Abstracts of the Emerging Scholars Program Research Projects Supported by CUNY COMPACT funds Fall 2006

Student	Faculty Mentor	Department	Project Title
Kai M. Ng	Niloufar Haque Nasreen S. Haque	Biological Sciences	Zebra fish : Modeling Cell Migration
Jin H. Zhu	Niloufar Haque	Biological Sciences	Microbial Diversity in the Gowanus Canal
Lauri Ann Gugulski	Vasily Kolchenko	Biological Sciences	Development of the Optical Biosensor for Virus Detection: Gene Prediction Using Machine Learning
Yulia Gruber	Vasily Kolchenko	Biological Sciences	Development of the Optical Biosensor for Virus Detection: Gene Prediction Using Machine Learning
Victor Acevedo	Victoria Ying	Biological Sciences	Use of Drug Loaded Porous Silica Particles to Treat Cancer
Lisalena Galarza	Victoria Ying	Biological Sciences	Use of Drug Loaded Porous Silica Particles to Treat Cancer
Maximo A. Sierra	Isaac Barjis	Biological Sciences	Modeling of Glucose Metabolism using Hidden Markov Models Bioinformatics
Mary Chan	Peter Spellane	Chemistry	Electrochemistry of porphyrin compounds with aniline oligomer side chains: stable organic compounds with charge-separated excited states.
Rachel Wilson	Annette Saddik	English	Research for a book project: Contemporary American Drama: Performing Postmodernism (Edinburgh University Press, forthcoming 2007).
Jian Hong Li	Urmi Ghosh-Dastidar	Mathematics	Exploration of Mathematical Models in Data Networks
Martin Shirer	Kyle Courdileone	Social Science (History)	Research for article on "Communist Brainwashing-Were We Prepared?" American Cold Warriors in Manchuria. The article will be part of an anthology on American Political Culture to be published by Princeton University Press.
Kubee Kassaye	Jean Kubeck	Social Science (Psych)	Modeling the Relationship Between Age and Job Satisfaction
June T. Sandiford	Jean Kubeck	Social Science (Psych)	Are School-aged Children's Cartoon Preferences Gender-Typed?
Erez Gati	Lufeng Leng Roman Kezerashvili	Physics	Research Topic: Nuclear Energy and Global Energy Use.

Zebra fish: Modeling Cell Migration

Student: Kai Nguyun
Research Mentors: Niloufar Haque and Nasreen S. Haque
Department: Biological Sciences

Atherosclerosis is a disease that leads to dysfunction of the endothelium and attracts monocytes and smooth muscle cells to the site of injury. The biochemical mediators that induce vascular smooth muscle cell activation from a quiescent to a synthetic phenotype during atherogenesis or following mechanical vascular injury are not well understood. CC chemokines are a family of closely related proteins characterized by two adjacent cysteine residues that function as leukocyte activators and chemoattractants in inflammatory reactions. The CC chemokine CCL1 receptor 8 (CCR8) is expressed on monocytes and T-lymphocytes and is the sole receptor for the human CC chemokine CCL1 (I-309) and for the viral chemokine, vCCL1 (vMIP-1). We have previously shown that human vascular cells possess functionally active CCR8 which indicates a potential role of CCL-1 in vascular wall biology.

In the present study we aim to extend our studies to zebra fish (*Danio rerio)* to determine the regulation of vascular cell migration by CCR8. Controlled egg production, transparent embryos for easier visualization of developmental changes and cost effective maintenance makes zebra fish is a powerful vertebrate model ideally suited for the study of biological complexities. Our specific aims are to (1) Isolate and characterize zebra fish orthologue of human CCR8 mRNA and (2) generate CCR8 deficient zebra fish for modeling of cell migration. These experiments will aid us in providing an *in vivo* model for understanding the role of CCL1 and its receptor CCR8 in vascular pathology. We have successfully isolated zebra fish DNA as a first step in this process. Mary Chan

Microbial Diversity in the Gowanus Canal

Students: Jin H. Zhu, Kai Ng, Arifa Ali
Research Mentor: Niloufar Haque and Niloufar Haque
Department: Biological Sciences

