Abstracts of the Emerging Scholars Program Research Projects

Supported by CUNY Compact funds
Spring 2008

Student Name	Faculty Mentor	Department	Project Title
Igor Ashurov	Oleg Berman	PHYS	The Properties of Electric and Magnetic Dipoles and the Interaction between Various Dipole Molecules (DNA)
Ian Rubenstein	Reginald Blake	PHYS	Enhanced Observation Capability of the New Generation Geostationary Satellites for Better Vegetation Monitoring
Kurt Sealey	Reginald Blake	PHYS	Enhanced Observation Capability of the New Generation Geostationary Satellites for Better Vegetation Monitoring
Giuseppe Macaluso	Daniel Capruso	SS	A Computerized Test of a Hypothesis Involving the Effect of the Poggendorff Illusion on an Embedded Stimulus
Feng Yan Tang	Daniel Capruso	SS	A Simplified Chinese Character Version of a Computerized Forensic Evaluation
Michael Dulski	Daniel Capruso	SS	Stimuli and Response Choices to Test the Effects of Landscape Planar Elevation and Spatial Frequency Filtering on Perception of the Mona Lisa
Tamara Shand	Sanjoy Chakraborty	BIO	Endocrine Disruptors and Reproductive Axis, Puberty
Taznia Sultana	Sanjoy Chakraborty	BIO	Endocrine Disruptors and Reproductive Axis, Puberty
Tomar Yakov	Sanjoy Chakraborty	BIO	Estrogen and its Neuroprotective Effect
Adelle Thomas	Andrew Douglas	MATH	The Life and Work of Fiona Murnaghan
Parveen Chowdhury	Laura Ghezzi	MATH	Karen Smith: A Young World Leader in Commutative Algebra and Algebraic Geometry
Jian Hong Li	Urmi Ghosh-Dastidar	MATH	Mathematical Modeling of Bird Flu Propagation
Elisa Eishamy	Victoria Gitman	MATH	Julia Robinson: A Pioneer in Logic
Stacy Cruickshank	Richard Hanley	ENG	Water and Work: The History and Ecology of Downtown Brooklyn
Fejzije Bala	Nasreen Haque	BIO	Biodiversity in the Gowanus Canal
Marakia Jean-Noel	Nasreen Haque	BIO	Molecular Profiling of Microbial Populations in Extreme Environments
Luis Calzadilla	Niloufar Haque	BIO	Alterations in Brain Protein Profile in Alzheimer's Disease
Esther Goldstein	Caroline Hellman	ENG	House and Home Papers: Domesticity in the Works of Stowe, Alcott, Cather, and Wharton
Franklin Fung	Delaram Kahrobaei	MATH	Group Theory and Cryptography
Weiyan Guo	Delaram Kahrobaei	MATH	Work and Life of Sarah Rees
Kazy Islam	Delaram Kahrobaei	MATH	Some Applications of Combinatorial Group Theory in Cryptography
Crystal Hernandez	Laina Karthikeyan	BIO	Antiviral Properties of Fruit Juices
Thinh H. Le	Lufeng Leng	PHYS	Brillouin/Erbium Fiber Laser

Abstracts of the Emerging Scholars Program Research Projects

Supported by CUNY Compact funds
Spring 2008

Student Name	Faculty Mentor	Department	Project Title
Mikhail Tsich	Zongmin Li	BIO	The Effect of Long-Term Exposure to Anti-bacterial Soap on the Development of Microbial Resistancy
Lori Younge	Janet Liou-Mark	MATH	An African-American Woman Mathematician: Dr. Martha Euphemia Lofton Haynes
Preston Webber	Djafar Mynbaev	TCET	Electronic Circuitry for Improving Performance of an Optical Communications Link
Prashant Rana	Djafar Mynbaev	TCET	Design of Electronic Dispersion Compensation Circuitry for Optical Communications
Meisha-Gay Ringrose	Mark Noonan	ENG	Legal Regulations Pertaining to Air and Water Pollution along the Brooklyn Waterfront
Crystal Hernandez	Howard Sisco	SS	Validation of a Cultural Value Scale
Nerrine Douglas	Simboonath Singh	SS	Unity in Diversity: Diasporic Encounters and the New Hinduism in the North American Diaspora
Cheng Tan	Shelly Smith	ARCH	Documentation Phase 2 and Structural Analysis - The Timothy Knapp House, Rye, NY
	Osei Gyebi	CMCE	
Jorman Pena	Shelly Smith	ARCH	Documentation Phase 2 and Structural Analysis - The Timothy Knapp House, Rye, NY
Shazadi Mohammed	Suresh Tewani	CHEM	Hydrogen Gas is the Fuel of Future
Mary Bellamy	Shauna Vey	HU	One Hundred Years of Child Labor Onstage in America
Francesca Montijo	Huseyin Yuce	MATH	The Tale of Zero

NSF supported students - DUE 0622493

Student Name	Faculty Mentor	Department	Project Title
Mukhtar Adyinka	Sidi Berri	MECH	The Use of CAD/CAM in Industrial Product Design
Eddy Moises	Sidi Berri	MECH	The Use of CAD/CAM in Industrial Product Design
Adam Atia	Aparicio Carranza	CET	Synchronous Binary Counter
Shadrack Mbogho	Candido Cabo	CST	Computer Systems
Javier Joya	Henry Africk	Math	Mathematical Simulations

Title: The Properties of Electric and Magnetic Dipoles and the Interaction between Various Dipole Molecules (DNA)
Undergraduate Researcher: Igor Ashurov
Faculty Mentor: Dr. Oleg Berman

We studied dipole properties, such as electrostatic forces between dipoles that keep the double helix in DNA molecular strands together. We also estimated the net force between various molecular compounds like H_2O and the CO-HN group. The electric field and electric potential generated by various dipole molecules have also been calculated. Moreover, we have extended our quantitative analysis on the magnetic field generated by magnetic dipoles. The classical electrodynamics framework has been applied for these calculations.

