Abstracts of the Emerging Scholars Program Research Projects

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Student Name	Faculty Mentor	Department	Project Title
Sara Khwaja	Mehrzad Ajoodanian	MATH	Platonic Solids
Magdalena Gubernat	Isaac Barjis	BIO	Modeling of apoptotic signaling pathway relevance to cancer
Antonia Ermilko	Isaac Barjis	BIO	Modeling of apoptotic signaling pathway relevance to cancer
Renee Clarke	Oleg Berman	PHYS	The many electron interactions in metals, semiconductors and graphene.
Franklin Fung	Oleg Berman	PHYS	The many-electron interactions in 2-dimensional and 3-dimensional electron gases
Edward Bear	Oleg Berman	PHYS	The influence of many-particle interactions on the electric and magnetic properties of two-dimensional and three dimensional electron systems
Ian Rubenstein	Reginald Blake	PHYS	Explore the potentials of mapping ice cover with GOES-R ABI
Guiseppe Macaluso	Daniel Capruso	SS	Development of a computerized fitness evaluation with a graphical user interface
Michael Dulski	Daniel Capruso	SS	Digital artwork for a computerized forensic evaluation equipped with a graphical user interface
Tomar Yakov	Sanjoy Chakraborty	BIO	Estrogen and its neuroprotective effect
Jian Li	Urmi Ghosh-Dastidar	MATH	Stability Analysis of bird-flu propagation
Maraika Jean-Noel	Nasreen Haque	BIO	Microbial diversity in the Gowanus Canal
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Francis Pabarue	Laina Karthikeyan	BIO	Mouse model of early onset Parkinson's disease
Thinh Le	Lufeng Leng/ Roman Kezerashvili	PHYS	Impact of Rayleigh Backscattering Effect on Bidirectional Optical Communication
Tamelia Spence	Vasily Kolchenko	BIO	Viral protein structure prediction in the optical biosensor development
Barbara Culver	Vasily Kolchenko	BIO	MS2 Virus – Prediction & Detection Methods
Edward Bear*	Jean Kubeck Vera Albrecht	SS	The treatment of juveniles as adults in the criminal justice system
Cheng Tan	Shelley Smith	ARCH	Documentation of stuctural systems: The Timothy Knapp House, Rye, NY
Iman Farraj	Suresh Tewani	CHEM	Nanotechnology to cure blidness
Mary Bellamy	Shauna Vey	HUMANITIES	Professional juvenile entertainers in America: Two centuries of child labor on stage

Title: Platonic Solids
Undergraduate Researchers: Sara Khwaja
Faculty Mentor: Mehrzad Ajoodanian

It is natural to wonder why there should be exactly five Platonic solids, and whether there might conceivably be one that simply hasn't been discovered yet. However, it is not difficult to show that there must be five - and that there cannot be more than five. First, consider that at each vertex (point) at least three faces must come together, for if only two came together they would collapse against one another and we would not get a solid. Second, observe that the sum of the interior angles of the faces meeting at each vertex must be less than 360°, for otherwise they would not all fit together.

Now, each interior angle of an equilateral triangle is 60°, hence we could fit together three, four, or five of them at a vertex, and these correspond to the tetrahedron, the octahedron, and the icosahedron. Each interior angle of a square is 90°, so we can fit only three of them together at each vertex, giving us a cube. (We could fit four squares together, but then they would lie flat, giving us a tesselation instead of a solid.) The interior angles of the regular pentagon are 108°, so again we can fit only three together at a vertex, giving us the dodecahedron.
That makes five regular polyhedra. What about the regular hexagon, that is, the six-sided figure? Well, its interior angles are 120°, so if we fit th ree of them together at a vertex the angles sum to precisely 360°, and therefore they lie flat, just l ike four squares (or six equilateral triangles) would do. For this reason we can use hexagons to make a tesselation of the plane, but we cannot use them to make a Platonic solid. And, obviously, no polygon with more than six sides can be used either, because the interior angles just keep getting larger.

