescence microscope to detect cell surface differences among *C. albicans* and *S. cerevisiae* mutants in chitin composition. Lastly, mRNA analysis will be done to examine the expression of the chitin synthesis (CHS) gene family after exposure to Calcofluor White in the various *C. albicans* and *S. cerevisiae* strains.

"As a mentor, I teach students how I think about biological questions, and how I approach answering them through research. However, once I have taught them my style of doing science, I push students to do it themselves, to develop their own projects and take ownership of them. I give students the freedom to test their own ideas while still guiding them. I think that I've done my job properly if a graduating student feels like their work was mostly the result of their own ideas, not mine." (Dr. Lents)

Zully Santiago

I was the first in my family to attend college, and like many in the same situation, my family thought that the only successful professions that required a college education were medical doctor and lawyer – and I had no intentions of taking blood from a patient. In pursuing law, I graduated from John Jay with a degree in Government and prepared for law school. However, my fiancé noticed my indifference. He explained that I would light up when reading articles in *Discover* and the *Science Times* (both I read for fun), and I enjoyed my science courses the most, not law. He convinced me to pursue what I loved. Now as an undergraduate in Forensic Science, I plan on earning a PhD in Biochemistry. I can honestly say the decision to go into science was the best decision of my life (tied with being with my fiancé).

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

Pokeweed antiviral protein (PAP) is a ribosome inactivating protein (RIP) produced by the common pokeweed plant (*P. Americana*). RIPs are N-glycosidases that remove purines from the sarcin/ricin (S/R) loop of large rRNA molecules, and this lesion interferes with protein synthesis, causing the ribosome to stall. PAP, however, is also known to depurinate mRNA, tRNA, DNA, and viral RNA as well. RIPs serve an important role in plant defense mechanisms against viruses and other pathogens. Specifically, PAP reduces the infectivity of influenza, HIV-1, and the herpes simplex virus (HSV) *in vitro*. Because PAP is a cap-binding protein, it is thought that its preferential binding to the 5'-cap of the RNA initiates PAP-substrate recognition with subsequent depurination. However, it does not explain the reduction in the virulence of uncapped viruses such as influenza or polio. The mechanism of PAP's antiviral activity is poorly understood. This study characterizes the binding interactions between PAP and a variety of highly structured 3'-untranslated regions (3'-UTRs) of RNA viruses, namely tobacco mosaic virus (TMV), turnip yellow mosaic virus (TYMV), brome mosaic virus (BMV), and alfalfa mosaic virus (AlMV), using fluorescence spectroscopy and HPLC techniques. Then, this binding affinity is correlated with the structural differences within the 3'-UTRs to identify the relationship between PAP-substrate recognition and the depurination of viral RNA. Understanding PAP's antiviral mechanism and how it selects its substrate RNA for depurination may be used for selective targeting of PAP to plant and animal viruses.

Baibhav Rawal

Kelly Song

I have always been interested in science, but did not think of it as a career path. That was not until I experienced chemistry in high school and following that, AP chemistry. From then on, I knew I would pursue a career in science, despite the doubts my parents had. It has been a good handful of years since then and I have learned a lot along the way. I started my college career majoring in Chemistry, but realized that Forensics and its puzzle-solving aspects are much more intriguing than chemistry alone. Although research with Professor Yaverbaum is not chemistry related, but rather physics, I have developed a great interest in physics after taking my very first physics course at John Jay with Professor Yaverbaum. I am looking forward to where this research will lead us and how I can apply my current knowledge to the challenges that await me.

A Study in Visual and Linguistic Cognition Regarding Galileo's Principle of Relativity: That All (Inertial) Reference Frames are Physically Equivalent (Mr. Yaverbaum)