Title: Enhanced Observation Capability of the New Generation Geostationary Satellites for Better Vegetation Monitoring
Undergraduate Researchers: Kurt Sealey and Ian Rubenstein
Faculty Mentor: Dr. Reginald Blake

GOES-R ABI will be the first GOES (Geostationary Operational Environmental Satellite) imaging instrument to provide observations in both the visible and the near infrared spectral bands. The sensor will, therefore, be ideal for generating vegetation indices that can be used for monitoring the state of the vegetation cover as well as for identifying vegetation stress and drought. In addition to its improved spectral capability, the advantage of GOES-R ABI has enhanced spatial (2 km) and temporal (every 5 min.) resolution. This project focuses on the results of the work on generating the NDVI (Normalized Difference Vegetation Index) and evaluating compositing algorithms using Meteosat 8/9 SEVIRI data as a proxy for GOES-R ABI prototype. A set of remapped and reprojected MSG SEVIRI half-hourly images covering Europe and Africa has been analyzed since May 2006. Collection of a set of SEVIRI full-disk 2-byte images started in late February 2007. Both of these datasets are used to test NDVI algorithms and assess their accuracy. Preliminary results indicate that with enhanced observation capability of the new generation geostationary satellite, the advantages of GOES-R ABI can be demonstrated through its improved spectral, spatial and temporal resolutions.

Additional Mentors: Peter Romanov[1], Hui Xu[2] , Dan Tarpley[3]

[1]CICS, University of Maryland
[2]IMSG Inc., Kensington, MD
[3]NOAA/NESDIS/STAR, Camp Springs, MD

Title: A Computerized Test of a Hypothesis Involving the Effect of the Poggendorff Illusion on an Embedded Stimulus
Undergraduate Researcher: Giuseppe Macaluso
Faculty Mentor: Dr. Daniel Capruso

Aim: The Poggendorff illusion occurs when an intervening rectangle causes an apparent visual misalignment of two collinear stimuli. The aim of the project is to devise a test of an original hypothesis that the Poggendorff Illusion may also induce a misjudgment of the angle or vertical elevation of a line embedded within the central rectangle.

Method: The Method of Adjustment was selected because it allows the measurement of perceptual judgments with the minimum number of trials. In order to accomplish rapid, paperless data collection of multiple subjects in a psychology laboratory, Visual Basic 2005 was used to create the experimental computer application.

Results: A Visual Basic 2005 application (computer program) was created. The application tests the accuracy of two types of perceptual judgment under random administration of both control

and experimental conditions: (1) Judgment of Angular Line Orientation: Control trials are presented in which oblique target lines of varying angular orientation are presented to the right or left of a rectangle, and the subject must use graphical user interface (GUI) buttons to adjust the angle of a response line embedded within the rectangle to match the angle of the target sample. Experimental trials are also presented in which the response stimulus is embedded within the rectangle of a Poggendorff display with collinear peripheral lines of varying angular orientation. The subject must match the response line to the angle of the collinear target lines. (2) Judgment of Elevation: Control trials are presented in which oblique lines of varying angular orientation are presented at the top or bottom of the rectangle. The subject must adjust the elevation of the response line with GUI buttons until the embedded line is bisected by two horizontal collinear peripheral lines. Experimental trials are also presented in which the subject must adjust the elevation of the response line so that it is bisected by the two oblique collinear lines in a Poggendorff display.

Conclusion: A computer application has been developed that can be used to empirically test a hypothesis that the Poggendorff configuration will affect judgments of angular orientation and elevation in embedded stimuli.

Title: A Simplified Chinese Character Version of a Computerized Forensic Evaluation
Undergraduate Researcher: Feng Yan Tang
Faculty Mentor: Dr. Daniel Capruso

Aim: New York has a rapidly increasing Chinese immigrant population for whom it is difficult to provide forensic psychiatric services due to a language barrier. The aim of the project was to produce a Chinese character version of a computerized fitness evaluation. The computer application will evaluate and train monolingual Chinese immigrants regarding fitness to proceed on criminal matters in the New York State legal system.

Method and Results: The 105 question item pool of an existing computerized forensic evaluation produced at the New York City College of Technology was translated into a simplified Chinese character set and created as a digital file. Because the various dialects of Chinese are mutually intelligible with the same set of written (not spoken) language characters, the computer application can be used with any literate Chinese forensic patient.

Conclusion: The production of a Chinese version of the Computerized Fitness Evaluation allows provision of improved forensic services to Chinese immigrant forensic patients, many of whom have a limited comprehension of the legal system in New York State. Because English and Spanish language versions of the forensic program already exist, production of the Chinese computer application will also allow cross-cultural research into differences in fitness to proceed among persons born in the USA versus various Hispanic and Chinese immigrant groups.