The biogeochemical processes in the estuarine environment are a profound indicator of its status. The aquatic habitat depends on the presence or absence of biotic organisms and the physical and chemical conditions around it. Despite the significant attribution of microbial population on the estuarine ecosystem, the relationship between estuarine surface and benthic microorganisms are not well defined. Gowanus Canal in New York City is infamous for the effluents being discharged into it from industries presiding around it have made this area unhealthy. We postulate that as a result of this continuous inflow of effluents from the city the area would contain high levels of toxic elements which would in turn influence the health of the organisms residing there. Therefore we aim to determine the microbial diversity that exists in this canal both in the surface and at the bottom. Our aims are (1) to determine changes in physical condition (2) effect of these changes on the microbial populations. We have monitored marine life in the Gowanus Canal with Urban Divers, NY which included pH levels, dissolved oxygen, salinity and nutrient levels. Preliminary data obtained by periodic monitoring shows a trend of decreased dissolved oxygen (DO), phosphate and nitrate levels over the years. Bacterial samples were collected at the site both from the top and bottom of the estuary. These were brought to the lab and cultured on differential media. We have observed differential pattern of colony formation in terms of size and shape and growth rate. Both gram negative and gram positive bacteria were

identified. These results indicate the influence of effluents on different regions of the canal and are important to be further tested. An understanding of the microbial diversity will help in an understanding of the food chain and address health issues of population directly affected by the constantly changing environment in our waterways.

Development of the Optical Biosensor for Virus Detection: Gene Prediction Using Machine Learning

Student: Lauri Ann Gugulski
Student: Yulia Gruber
Student: Nicole Johnson
Research Mentor: Vasily Kolchenko
Department: Biological Sciences

`The optical biosensor developed as a result of collaboration of CityTech and Polytechnic University researchers was first presented at the American Physical Society conference (2004). The method has a potential of high sensitivity macromolecule identification that may be extended to identification of nanoparticles including viral particles. The high sensitivity of the biosensor is based on the use of optical resonances in a silica microsphere. The resonance frequency shift resulting from the nanoparticle absorption provides information about the absorption process, nanoparticle molecular weight and other features of the nanolayer at the surface of the microshpere.

During the first stage of the project, we will be using synthetic polystyrene nanoparticles of the sizes comparable to the sizes of the viral particles (~100 nm) to explore the dependency of detection sensitivity on nanoparticle size, geometry, chemistry, concentration, microshpere surface modification and other variables. The results will give us clearer view of the potential for viral detection using the optical biosensor as well as the understanding of the possible limitations of the method and the need for technical improvement. After validating the method, we can proceed to the future experiments in order to detect viral particles of bacteriophage.

In addition to participating in and learning about this research project, the students will research diverse gene finding techniques based on machine learning. Identification of genes in the genome DNA sequences is one of the central problems of modern biology. The students will select and use different computer tools available online to compare and contrast the effectiveness of gene prediction in viral and prokaryotic genomes. They will learn about machine learning applications in different fields, particularly in molecular biology. The advantages of machine learning in gene prediction will be investigated. We will evaluate Open Reading Frame (ORF) finder, GeneMark and other programs. Bacteriophage MS2 will be used for gene prediction and gene function research. This virus is currently used as a viral particle model in Microparticle Photophysics Lab. A poster based on their research will be presented during the Honors Scholars Program poster presentation.

Use of Drug Loaded Porous Silica Particles to Treat Cancer

Student: Victor Acevedo
Student: Lisalena Galarza
Research Mentor: Victoria Ying and Prof. Michal Kruk (College of Staten Island)

Work is being done on the synthesis of silica porous polymers as a drug delivery vehicle for controlled release of camptothecin (CPT), a potent fluorescent cancer drug. Silica (Si_xO_y) is an ideal compound because silicon (Si) is the second most common element in the earth's crust, which makes silica compounds plentiful and inexpensive. Many therapeutic drugs require multiple dosing for treatment. Instead of relying on multiple injections, one time injection of drug loaded silica particles would be sufficient. The pore sizes of these silica particles affect the release rates of CPT. Controlled release rates of CPT are slower with silica particles that have smaller pore sizes than those with larger pore sizes. Victor is focusing on the synthesis of **M**eso**C**ellular **F**oam (MCF) silica particles that have larger pore sizes in the 20-50 nanometer range. Lisalena is working on the synthesis of **S**anta **BA**rbarba-15 (SBA-15) particles that have smaller pore sizes in the 5-20 nanometer range. The CPT drug release rate that works best in treating certain types of cancers will be determined. One limitation of CPT is that it converts to the less effective and more toxic carboxylate isomer in the presence of plasma. The more therapeutic lactone isomer with reduced side effects may be stabilized if conjugated to silica particles that are post-modified with reactive -OH, $-NH_2$, or -SH surface groups. Once the fluorescent CPT drug is attached, the amount of drug released into buffers, cells, and tissues may be measured with a fluorimeter. The biological response of the tumor cell lines treated with CPT lactone conjugated to silicas may be compared to free CPT carboxylate not conjugated to silicas. We hypothesize that both the conjugation to stabilize the active CPT lactone and the continual drug release process via silicas together are more effective in treating cancer than multiple drug injections with the inactive CPT carboxylate not bound to silicas.