The Greeks, who were inclined to see in mathematics something of the nature of religious. truth, found this business of there being exactly five Platonic solids very compelling. The philosopher Plato concluded that they must be the fundamental building blocks - the atoms - of nature, and assigned to them what he believed to be the essential elements of the universe. He followed the earlier philosopher Empedocles in assigning fire to the tetrahedron, earth to the cube, air to the octahedron, and water to the icosahedron. To the dodecahedron Plato assigned the element cosmos, reasoning that, since it was so different from the others in virtue of its pentagonal faces, it must be what the stars and planets are made of.

Although this might seem naive to us, we should be careful not to smile at it too much: these were powerful ideas, and led to real knowledge.
As late as the 16th century, for instance, Johannes Kepler was applying a similar intuition to attempt to explain the motion of the planets. Early in his life he concluded that the distances of the orbits, which he assumed were circular, were related to the Platonic solids in their proportions. This model is represented in this woodcut from his treatise Mysterium Cosmographicum. Only later in his life, after his friend the great astronomer Tycho Brahe bequeathed to him an enormous collection of astronomical observations, did Kepler finally reason to the conclusion that this model of planetary motion was mistaken, and that in fact planets moved around the sun in ellipses, not circles. It was this discovery that led Isaac Newton, less than a century later, to formulate his law of gravity - which governs planetary motion - and which ultimately gave us our modern conception of the universe.The beauty and interest of the Platonic solids continue to inspire all sorts of people, and not just mathematicians. For a look at how one artist used these shapes, study M.C. Escher.

Title: Modeling of apoptotic signaling pathway relevance to cancer
Undergraduate Researchers: Antonina Ermilko, Magdalena Gubernat
Faculty Mentor: Dr. Isaac Barjis

During the last decade many of the molecular mechanisms of apoptosis signaling have been examined and elucidated. A systemic understanding of apoptosis is, however, still missing. One

approach to overcome this problem and better understand cellular signaling pathway is mathematical modeling.   Understanding the mechanisms of signaling pathways of cellular microenvironment are very important in medical applications such as cancer development and chemotherapy.

In this paper we use Petri nets to model, simulate and analyze molecular interactions and mechanisms of signaling pathways. In order to model the signaling pathway we introduce some extensions to the graphical notation of ordinary Petri nets.   Then we used the extended Petri net to model, simulate and analyze the apoptotic signaling pathway induced by Fas Ligand and INF-Alfa.

Title: The many electron interactions in metals, semiconductors and graphene.
Undergraduate Researcher: Renee Clarke
Faculty Mentor: Dr. Oleg Berman

Graphene, which is a single two-dimensional atomic layer of graphite, was discovered in 2005 by K. S. Novoselov, D Jiang, F. Schedin, T. J. Booth, V. V. Khotkevich, S. V. Morozov, and A. K. Geim, from the University of Manchester (UK). Graphene is noted for its stability, high flexibility and, strong and excellent conductivity. Graphene possesses some unusual electrical properties. It has a linear energy dispersion, which gives rise to massless Dirac quasiparticles, with energy independent propagation speed $v_f \approx 10^6$ m/s (where v_f is the Fermi velocity of electrons in graphene). The peculiar electrical properties of graphene were compared with 2D and 3D electrical properties in regular materials such as GaAs/GaAsAl, two-dimensional electron gas (2DEG) and three-dimensional electron gas (3DEG) in different metals. Graphene's dielectric function was observed to be proportional to the square root of n (2D electron density), while GaAs/GaAaAl's was independent of it. The dependence of wave number on dielectric function was analyzed for different metal (different free electron densities). Besides, a strange Quantum Hall Effect in Graphene was observed. Quantum Hall Effect was discovered in 1980 by von Klitzing, Dorda and Pepper. In 1985 Klaus von Klitzing was awarded the Nobel Prize for it. Dirac-like electronic band structure in grapheme can be applied for invention of new and powerful electronic devices.