Title: Stimuli and Response Choices to Test the Effects of Landscape Planar Elevation and Spatial Frequency Filtering on Perception of the Mona Lisa
Undergraduate Researcher: Michael Dulski
Faculty Mentor: Dr. Daniel Capruso

Aim: The perceptual instability and illusory movement apparent in the smile of Leonardo DaVinci's "Mona Lisa" has been the subject of comment and speculation by art historians, critics, and scientists. The primary aim of the project was to devise digital stimuli that will allow an empirical test of an original hypothesis that Mona Lisa's smile is, at least in part, caused by a Poggendorff type perceptual illusion induced by the unequal elevations of the landscape planes on either side of Mona Lisa's head. A secondary aim of the project was to construct stimuli that would also allow an empirical test of Livingstone's spatial frequency hypothesis of perception of Mona Lisa's smile.

Method: A 717x1101 (WxH) pixel image of the Mona Lisa was manipulated in Adobe Photoshop CS3. In order to test the original hypothesis, the landscape background was retouched and leveled using the "healing brush" and "clone stamp" tools. To test Livingstone's spatial frequency hypothesis, Mona Lisa's face was cropped to 278 x 350 pixels and then passed through high and low pass frequency filters. Finally, matching to sample response choices for the smile were produced using the "liquefy" and "smudge" tools to warp the mouth into a greater or lesser smile without noticeably changing the image to a casual observer.

Results: For experimental purposes, the following digital stimuli have been produced: (1) A Mona Lisa with background landscape planes of equal elevation; (2) High and low spatial frequency filtered versions of Mona Lisa's face; and (3) More acute versus flattened versions of Mona Lisa's smile to be used as response choices in testing the effects of altered background and high versus low spatial frequency filtering on perception of Mona Lisa's facial expression.

Conclusion: The digitally altered stimuli will be used in a computer application to be constructed which will provide automated empirical testing of whether alterations in surrounding contextual landscape or spatial frequency may account for illusory or unstable perception of the Mona Lisa smile.

Title: Endocrine Disruptors and Reproductive Axis, Puberty
Undergraduate Researchers: Tamara Shand and Taznia Sultana
Faculty Mentor: Dr. Sanjoy Chakraborty

After several accidental discoveries and the beginnings of modern research, scientists have revealed overwhelming evidence that there is at least one group of chemicals, namely endocrine disrupting chemicals (EDC), both natural and man-made, which are responsible directly or indirectly for damage to the homeostasis of living things. The endocrine system that regulates our body's major functions, including normal growth, maturation, and reproduction utilizes many hormones. Hormones, the chemical messengers, work through specific receptors that are expressed all over the body. EDCs that are found in the environment potentially interfere with the proper functioning of the hormonal system by binding to their receptors. In this project, some specific EDCs and their profound effect on sexual characteristics, including earlier menarch in girls and reduced sperm quality in males, were studied.

Title: Estrogen and Its Neuroprotective Effect
Undergraduate Researcher: Tomar Yakov
Faculty Mentor: Dr. Sanjoy Chakraborty

Glucose is the main metabolic fuel for the neuronal cells. In the event of low glucose (hypoglycemia) the regions of the brain like the cortex, hippocampus and hypothalamus become vulnerable to injury. Reports of necrotic and apoptotic cell death in the neocortex has been reported. We studied the effect of hypoglycemia on hypothalamic cells and explored estrogen as a potent neuroprotective agent. Reports are available that estrogen acts a neuroprotective agent in animal models, but the contribution of estrogen receptors in the estrogen-primed neuroprotection in hypothalamic cell line remains unsolved.

Title: The Life and Work of Fiona Murnaghan
Undergraduate Researcher: Adelle Thomas
Faculty Mentor: Dr. Andrew Douglas

Dr. Fiona Murnaghan is a Professor of Mathematics at the University of Toronto. Since earning her PhD from the University of Chicago in 1987, she has made many important contributions to

the field of Representation theory of p-adic groups.   We examined her rise to success from grade school, through graduate school and finally as a Professor of Mathematics. Next, we studied the general area in which Dr. Murnaghan's research lies, group theory. After learning the basic results of group theory, we examined one of its classical results: A description of the symmetry group of each platonic solid. This work was presented at the NSF sponsored Women in Mathematics Conference, held at City Tech on May 2, 2008.

Title: Karen Smith: A young world leader in Commutative Algebra and Algebraic Geometry
Undergraduate Researcher: Parveen Chowdhury
Faculty Mentor: Dr. Laura Ghezzi

This project concerned Karen Smith (1965 -), Professor of Mathematics at the University of Michigan. Dr. Smith is a world leader in Commutative Algebra and Algebraic Geometry. She has been the recipient of prestigious awards, and is a devoted mother of three children. We explored her path towards a career in mathematics, her outstanding achievements, and her extremely positive influence on the numerous undergraduate students, graduate students and postdocs that she has mentored. We also briefly researched the role of Commutative Algebra and Algebraic Geometry in modern mathematics, to better understand Dr. Smith's contributions to these fields. This work was presented at the NSF sponsored Women in Mathematics Conference, held at City Tech on May 2, 2008.

Title: Mathematical Modeling of Bird Flu Propagation
Undergraduate Researcher: Jian Hong Li
Faculty Mentor: Dr. Urmi Ghosh-Dastidar

This is a continuation of the project that we started in fall of 2007.
We built a bird-flu propagation model using mathematical tools. This model is based on numerous assumptions (please see the abstract of Emerging Scholar Program, fall 2007 for further information). We found four equilibrium points. Three out of these four equilibrium points are in the feasible region. For each of these equilibrium points, the system of differential equations is linearized and corresponding eigen-values are found. We found that two of these equilibrium points are unstable since one of the eigen-values is positive for both cases. We found that the remaining equilibrium point is asymptotically stable because all three eigen-values associated to this equilibrium point have negative real parts. Our analytical results nicely agree with numerical simulation.