Although motions of multiple objects shift in perspective and smooth velocities are experienced in our daily lives, a seemingly straightforward principle of relativity itself, as formulated by Galileo, is frequently misunderstood or misapplied – particularly by physics students. Despite its centrality in the development of fundamental physical laws, relativity is emphasized only to a small extent in contemporary physics curricula; it is grasped to an even smaller extent. We are investigating and monitoring students' understanding of relativity throughout a college physics course that is organized through a theoretical framework of relativity. We conduct our investigation by means of three different instruments that probe student mental models pre- and post-physics instruction. The first instrument is called "Train of Thought" (ToT). This original exercise provides students with a scenario in which they had to answer questions regarding relative motion. The second instrument is the "Force Concept Inventory" (which we called Intuition Inventory, or II). This previously published multiple choice test is used to measure physics intuition with respect to an independently established and widely accepted standard. The third is called "Reference Frame Reportage" (RFR). This presentation provides students with animations with which they are to use to answer questions regarding relative motion. In addition to the data collected, several students were interviewed after the post-physics instruction assessment. All the data is currently being analyzed. Our central research question is: To what extent, if any, does success in solving introductory college physics problems correlate with the comprehension of Galileo's principle or relativity?

Anna Stoll

Starting my research with Dr. Cheng, almost three years ago, was and is a defining moment in my life, for from that moment on, I knew research was going to be a part of my future career in science. My research on pesticides and the effect they have on cells in causing Parkinson's symptoms has introduced me to the world of molecular biology and toxicology; it is a world I plan to venture through for years to come. As Sean Carroll states "The world keeps happening, in accordance with its rules; it's up to us to make sense of it and give it value." As I move forward, I hope to be able to make sense of different diseases that may harm a person and give value to the immense amount of time that Dr. Cheng and PRISM have spent to help mold the scientist and person I am today.

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

Mn-containing dithiocarbamates, such as maneb (MB) and mancozeb (MZ), often seen in the agricultural industry, have been known to increase the toxicity of neurotoxin MPTP on dopaminergic neurons leading 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 the uptake of MPTP. Alpha-synuclein, a protein that interacts with the Dopamine Transport, regulates DAT trafficking and cell surface expression. Alpha-synuclein (wt) and its mutants (A30P and A53T) have been associated with Parkinson's disease. The aim of this study is to 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 integrated density values (IDV) of the alpha-synuclein was normalized to the IDV of the DAT. The PBS control was taken as 1. We report roughly a 30% decrease in the DAT/alpha-synuclein interaction in the presence of the A53T mutant versus wild-type, but not in the presence of the A30P mutant. With dithiocarbamates the interaction of DAT and alpha-synuclein (wt) was enhanced, with increases ranging from 50 percent to 200 percent. Pesticide treated A53T mutants respond more dramatically than A30P mutants in increasing the interaction between the DAT and the alpha-synuclein. Fluorescence Resonance Energy Transfer (FRET) will be performed to analyze the interactions of the DAT and alpha-synuclein with the use of fluorescence.

Christine Ta

Science was never my best subject, however science is the most entertaining subject I have ever encountered. While growing up in a family of seven with four other sisters, all of us shared an interest in science (whether its biology, chemistry, or even physics). We would chat across the table sharing what we have learned each day. As we age and try to define who we are as an individual each of my sisters and I have found a concentration in the science field. For me, I picked medical examiner. In the ninth grade I found myself drawn into a TV series with people in white lab coats gathering evidence and trying to trace back who the murderer was. In my young eyes they were like super heroes and I wanted to be like them. I soon set my goal to John Jay's Forensic Science program. From here I learned many techniques from using simple plastic pipettes to complicated instrumentation. My next goal in life is getting into medical school but before doing so I want to have a better understanding of the effects of drugs in the human body.

The Role of RTP801 in Toxic Mechanism of Dithiocarbamates (Dr. Cheng)

RTP801 is a protein that involves cell death when it is expressed. In this study the core focus is the expression of RTP801 protein and the cytotoxicity relationship with dithiocarbamate. RTP801 expression will be knockdown with the use of shRTP801 (short-hairpin RNA of the protein). The use of shRTP801 should show an increase in cells viability (survival capability) since it suppresses the expression of RTP801. Using two different assays (MTT and LDH), the amount of cell deaths will be observed. Currently, in research the MTT assay has been successfully employed and although the result is not significantly different there is an indication that there are more cells surviving in the toxic environment after shRTP801 knockdown.

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, like this Attune Acoustic Focusing Cytometer.

This Cytometer uses a flourescent probe to detect the population of aptotic cells after chemical treatment. It is used regularly in both Dr. Rauceo and Dr. Cheng's labs.