Modeling of Carbohydrate Metabolism Using Hidden Markov Models

Student: Maximo Sierra
Research Mentor: Isaac Barjis
Department: Biological Sciences

The processes of metabolic network are very complex, and consequently, difficult to understand and teach; furthermore, it is impossible to predict and analyze it when unpredictable changes are made. Because of the complexity of metabolic networks and their regulation, formal modeling is a useful method to improve the understanding of these systems. To achieve our goal, we've used probabilistic modeling methods to model, analyze, and simulate the process of carbohydrate metabolism in a very compact notation. In particular our research is directed to the development of new probabilistic model of complex biological process such as carbohydrate metabolism. In this paper we use Hidden Markov Models (HMMs) and conditional statistics to model and simulate the process of carbohydrate metabolism.

Electrochemistry of Porphyrin Compounds with Aniline Oligomer Sidechains: Stable Organic Compounds with Charge-separated Excited States

Student: Mary Chan
Research Mentor: Peter Spellane
Department: Chemistry

In the photosynthetic conversion of light energy to chemical energy, energy storage begins with the separation of charge. Light absorbed by a porphyrin chromophore produces an excited electronic state that leads to formation of a transient molecular dipole. The long-range goal of this research is the preparation and characterization of compounds that mimic the photosynthetic donor—acceptor complexes. To date, we have developed methods for preparing asymmetric mono-amino-functional TPP and used optical spectroscopies to characterize their electronic states. In new work, we are developing electrochemical methods to characterize the redox properties of the compounds.

Cyclic voltammetry (CV) allows an investigator to measure the electrochemical potential required to remove an electron from (oxidize) or add to an electron to (reduce) a chemical species being investigated. In a three-electrode electrochemical cell (working, counter, and reference electrodes), the potential of the WE is scanned in one direction and the current flows between WE and CE are measured. In cyclic voltammetry, the direction of potential is reversed at the end of the first scan. Coupling the reverse (cathodic) scan to the anodic scan lets the experimentalist observe whether the product of the electron transfer that occurred in the forward scan can be observed in the reverse scan. Cyclic voltammetry is a powerful tool for the determination of the formal redox potentials of compounds and for the detection of chemical reactions that may follow the initial electrochemical reaction. CV also enables measurement of electron transfer kinetics.

Research for a book project: Contemporary American Drama: Performing Postmodernism (Edinburgh University Press, forthcoming 2007).

Student: Rachel Wilson
Research Mentor: Annette Saddik
Department: English

As the semester began, I wondered how I was going to balance my already busy schedule of a full-time course load and work. I didn't think that entertaining any new ventures would be a good idea, until the opportunity to work with Dr. Saddik presented itself. With concentrated thought, and a lot of prayer, I accepted this great opportunity and it's turned out to be all I expected it to be.

Approaching the Honors Scholars Program, I was excited, but also apprehensive. Considering my schedule, I wasn't sure I'd be able to fulfill the duties of this program. I had never done research on this level (college) before, so it proved challenging. The research I'm doing for Dr. Saddik is for her upcoming book, Contemporary American Drama: Performing Postmodernism. It explores the history of contemporary American theatre, beginning with the influences of Bertolt Brecht and Antonin Artaud after World War II, and focuses on anti-realistic drama from the 1960s to the present day. There were several topics that I was assigned to research. The Living Theatre, Open Theatre, and Paula Vogel, as well as other prominent names in drama.

I did all my research online using the CUNY library, which proved tricky at first. Since I had never used the library databases, I had difficulty obtaining some of the articles which

pertained to my search. However, once I became familiar with the different databases, I was able to get better results more quickly. I used Literature Resource Center/MLA, Jstor, and EBSCO Host, which all proved to be very efficient. They all contained full text articles that were recently published.

While doing this research, I had the advantage of gaining knowledge about the Living Theatre and Open Theatre and what their contributions were to drama. The Living Theatre was an experimental theatre that was founded by Julian Beck and Judith Malina in 1947. Their theatre was considered provocative because they introduced sexuality into the theatre. Beck and Malina believed that art and life should not be separate. Though the theatre received harsh criticism, it was very popular. It introduced theatrical styles and influences that were never done before. The Living Theatre's methods and influence are still present in drama today.

The Open Theatre was also an experimental theatre that introduced new methods to drama. The Open Theatre was founded in 1963 by Peter Feldman and Joseph Chaikan. The theatre used drama to address current and social issues. Feldman and Chaikan also attempted to find ways to combine improvisation, music, and dance into one production. Though the Open Theatre came to an end in 1973, it influenced the world of drama drastically.