Title: Julia Robinson: A Pioneer In Logic
Undergraduate Researcher: Elisa Eishamy
Faculty Mentors: Dr. Victoria Gitman

In 1976, the American mathematician Julia Robinson (1919-1985) became the first woman to be elected to the National Academy of Sciences. Robinson's work on existential definability and exponential Diophantine equations provided much of the basis for the solution of the famous Hilbert's Tenth Problem. Even though it was Yuri Matiyasevich who proved the negative solution to the Tenth Problem and not Robinson, his solution built fundamentally on Robinson's joint work with Hilary Putnam and Martin Davis. Robinson made major contributions to the field of mathematical logic and became an inspiration to aspiring women mathematicians worldwide. Our poster will take a journey through Julia Robinson's life and her accomplishments as well as give an overview of Hilbert's Tenth Problem and the Matiyasevich, Robinson, Davis, Putnam (MRDP) solution. This work was presented at the NSF sponsored Women in Mathematics Conference, held at City Tech on May 2, 2008.

Title: Water and Work: The History and Ecology of Downtown Brooklyn
Undergraduate Researcher: Stacy Cruickshank
Faculty Mentor: Dr. Richard E. Hanley

The Water and Work: History and Ecology of Downtown Brooklyn project was made possible through a National Endowment for the Humanities (NEH) sponsored faculty development seminar at the New York City College of Technology. The City Tech faculty seeks to understand the historical, technological, social and ecological forces that have created Downtown Brooklyn.

The Emerging Scholars Program has afforded me the wonderful opportunity to work along with faculty members on their quest to discover and thoroughly study the Brooklyn Waterfront; the fruition of which will result in the development of a humanities course for all freshmen students.

My involvement with this project has proved very interesting and informative – from learning about Walt Whitman and his poetry about Brooklyn and Manhattan (which he referred to as Manahatta) to learning about containerization. I worked along with faculty members in creating an archive of the various planned events. The first such event was a panel discussion that featured three eminent scholars, who focused on the Brooklyn waterfront from their areas of specialization. Professor Karen Karbiener discussed Walt Whitman's close relationship to the waterfront and showed its presence in his poetry. Professor Joshua Freeman focused on the history of waterfront labor in Brooklyn since World War II and Professor Betsy McCully focused on the natural history of Brooklyn's waterfront. Some of the other events include a "history hunters" workshop at the Brooklyn Historical Society, during which the facilitators focused on key events of U.S history that had a critical link with, or to Brooklyn; namely the Revolutionary War's Battle of Long Island, the Brooklyn Navy Yard in WW II, and Brooklyn's various influxes of immigrants, just to name a few. The workshop ended with a discussion on some key places in Green Point's historical development. This proved to be very timely and informative as one of our scheduled events was a walk through Green Point and Williamsburg.

The team also plans to visit the Barge Museum in Red Hook and have a tour of the Brooklyn Navy Yard. All the places that we have scheduled walks and tours to, have proved to be very rich sources of information about the forces in the creation of Downtown Brooklyn.

I am also a contributor on the Word Press website, on the Water and Work section created by Matthew Gold, one of the faculty members for relevant Water and Work blog entries. This entails writing blog entries on synopses or announcements of the activities we have had or upcoming events and also, putting links to articles of topics related to Water and Work.

It is indeed a pleasure working with the faculty members on this project. We are all learning and discovering much exciting information about the history of the Brooklyn Waterfront, which we believe will translate into an excellent awareness course in the humanities for freshmen students.

Title: Biodiversity in the Gowanus Canal
Undergraduate Researcher: Fejzije Bala
Faculty Mentor: Dr. Nasreen Haque

Every living organism has a specific role in maintaining the balance of the ecosystem. As a result of this balance, all organisms including bacteria can contribute to a healthy and balanced ecosystem. When this balance is disturbed, the ecosystem can suffer. The Gowanus Canal, an estuary in New York City is infamous for its level of pollution. Different industries discharge their waste, which is the prime reason for the pollution. We are studying the microbial populations colonizing in this water body. In spite of measures being taken, various microbes survive in this environment. Probably, the metabolic activity of these organisms aids in their survival. Our hypothesis is that inhibitory factors for diseased conditions can be obtained from the microorganisms. Our aims are (1) to identity the microbes in the canal, (2) to observe the role of

extracts of these microorganisms in inhibition of pathogenic microbes and (3) the characterization of bacteria by cloning and sequencing of specific DNA.

Gram staining revealed both gram-negative and gram-positive microbial populations. A differential pattern of mobility was observed amongst microorganisms by the Motility Test. Bioassays were performed to test the inhibitory effect of extracts from various cultured bacteria. Extracts of microorganisms (#29, 31, 32, 35) prevented the growth of different pathogens (S.aureus, E.coli, S.marcesces, C.defficile)in the laboratory.

Marine microbes are revealing new compounds for anti-cancer, anti-inflammatory and other diseases. These studies could provide alternative sources of drugs as shown in the above-mentioned findings.