Davilenys Tahan

Ah, the last semester of my undergraduate year. Five years ago I entered John Jay determined to obtain my Bachelors in Forensic Science. I wasn't sure what track to focus on until I took Quantitative Analysis with Dr. Yi He. At the time, her research was tracing metals in rice. I was interested in her research and soon declared my track as Forensic Science in Toxicology. In the past two years, I have done research, an external internship in Dr. Stripp's lab (AFTS Lab), and I am currently interning in the Office of Chief Medical Examiner. Thanks to PRISM, I've had opportunities to explore research and hands-on lab work. My goal is to apply all the knowledge I've gained from these experiences to be the best I can be in the future. Thank you PRISM and Dr. He.

Analysis of Elemental Fingerprints by Using ICP-MS: Data Analysis (Dr. He)

The purpose of this research is to determine the concentrations of 22 trace metals in wool samples using inductively coupled plasma-mass spectrometry. The trace metals are Zinc (Zn), Barium (Ba), Aluminum (Al), Iron (Fe), Chromium (Cr), Nickel (Ni), Magnesium (Mg), Manganese (Mn), Vanadium (V), Copper (Cu), 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 content of the low concentration elements of In, Sb, Cs, Pb, Bi. U, Hg, Be, Co, Cd, Mo, As, and Se were determined. The data was analyzed resulting in the final concentrations of the elements in the wool samples. It was concluded that the ICP-MS is very sensitive and able to detect trace levels of In, Cs, Sb, Pb, Bi, and U in wool samples. In the past year, the raw data for the high concentration elements was collected. This data is currently being analyzed to determine the true values of the elements' concentration in the wool samples.

Sudip Ulak

During childhood, I was amazed how a small box-like radio can produce different voices. This was curious nature of mine led me to open electronic devices. This curiosity grew with me, and when I started to work with computers, I started to open the CPU to check how it worked. I started formatting, installing Windows in my friends and families computers. It made me a tiny technician who fixes minor computer problems. I started QBasic programming language as my first programming language. I wanted to develop a business program where all goods can be entered and enable us to check remaining stocks from entered goods. I wanted to develop this program to help my father's business. I was not able to build that software since my knowledge was inadequate at that time. But it became important factor in my life to lead me to my aim. At this phase of my life I am working with Dr. Johnson on this project where I am working on C++ programming language.

Activity Annotation Using the Microsoft Kinect (Dr. Johnson)

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

Student Publications and Presentations

In addition to our Annual Symposium, PRISM students regularly present their research to their peers on CUNY campuses, and at professional events. Below are a few of the many professional accomplishments students achieved before finishing their studies at John Jay.

Publications

Champeil, E., Paz, M., Lukasiewicz, E*., Kong, W.*, Watson, S., & Sapse, A.M. (2012). Synthesis of a major mitomycin C DNA adduct via a triaminomitosene. *Bioorganic and Medicinal Chemistry Letters* (22) 71–98

He, Y., Pedigo, C. E.*, Lam, B., Cheng, Z., & Zheng, Y. (2012). Bioaccessibility of arsenic in various types of rice in an in vitro gastrointestinal fluid system. *Journal of Environmental Science and Health,* Part B (47) 74–80

Korobkova, E., Nemeth, J., Cadougan, M., Venkatratnam, A., Bassit, M.*, & Azar, N. (2012). Reactive metabolites of desipramine and clomipramine: The kinetics of formation and reactivity with DNA. *Bioorg. Med. Chem.* (20.1) 340–345

Korobkova, E. Sukala, L.*, (2012). Small molecules targeting mitochondria: applications for cancer and neurodegenerative disease therapeutics. *Chemistry and Biology Interface* (2.2) 59–75

Li, R., Klempner, S., Carter, D.*, and Saenz, Y*. (In Press). Evaluation of methods to process bone evidence for forensic DNA analysis. *Proceedings of the 22nd Conference of the International Academy of Legal Medicine*

Mahmood, N*., He, Y., and Petraco, N.D. (2012) Elemental fingerprints profile of beer samples constructed using fourteen elements determined by inductively coupled plasma – mass spectrometry (ICP-MS): Multivariation analysis and potential application to forensic sample comparison. *Analytical and Bioanalytical Chemistry* (402) 861–869