I also became familiar with some prominent names in drama. Suzan-Lori Parks and Sarah Jones are just two of the fine talents I encountered. Suzan-Lori Parks is a playwright who has written screen plays for Spike Lee and Toni Morrison. Her notable works include 365 Days/365 Plays and Getting Mother's Body. Her play Topdog/Underdog earned her a Pulitzer Prize in drama, making her the first Black woman to ever receive that award. Sarah Jones is young talented poet, playwright, and performer. Ms. Jones' most notable work is Bridge & Tunnel, which she wrote and produced. She was awarded a special 2006 Tony Award for this theatrical production, where she played more than 14 characters.

The Honors Scholars Program has been beneficial to me in many ways. It has enabled me to improve my research skills and methods. It has also helped me appreciate the many works in theatre and drama and the authors of those works. Lastly, it has given me an added confidence in my ability to take on new projects. Before accepting this position there was some doubt whether I could handle the added responsibility. Now, I feel I can accept, and overcome, any type of challenge.

Exploration of Mathematical Models in Data Networks

Student: Jian Hong Li
Research Mentor: Urmi Ghosh-Dastidar

Financial optimization plays an important role in today's world. When an investor invests some amount of money to build a data network, s/he wants to maximize her/his profit. Optimizing data network is a very complex procedure; several things need to be considered. For example, 1) the amount of money the investor wants to invest is limited, 2) there is a payback period: the investor wants to make the profit within a certain time frame, 3) the operating cost, installation cost and capital cost of the network should be addressed, 4) the interest rate and the inflammation rate during this payback time should also, be considered. In this project we will explore, study and analyze the mathematical models of such data network.

"Communist Brainwashing: Are We Prepared?" American Cold Warriors in Manchuria

Student: Martin Shirer
Research Mentor: K. Cuordileone

This project will explore the circumstances surrounding the 21 American Prisoners of War (POWs) who were captured during the Korean War (1950-1953) and refused repatriation back to the US when the war ended. As these POWs declared themselves Communists and denounced American values, U.S. military and psychiatric officials became alarmed and theorized these men had been "brainwashed" the hands of their Chinese captors. This study asks several important questions: 1) What exactly happened to these men and can we legitimately call it "brainwashing"? 2) What role did ideology play in the way that these "turncoat GI's" were discussed, diagnosed, demonized and/or punished by American officials? 3) How did the media portray these soldiers and how did that portrayal reflect popular beliefs that our nation had serious internal problems that made these men vulnerable to mental manipulation? Finally, 5) What did these GI's report about their capture and their lives afterward in the Communist world, and what has become of each of the soldiers?

Are School-aged Children's Cartoon Preferences Gender-Typed?

Student: June Tasha Sandiford
Research Mentor: Jean E. Kubeck, Ph.D.

Gender refers to physical, cognitive, and behavioral traits that characterize people of one sex, male or female. Developmentalists often ask "Why do girls play with dolls and boys with trucks?" Is it genetics or is it the environment? One explanation involves modeling and the influence of various kinds of models including television (Chancellor, 2002; Cook & Cook, 2005). The overall focus of this project was to interview school-aged children to assess their cartoon preferences as related to gender. A pilot study was conducted to test cartoon stimuli using ten college-aged students. A questionnaire was developed to assess reactions to male- and female-oriented cartoons. All 5 females stated they would watch the female-oriented cartoons but not the male-oriented cartoons, whereas only 1 out of the 5 males stated he would watch the female-oriented cartoons. The remaining 4 males stated they would watch the male-oriented cartoons. As a result of this pilot study, a study was designed for school-aged children. This study incorporates more in-depth questions aimed at assessing possible environmental influences.

Age and Job Satisfaction: A re-analysis of Jahad (1995)

Student: Kubee Kassaye
Research Mentor: Jean E. Kubeck, Ph.D.

Many models of job satisfaction and its relationship to age have been proposed in the literature. However, there are discrepancies in the literature regarding the shape of the relationship between job satisfaction and age, as well as the nature and explanation of that relationship. This project contributes a data point for a meta-analysis being conducted by Jean E. Kubeck and Anthony Sterns (2006). Data were scanned from work done by Jahad (1995), extensively checked for errors, and a Spearman Correlation Coefficient was run. The correlation between age and job satisfaction was 0.026 and was not significant. The scatterplot supports a linear relationship between age and job satisfaction. The sample was comprised of 328 (232 female) teachers.

Future of Nuclear Energy

Student: Eretz Gati
Research Mentor: Lufeng Leng and Roman Kezerashvili

Nuclear power industry is a fast growing international industry with a proven half-century track record of providing energy for the base economical activities of developed industrial nations. With different nations being involved in nuclear power generation to a different degree the spectrum includes such front-runners as France and Lithuania, where up to 80% of electricity is being generated by nuclear plants and US as the world biggest producer of nuclear power.