Title: Molecular Profiling of Microbial Populations in Extreme Environments
Undergraduate Researcher: Marakia Jean-Noel
Faculty Mentor: Dr. Nasreen Haque

Microbial diversity is a major contributor to the biogeochemical processes in the estuarine environment. The growth and development of these organisms in turn, depends on the presence of other biotic organisms and the physical and chemical conditions around it. Despite the significant and profound effect of the microbial population on the estuarine ecosystem, the relationship between estuarine benthos and society is not well understood. The Gowanus Canal in New York City is extremely polluted. Preliminary data obtained by regular EPA monitoring shows a trend of decrease in dissolved oxygen (DO), phosphate and nitrate levels over the years. There are no documented records on the existing microorganisms in this area. The present study aims to study the microbial biodiversity at the molecular level in the canal.

Advances in technology allow for rapid localization, isolation and analysis of microorganisms based on genetic differences. This is an important tool in ecological research. The identification process involves isolation of DNA, PCR-based amplification of the specific 16S rDNA and sequence analysis. As a first step we have cultured bacteria from the canal on agar plates and successfully isolated genomic DNA.

Title: Alterations in Brain Protein Profile in Alzheimer's Disease
Undergraduate Researcher: Luis Calzadilla
Faculty Mentor: Dr. Niloufar Haque

ABSTRACT PENDING

Title: House and Home Papers: Domesticity in the Works of Stowe, Alcott, Cather, and Wharton
Undergraduate Researcher: Esther Goldstein
Faculty Mentor: Dr. Caroline Hellman

Professor Hellman's research involves establishing a complete understanding of the relationship between social history and literary accomplishment. She proposes that domestic space is a rich, generative site for political and social changes. The research I have conducted consisted of exploring women writers from the mid-nineteenth century to the early twentieth century and how they portray domesticity in their literature. More specifically, my aim was to investigate four major women writers, Stowe, Alcott, Cather, and Wharton. I researched works from the mid-nineteenth century to the twentieth century to see if these four major writers had been influenced by other

writers' literatures of domestic space. I examined the influence of Charlotte Perkins Gilman's book, *Women and Economics,* on post-1898 works of Wharton and Cather. I assisted Professor Hellman with research in determining whether particular primary and secondary sources are relevant on Stowe, Alcott, Cather, Wharton, and Gilman's writings on domesticity. I also studied the extent Downing's, *Architecture of a Country House,* influenced Stowe, Alcott, and Wharton's ideas of architectural design.

Title: Group Theory and Cryptography
Undergraduate Researcher: Franklin Fung
Faculty Mentor: Dr. Delaram Kahrobaei

The objective of this work was to write a paper which presents the theory of modern cryptography to the public. We mentioned its utilities and how to construct schemes and algorithms with it so that information can be transmitted over an insecure channel trustingly. This will help us to understand the basic task of cryptography which allows two or more users enable a communication over an insecure channel without information being altered and kept in secrecy. By doing that we discussed the mathematical backgrounds needed and the concepts involved in cryptography.

Title: Work and Life of Sarah Rees
Undergraduate Researcher: Weiyan Guo
Faculty Mentor: Dr. Delaram Kahrobaei

This project was a study of the British Mathematician, Sarah Rees (1957-), Professor of Mathematics at the University of New Castle in England. Professor Rees is a world leader in research at the junction of Group theory, geometry and combinatorics. Of her most recent projects, one examines connections between group theory and formal language theory, the other studies quantum computation from a group theoretic perspective. She has been internationally known for her work, and she is a devoted mother of a child. In this project the decision problem known as word problem and its hardness using an article of Sarah Rees, was explored. This work was presented at the NSF sponsored Women in Mathematics Conference, held at City Tech on May 2, 2008.

Title: Some Applications of Combinatorial Group Theory in Cryptography
Undergraduate Researcher: Kazy Islam
Faculty Mentor: Dr. Delaram Kahrobaei

Two important problems from non-commutative version of public key-encryption namely Diffie-Hellman and Elgamal key exchange system were presented. An introduction of combinatorial group theory, particularly two decision problems, namely word and conjugacy problems was also developed. It was shown that we can apply these problems in non-commutative versions of public key encryption. Particularly, a non-commutative ElGamal due to Kahrobaei and Khan was explored.

Title: Antiviral Properties of Fruit Juices
Undergraduate Researcher: Crystal Hernandez
Faculty Mentor: Dr. Laina Karthikeyan

Defined phytochemicals in potable juices have been shown to possess antiviral properties both *in vitro* and *in vivo*. However, cytotoxicity by chemical treatment of cells may mask any antiviral

effects. Accordingly, such testing is critical to validate the effect of the juices in question as antiviral agents.

Antiviral testing in cell culture has addressed the potential issue of cytotoxicity by monolayer pretreatment with cranberry and Concord grape juices. Such cytotoxicity testing employed trypan blue exclusion and cell subpassage. However, confirmatory testing to identify subtle effects by juices and other phytochemicals or nutraceuticals needs to be tested by a metabolic assay. The metabolic assay used is a non-destructive bioluminescent cytotoxicity assay, which quantitatively measures the release of adenylate kinase (AK) from damaged cells (ToxiLight[R] BioAssay, Lonza Rockland, Inc., Rockland, ME). Release of AK from damaged cells, in complex with ADP, luciferein and luciferase additives from the Toxilight[R] BioAssay kit, yields an ATP spark – which can be detected by placement of the reaction mix in a luminometer.

The luminometer detects the ADP to ATP conversion.
This project is a collaborative effort with Dr. Steve Lipson (St. Francis College).