Williams, A.*, Cheliout-Dasilva, S.*, Liu, M.*, Rawal, B.*, Bhatta, A.*, & Korobkova, E. (2012) Determination of the drug-DNA binding modes using fluorescence-based assays. *Anal. Biochem.* (422) 66–73

* denotes PRISM student author

Keisha Alexander

Presentations

Gonzalez-Lopez, E.*, and Cheng, S. The Role of Microtubule on Dithiocarbamate Cytotoxicity. [Presentation] Society of Toxicology, San Francisco, March, 2012

Gonzalez-Lopez, E.*, and Cheng, S. (2012) The Role of Microtubule on Dithiocarbamate Cytotoxicity. [Presentation] Experimental Biology conference, San Diego, CA, Apr 21-25, 2012

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

Marotta, D., Teubl, J.*, Sukala, L.*, Rauceo, J. (2012) Regulation of the Osmotic Stress Response by Transcription Factor Sko1. [Presentation] American Society of Microbiology (ASM) Conference on Candida and Candidiasis, San Francisco

Mitchell, A.*, Rauceo, J. (2012) Synthesis of *Candida albicans* ALS1 Mutant Expression Vectors. [Presentation] 15th Annual CUNY/AGEP STEM Conference, New York, 2012

Obatusina, M., Cordero, R.*, Jameel, Q., Proni, G., Petrovic, A. (2012) Helical molecular programming via supramolecular complexation of bis-porphyrins. [Presentation] 243rd ACS National Meeting, San Diego, March 25-29, 2012

Piszczatowski, R.* (presenting author) and Lents, N.H. (2012) MZF-1 Regulates the CTGF Gene in the Hematopoietic Compartment. [Presentation] Amer. Soc. of Biochem. & Mol. Bio. (ASBMB); Experimental Biology, San Diego, CA; Apr 25, 2012

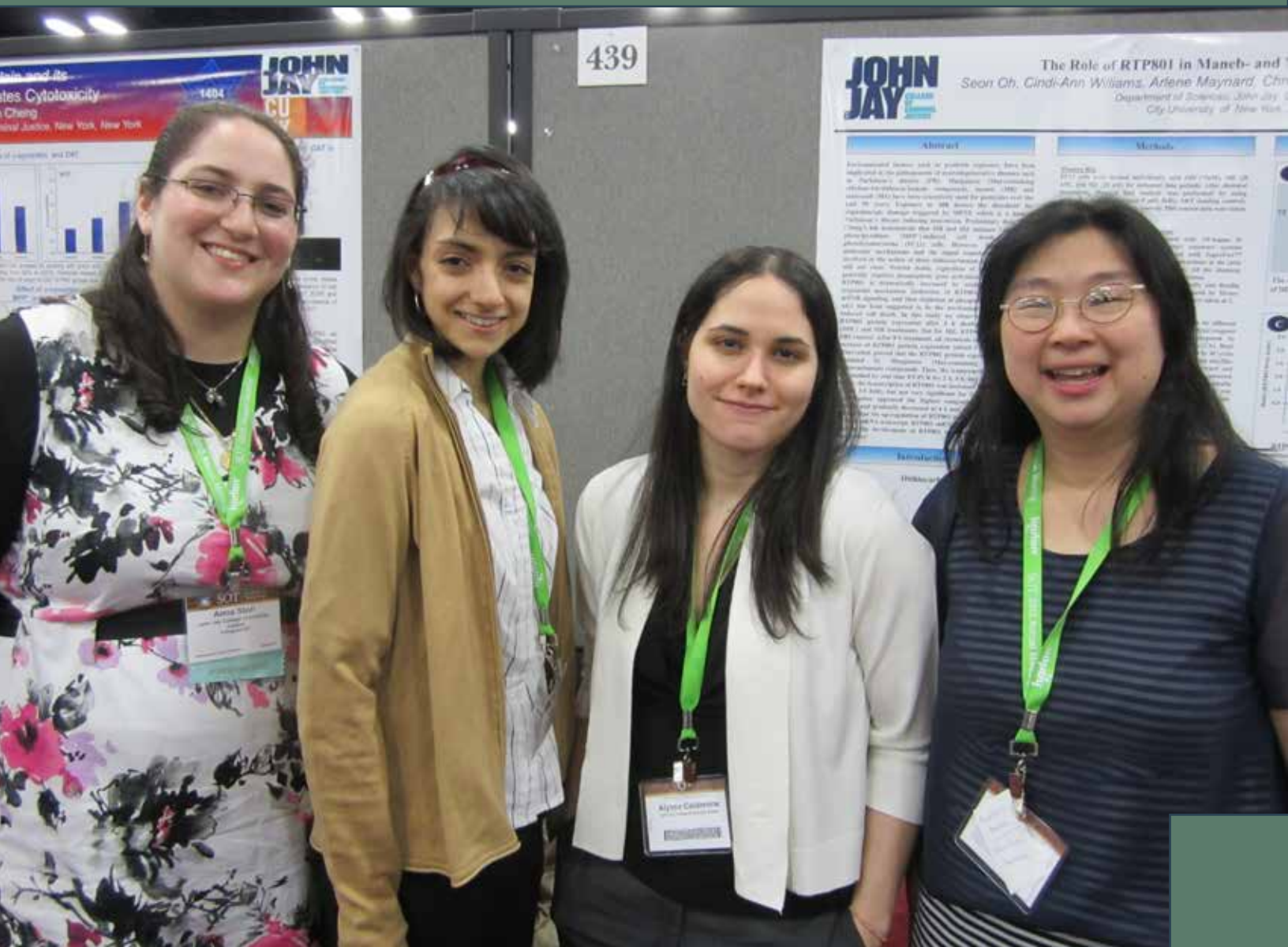
Stoll, A.*, Cheng, S. (2012) Role of Alpha-Synuelein and its Mutants on Dithiocarbamates Cytotoxicity. [Presentation] Experimental Biology conference, San Diego, CA, Apr 21-25, 2012