Title: Brillouin/Erbium Fiber Laser
Undergraduate Researcher: Thinh H. Le
Faculty Mentor: Dr. Lufeng Leng

We have constructed a Brillouin/Erbium fiber laser and evaluated the performance of its various configurations. We have identified an optimum laser configuration and improved its performance by 1. employing different lengths of single mode fiber in the laser cavity; 2. employing different lengths of Erbium fiber; 3. varying the injected Brillouin pump power; 4. varying the pump power of the Erbium doped fiber amplifier in the laser cavity; 5. including a polarization controller in the cavity for better Brillouin scattering efficiency. Optical and electrical spectra of the Brillouin/Erbium fiber laser output show that more stable output power and lower noise level have been achieved.

Title: The Effect of Long-Term Exposure to Anti-bacterial Soap on the Development of Microbial Resistancy
Undergraduate Researcher: Mikhail Tsich
Faculty Mentor: Dr. Zongmin Li

It has been clinically proven that overuse of antibiotics can cause sensitive bacteria to evolve resistance to their antibacterial action. However, it is not well defined yet whether overuse of antibacterial soap has a similar effect. Antibacterial soap is any cleaning product to which active antibacterial ingredients have been added. Many, or even most, liquid hand and body soaps contain antibacterial chemicals, such as triclosan and alcohol. Some studies have found that soaps containing antimicrobial active ingredients remove more bacteria than simply washing with plain soap and water. Nevertheless, long-term exposure to residual antibacterial soap on skin may result in selection of antibiotic-resistant strains of pathogens. This may also contribute to the production of so-called "super bug". In this study, we investigate the effect of long term exposure to low dosage of antibacterial soap on two common pathogenic bacteria: *Staphyloccocus aurues*, a Gram positive coccal bacterium and *E. coli*, a Gram negative rod-shaped bacterium. The results may bring us insights into the relationship between antibiotic resistancy and overuse of antibacterial soap.

Title: An African-American Woman Mathematician: Dr. Martha Euphemia Lofton Haynes
Undergraduate Researcher: Lori Younge
Faculty Mentor: Dr. Janet Liou-Mark

Dr. Martha Euphemia Lofton Haynes is the first African American Woman to receive her Ph.D. in Mathematics. She received her Ph.D. from the Catholic University of America in 1943. The title of her thesis is "Determination of Sets of Independent Conditions Characterizing Certain Special Cases of Symmetric Correspondences." Not only was Dr. Haynes well involved in the academic community, but she was also involved in many non-academic community related activities. She was a teacher, leader, philanthropist and mathematician. During her lifetime, Dr. Haynes has accomplished much and through her example, other women mathematicians can do the same. This work was presented at the NSF sponsored Women in Mathematics Conference, held at City Tech on May 2, 2008.

Title: Electronic Circuitry for Improving Performance of an Optical Communications Link
Undergraduate Researcher: Preston Webber
Faculty Mentors: Dr. Djafar Mynbaev

Optical communications is the linchpin of modern communications, delivering tremendous amounts of information at any point on the globe. However, optical communications links still have their drawbacks, and one of the major drawbacks is the dispersion that an optical signal experiences while traveling down an optical fiber. Dispersion results in the spread of optical pulses, which eventually reduces the bandwidth of optical links. Typically, network operators cope with dispersion by using optical devices; however, optical-based approach suffers from the non-existence of optical processing devices.

We'd like to explore another approach: The use of electronic circuitry for improving performance of optical communications links. This approach relies on mature electronic technology, but needs to overcome the problem of dealing with very weak optical signals. Our goal is to design the electronic circuits that will reduce the optical-pulse spreads to acceptable level.

Title: Design of Electronic Dispersion Compensation Circuitry for Optical Communications
Undergraduate Researcher: Prashant Rana
Faculty Mentor: Dr. Djafar Mynbaev

Optical communication systems are used to provide high-speed communication connections. Single mode optical fiber (SMF) is the transmission medium used for long distance telecommunication with very low losses and high bandwidth. However, SMF still suffers from dispersion, which limits its bandwidth. All forms of dispersion degrade a light wave signal, reducing the data carrying capacity through pulse-broadening. We concentrate here on chromatic dispersion (CD), which results from a variation in propagation delay with wavelength, and is affected by fiber materials and dimensions.

One of the means to cope with CD is electronic dispersion compensation (EDC) that utilizes advance DSP technique. The main component of an EDC module is a filter. Main types of electronic filters, as defined by their transfer functions, are the following:

1) **Butterworth filters:** It is designed to have a <u>frequency response</u>, which is as flat as mathematically possible in the <u>passband.</u>
2) **Chebyshev filters:** Chebyshev filters have the property that they minimize the error between the idealized filter characteristic and the actual over the range of the filter, but with ripples in the passband.

3) **Bessel filters:** Bessel filters are characterized by almost constant group delay across the entire passband, thus preserving the wave shape of filtered signals in the passband.

4) Ideal **filter:** Ideal filters allow a specified frequency range of interest to pass through while attenuating a specified unwanted frequency range.

The goal of this project is designing the EDC circuitry using the best applicable filter to compensate for chromatic dispersion of an optical signal. The classifications of filters and their mathematical models have been examined. The future work will involve mathematical description of the optical signal, its spectral analysis and the filter design, which include choosing the filter type and its parameters.

Title: Legal Regulations Pertaining to Air and Water Pollution Along the Brooklyn Waterfront
Undergraduate Researcher: Meisha-Gay Ringrose
Faculty Mentor: Dr. Mark Noonan

Meisha-Gay Ringrose worked with Professor Mark Noonan on the NEH grant "Water and Work." She attended various tours and talks on how the Brooklyn Waterfront is changing, and is writing a research paper on legal issues pertaining to commercial and community development along the Brooklyn waterfront.