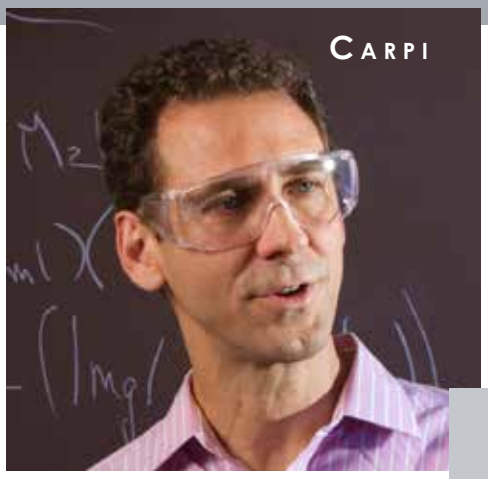
Troselj, P., Mazzeo, G., Proni, G., Cordero, R.*, Carofiglio, T., Petrovic, A., Berova, N. (2012) Host-guest complexes with metalloporphyrintweezers: insight into factors determining molecular recognition and chirooptical response. [Presentation] ICCP-7 7th International Conference on Porphyrin and Phthalocyanines, Jeyu, Korea, July 1-6, 2012

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 on well 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 processs 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.





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

Areas of Expertise: Environmental toxicology and science education

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

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

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

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

Areas of Expertise: Synthetic organic chemistry

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

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

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

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

I began my career as a pharmacist. We all know that the right dose can make the difference between a poison and a remedy. Drug-drug interaction is always a big issue for clinical medication, even with the right dose. Due to these reasons, I became interested in divulging the toxic mechanism of drugs that can potentiate or synergize the toxic effect of other drugs.

My current research is to study the role that environmental toxins (dithiocarbamate compounds) play in neurodegenerative diseases such as Parkinson's disease. In 2013, I will focus on elucidating the role of dopamine transporters in dithiocarbamate-triggered toxicity and the underlying toxic mechanisms, such as the NF kappa ß signaling pathway and the AKT/mTOR signaling pathway.

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

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.

Equipment Profile: High-Speed Camera, Diaczuk Lab

Our new camera is capable of capturing several thousand frames per second. With proper lighting, shutter speeds even faster are possible. The human eye, as fantastic as it is, cannot come close to this speed, being unable to discern individual "frames" that appear faster than about ten per second. With this camera, it is possible to examine events that take place in milliseconds, but that are nevertheless important to the forensic scientist.