Title: Validation of a Cultural Value Scale
Undergraduate Researcher: Crystal Hernandez
Faculty Mentor: Dr. Howard Sisco

Purpose
The faculty sponsor is the creator of a Cultural Value Scale, a 37 item inventory developed to identify respondents' individual differences on six main cultural values recently recognized in most societies. The inventory uses a 7 point rating scale ranging from strongly agree to strongly disagree. Respondents rate the degree to which each statement is representative of them. Until now a validated measurement instrument has not existed to allow social scientists to systematically investigate how cultural values moderate different types of behaviors. The purpose of this professor/student collaborative effort was to take data already collected in this IRB approved study, and validate the scale using statistical software.

Method
Collected data from 205 students participating from the New York City College of Technology was coded and transcribed into data files for analyses using Statistical Package for Social Sciences (SPSS). Construct Validity (analyzed via Principle Component Analysis, PCA) and Reliability (analyzed via Reliability Analysis) was assessed using the newly coded data. The student assisted with data coding and entry, analyses, and the writing up of results for this project.

Results and Conclusion
Results of the factor analysis (PCA) provide strong evidence of the convergent and discriminant validity of the Cultural Value Scale scores. As predicted, the Cultural Value items loaded on their hypothesized factors. Six latent factors accounted for a substantial portion of variance. This suggests that there are not any statistically significant cross-loading of items on to non hypothesized factors. Results of the reliability analysis indicated acceptable coefficient alpha ($r=.77$). Overall, statistical analyses of the Cultural Value Scale indicate a valid and reliable measurement tool worthy of further study.

Title: Unity in Diversity: Diasporic Encounters and the New Hinduism in the North American Diaspora
Undergraduate Researcher: Nerrine Douglas
Faculty Mentor: Dr. Simboonath Singh

This research project is based on an ethnographic case study of an Indo-Caribbean Hindu temple in Toronto, Canada. It focuses on how a new ethnic and immigrant congregation (such as Caribbean Hindus) is experiencing a 'cultural revolution' as its traditional ethno-cultural *identities* and practices are gradually being transformed as a result of particular globalizing, immigration and transnational processes. One area in which the traditional Indo-Caribbean Hindu identity is being constructed and transformed is in the area of religious institution, particularly in Hindu temples where, for the first time, Caribbean Hindus are worshipping and interacting, or "encountering/meeting-up" with their long lost, under the same roof, so to speak, with their lost and historically estranged ancestral sisters and brothers from the Indian subcontinent, namely, South Asian/Asian Indian Hindus. The meeting-up or "coming together" of these two culturally disparate groups, and the subsequent melding together of these two cultural traditions, have important implications for the development of a new Diasporic Hindu identity in both Canada and the United States. Thus, the idea of the new immigration and the character of the "new immigrant": the notion that the new immigrants as transnational, global and cosmopolitan have clear theoretical implications for future research and theorizing about the emergence of new and hybridized identities and cultures in the West.

Several Hindu temples in the Queens, Jamaica and Richmond Heights areas of New York were visited. We have touched the "tip of the iceberg" so to speak, as ethnographic and/or qualitative-based research often is highly processual i.e., it requires extensive visits to the research sites (temples) and, is therefore, very time consuming. We continue to engage in the preliminary survey of some of the diverse and wonderful sites where Hindu temples are allocated all over New York.

Title: Documentation Phase 2 and Structural Analysis: The Timothy Knapp House, Rye NY
Undergraduate Researchers: Cheng (Bryan) Q. Tan and Jorman Pena
Faculty Mentor: Dr. Shelley E. Smith

The Emerging Scholars program has been an opportunity to work along with Professor Shelley Smith, and a fellow student, Bryan Tan. Together we continued this project from last term to document and record architectural information for the Timothy Knapp House. This term we also began to analyze the loads on the structure and find any possible areas of improvement. For the analysis of the Timothy Knapp House the first task was to find the accurate dimensions and material properties for the wood framing, and also to determine by physical inspection the possible causes of the deformations in the house. After assisting in collecting data with Bryan, I proceeded by accurately identifying primary beams and girders, researching the history of timber framing, and determining the design loads and stresses that correspond to the time period. The most interesting and challenging aspect of the analysis was the roof, which underwent four phases of construction and is what is called a "saltbox"—a wooden frame house with a long, pitched roof that slopes down to the back. Along with the changing roof and multiple layers of beams being used to support the roof, and the settlement caused by the fireplace, the house was undergoing movement which led to cracked walls and bowing in one area of the house. Careful observation revealed settlement along floor sections on the first and second floor around the chimney stack, which support these theories. Tentatively, the conclusions were based not only on mathematical equations but also physical inspection of the property, which is why this experience is very valuable and necessary in the field of construction and architecture.

The knowledge gained from applying technical knowledge used in the classroom to real world problems is important for all students who wish to explore their field in greater detail. Also, the opportunity to work with others from different fields on a historic project over three centuries old is

13

an example of how the Emerging Scholars program can give back to students and the community.