One research project that is about to begin will examine three different conditions governing the deposition of gunshot residue. When a firearm is discharged, not all of the propellant is consumed, resulting in some unburned and partially burned particles being ejected along with the bullet. Many of these particles have sufficient energy to travel to and imbed themselves in materials that are within a couple feet of the firearm's muzzle. The research planned will explore three different environmental conditions: ambient air, dense fog and falling rain. The "fog" and "falling rain" will be created artificially in the laboratory. We plan to use the camera to observe the target materials as they are shot in an effort to determine how often propellant particles impact the substrate but do not remain imbedded, falling off.

DOMASHEVSKIY

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

Areas of Expertise: Biochemistry, molecular biology and biophysics

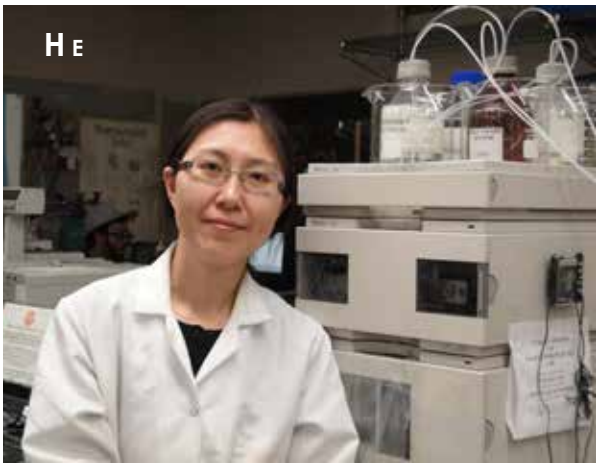
Our laboratory uses methods in molecular biology and biophysics to study structure, function, and properties of pokeweed antiviral protein (PAP) isolated from *Phytolacca americana*. Specific projects interests include:

Agricultural epidemics can have disastrous effects on nation's health via crop yield and safety and on its economy through costs of containment and eradication, reduced domestic demand, and global embargoes. A better understanding of the activities of PAP, e. g., how PAP selects its target RNAs for depurination, could help in devising ways to control pathogenic epidemics in plants.

Experimental cancer chemotherapy uses plant toxins coupled to a cancer marker recognition antibody to specifically deliver the toxin to the cancer cells. Side-effects of the toxin molecules remaining in the circulation or released from lysed cancer cells may be eliminated by using liposomal drug delivery and effective RIP inhibitors. PAP encapsulated into a lipid vehicle is being investigated as an anticancer agent, and the toxin delivery is tested for efficiency.

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

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

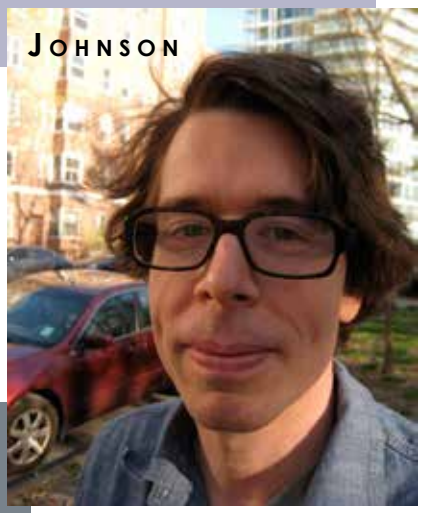


Yi He, PhD (City University of New York)
Associate Professor of Chemistry

Areas of Expertise: Analytical chemistry and environmental forensic toxicology

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

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



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

Areas of Expertise: Mathematical logic

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

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

Ekaterina Korobkova, PhD (University of Chicago)

Assistant Professor of Chemistry

Areas of Expertise: Biochemistry, biophysics, physical chemistry

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

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

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

Associate Professor of Criminalistics and Chemistry

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

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

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

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

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

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

LENTS

It is exciting time for the Lents lab because I am approaching a year where I will be on sabbatical and thus spending a lot of time in the lab itself. I have taken several new students and we are ramping things up on several new projects. We have one new project that is exploring the affects of vitamins A and D on the expression of some factors in blood cells and blood stem cells, which could have important implications for bone marrow donation and transplantation, blood transfusions, and the treatment of leukemias and lymphomas. In another new project, we are attempting to establish exactly which vitamin A receptor subtypes are involved in the expression of specific genes in blood stem cells.