Title: Hydrogen Gas is the Fuel of Future
Undergraduate Researcher: Shazadi Mohammed
Faculty Mentor: Dr. Suresh Tewani

Our detailed literature survey and research predicts that "Hydrogen Gas is the Fuel of Future," especially in this energy shrinking economy. Scientists are really working hard on making hydrogen fuel (Chemical and Engineering News, January 2008). The US government and petroleum companies are spending huge sums for alternative fuel research in the hope that one-day gasoline and other fuels will be replaced by hydrogen fuel. Gram per gram hydrogen is 4 times more energetic as compared to gasoline. Hydrogen gas burns clean with water as the only byproduct as compared to other conventional fuels, which release carbon dioxide, soxes and noxes.

The focus of our study is to investigate pathways to make large amounts of hydrogen gas in a safe and cheaper process. My preliminary research readings indicate that "Water splitting"
$[2H_2O \rightarrow 2H_2 + O_2]$ will be the best process to gain pure hydrogen and no toxic byproducts. The energy used in this process will be derived from Sun using solar cells. A synthetic chemical, $Ru(bippy)_3$ will be used in place of Chlorophyll.

In my experiments, I used a multimeter, a solar panel, wires, a beaker of water and 2 carbon rods. By performing these experiment, I discovered that on the negative side of the wire the hydrogen gas was forming and on the positive side oxygen gas was forming. While the gas was forming the readings on the multimeter were high up to a volt reading of 4.6 V and when upon removing the solar panel the readings of the multimeter were gradually decreasing. Results of initial experiments and detailed literature survey will be presented.

Title: One Hundred Years of Child Labor Onstage in America
Undergraduate Researcher: Mary Bellamy
Faculty Mentor: Dr. Shauna Vey

My mentor, Dr. Shauna Vey is in the process of writing a book that will focus on the working conditions of 19th century child performers. As her assistant, my duties were to read through archives of the 19th century newspaper The New York Clipper searching for stories and advertisements that gave details about the working children. Some of the information that I gained from my research will be used to supplement biographical sketches and to help create a broader picture of the working world of child entertainers.

I was able to gain the appropriate information by utilizing the availability of various research aides at the research division of the New York Public Library for the Performing Arts. One of those research aides was the microfilm. The microfilm allowed me to view articles from The New York Clipper. I was not only looking for information on the star performers of the 19th century, but for information about those children who were barely able to make a living. I also used the internet to perform searches in order to get additional information.

Helping Dr. Vey with her research project has taught me a number of things. I learned that many scholars have mentioned the stories behind the well known child performers but have not explored the wider context of child workers. I also learned that it was a common practice for the 19th century troupe managers to buy and sell the children's contracts in order to boost ticket sales.   A large majority of the children's families supported the transactions because the whole family performed in various entertainment venues. Many of the children died because of poor work conditions and strenuous routines. Although the newspaper mentioned those deaths in their

articles, no one really questioned the safety of the children's work environment. In conclusion, what I learned personally from this experience was how to be thorough, concise and orderly.

Title: The Tale of Zero
Undergraduate Researcher: Francesca Montijo
Faculty Mentor: Dr. Huseyin Yuce

This is the history of how one digit number, zero, shaped the human mind. From its birth in ancient times to present time, it has been the center of the biggest questions in sciences and religions. The power of zero also lies within its twin infinity and the battle between nothingness and eternity.

This most important number in mathematics is now used in everyday's life. Present work shows the power of zero throughout the ages and demonstrates the paradoxes posed by this innocent-looking number with examples driven from calculus.

Title: The Use of CAD/CAM in Industrial Product Design
Undergraduate Researchers: Eddy Moises and Mukhtar Adyinka
Faculty Mentor: Dr. Sidi Berri

Design of new products in the industrial world requires the use of a wide variety of engineering methods. The most commonly used and rapidly growing methods are CAD (Computer-Aided Design), CAM (Computer-Aided Manufacturing), and RP (Rapid Prototyping).

This research project investigates the use of CAD/CAM/RP in the design of new products. Once the CAD model is developed, it is sent to a CAM module within a software package called MasterCAM to simulate the different machining operations. Then, the model is exported to a rapid prototyping machine. This final phase allows the CAD/CAM model to be directly sliced into a number of thin layers, which are then physically built up one on top of the other. The more slices the piece is cut into the more precise the product will come out but the more time it will take to finish the prototype.

In this project several 3D models of different products are developed using MasterCAM. Working prototypes of the 3D models are made of tough ABS plastic using a 3D printer. Finally, the prototypes are used to better understand and communicate product designs and to make rapid tooling to manufacture the new product.

Title: Synchronous Binary Counter
Undergraduate Researcher: Adam Atia
Faculty Mentor: Dr. Aparicio Carranza

The objective of this project is to design and implement a synchronous counter that will count the following sequence: **4 – 7 – 3 – 5 – 2 – 4**. The counter will be implemented using the 7400 series Integrated Circuits (ICs), resistors, Light Emitting Diodes (LED), etc., and placed into a breadboard. For the second approach a Complex Programmable Logic Device (CPLD) will be used. A CPLD contains a bunch of PLD blocks whose inputs and outputs are connected together by a global interconnection matrix. The flexibility of using CPLDs is that it replaces many discrete components, is programmed using a programming language similar to C, known as VHDL (Very High Speed IC Hardware Description Language). Programmable logic devices are much more efficient for designing circuits (especially for complex circuits) opposed to wiring a number of Integrated Circuit chips using the "old fashioned" breadboard method. Using Altera's UP2 board, which contains a CPLD, the EPM7128S, along with several other components, the Binary Synchronous Counter is implemented. Synchronous counters are key elements in digital electronics for sequencing any set of binary states, processes, or operations relative to an input clock signal.