Richard Li, PhD (University of Wisconsin-Madison)

Associate Professor of Forensic Biology

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

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

Gloria Proni, PhD (University of Bologna)

Associate Professor of Organic Chemistry

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

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

The research method applied in my laboratory goes through several steps. First the student will be exposed to a problem (for which we need an answer). The student will go through previous observations and literature work in order to educate him/herself about the problem under investigation. Then he/she will design (with help) and conduct the necessary experiments in order to solve the problem. He/she will also work on control experiments in order to build scientifically sound results. Based on the experiments and with the help of the mentor, some conclusion will be formulated. When the problem under analysis is answered the results will be organized in order to present them to a larger public.

Currently my lab is in a transition phase. Many new students are joining the lab and many former students are moving on to PhD programs, Pharmacy School, etc. During 2013 we will continue to explore the colorimetric and fluorescent properties of lawsone and derivatives. We will separate and characterize more organophosphorus compounds, and we will try to conclude the research lines that are still open.

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

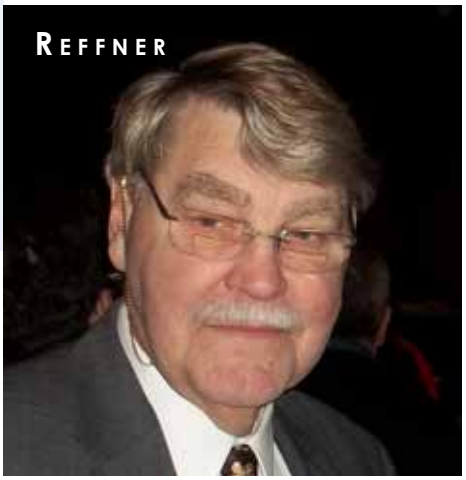
Areas of Expertise: Molecular biology, molecular genetics, and mycology

I was a late bloomer when it comes to my interest in science. As I became more involved in my science studies, I began to appreciate science for its inquiry and I was able to see all of the possibilities. I pursued a scientific career mainly to understand the mechanisms underlying clinically relevant diseases. Fungi have served as model organisms in which extraordinary biological processes have been elucidated. Thus, mycology lies at the core of my biomedical research career.

Our research focuses on the major human fungal pathogen *Candida albicans*. We are interested in the molecular mechanism underlying the cell wall stress response. We are also interested in how cell-surface glycoproteins mediate attachment to host surfaces. Currently, we are exploring how the transcription factor Sko1 confers stress protection to cells challenged with hyperosmotic stress and antifungal drugs. We are also identifying the chaperone network that governs processing and localization of the Als cell-surface adhesins.

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

RAUCEO



REFFNER

John Reffner, PhD (University of Connecticut)
Associate Professor

Areas of Expertise: Microscopy, molecular spectroscopy and materials science

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

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

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

Areas of Expertise: electrochemistry, spectroscopy and analytical chemistry

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

My research interests focus on creating novel devices for identification but also the detection of drugs, explosives and contaminants. My specialty is chemical biology but I have a profound interest in toxicology and biomedical engineering. I am fascinated with creating devices that can have immediate and practical applications in border security, forensic science and food safety. My interest and love for science is linked to my love for science fiction and all things geeky and nerdy.

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

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

Currently in my lab, we are organizing and analyzing the data taken from the 70-odd students who participated last semester in a project known as “Transforming Reference Frames.” This project seeks to probe student mental models regarding Galileo’s Principle of Relativity. This spring, we expect to set up and start using a state-of-the-art eye-tracking device in order to collect optical data. We will thereby vastly deepen our investigation of student cognition as it applies to relative motion.

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

In addition to training in the lab, mentors help students prepare for being active participants in the scientific community. Seminars include developing skills in public speaking and giving a successful poster presentation.

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 19 students who actively participated in mentored research and several dozen additional students who participated in program seminars and training activities. In its most recent year of operation, 50 students have participated in mentored research and receive research stipends, an additional 23 students have participated in research training activities, and well over 100 students have participated in program seminars and training activities. PRISM has been highly successful in increasing the number of students moving on to post-graduate education and successful careers in science. For more information, contact us at PRISM@jjay.cuny.edu, visit our website www.prismatjjay.org or 'like' our PRISM group on Facebook®.

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PRISM Director

Lawrence Kobilinsky, PhD
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