Title: The Many-Electron Interactions in 2 Dimensional and 3 Dimensional Electron Gases
Undergraduate Researcher: Franklin Fung
Faculty Mentor: Dr. Oleg Berman

The many electron interactions in metals and semiconductors are studied in 2 Dimensional (2D) and 3 Dimensional (3D) cases. Poisson's equation is used to get Laplace's equation, and is applied in order to derive Thomas-Fermi Approximation. Quasiparticle concept is used in the Thomas-Fermi Approximation. Applying the Thomas-Fermi Approximation we get the formulas to understand the behavior of electrons in different material under the screening effect for pair potential energy and the dielectric function for both cases (3D & 2D). The Drude assumptions are used to understand closer the reactions of electrons in different circumstances and to explain the transport properties of electrons in different materials. The Quantum Hall Effect is useful in many ways for example we can use it to find the Planck's constant (universal constant) with high precision. Quantum Hall Effect (QHE) is achieved through low temperatures (around 4 Kelvin or lower) and high magnetic field (10 Tesla or more). We can notice that in QHE are present energy levels. K. Klitzing won the Nobel Prize in 1985 for the invention of Quantum Hall Effect. Besides, the pair potential energy, the dielectric constant and QHE has been considered in Graphene (which is 2D single atomic layer of graphite). Graphene is an interesting material that was discovered in 2004 by a group of physicists from Manchester University, UK.

Title: The influence of many-particle interactions on the electric and magnetic properties of two-dimensional and three dimensional electron systems
Undergraduate Researcher: Edward Bear
Faculty Mentor: Dr. Oleg Berman

We derive the theoretical predictions of the Drude model for electron gas in the Thomas-Fermi approximations and compare the three common metals with the analogous theoretical characteristics of a Gallium Arsenide/ Aluminum Gallium Arsenide quantum well two dimensional electron gas (2DEG). The screened free electron and external charge potential energy, DC conductivity, dielectric function, and classical Hall effects of Copper, Lithium at 78K, and Gold are calculated from experimental results and the validity of the obtained values is explored. These materials' macroscopic Hall resistance is compared with the Quantum Hall Effect (QHE) in and the use of the QHE to accurately measure the Fine Structure constant and Planck's constant is discussed**.**

Title: The development of an advanced technique for mapping & monitoring sea & lake ice for the future GOES-R advanced baseline imager (ABI) – part 2
Undergraduate Researcher: Ian Rubenstein
Faculty Mentors: Dr. Reginald Blake, Dr. Hosni Ghedira, NOAA-CREST, CCNY - CUNY

Information on the ice cover extent, distribution, concentration, ice surface temperature and other physical parameters of the ice pack is needed in numerical weather prediction, ship navigation, water management, civil engineering and in other environmental and practical tasks. Ice cover is also a sensitive indicator of climate variations. Ability of satellites to provide global observations at high temporal frequency has made them the primary tool for monitoring ice cover extent.

The main objective of this research is to explore the potentials of mapping ice cover with GOES-R ABI and to develop an automated ice-mapping algorithm, which would make maximum use of ABI's improved observing capabilities. By comparing the amounts of ice, and the rate at which it is melting year by year, we can quantify the effects of global warming. GOES-R ABI is a new generation of earth observation satellite, currently at the design stage, is expected to be launched in 2012 by the National Oceanic and Atmospheric Administration (NOAA). The NOAA Cooperative Remote Sensing Science & Technology Center (NOAA- CREST) at the City University of New York is actively involved with NOAA scientists in the development of new applications for this new spatial mission especially for ice monitoring and mapping. Data collected by SEVIRI instrument onboard of Meteosat Second Generation (MSG) satellite have been used as a prototype for the future GOES-R ABI. The Northern region of the Caspian Sea has been selected for algorithm development and calibration. The Caspian Sea is an endorheic, saline, permanent natural body of water located at 40°0′N, 51°0′E, boarded by Russia and Kazakhstan to the north, Azerbaijan to the west, Turkmenistan to the east, and Iran to the south. The Northern region of the Caspian Sea is generally covered by ice from the end of October to the beginning of March.

The approach used in the algorithm development includes daily cloud-clear image compositing as well as pixel-by-pixel image classification using spectral criteria. Additional testing of pixels spectrally similar to ice for temporal stability of their reflectance and temperature (large variation of the scene temperature and/or reflectance is indicative of cloud contamination). All available spectral channels (reflectance and temperature) will be tested and used in a statistical-based approach to accurately discriminate between cloudy pixels and ice. The preliminary results have been assessed using the interactive maps of snow and ice cover produced within NOAA Interactive Multi-sensor Snow and Ice Mapping System (IMS). The preliminary results are promising. An additional screening is undergoing in order to reduce some remaining confusions especially between ice and cirrus clouds.

The satellite used recorded 11 channels per image; 48 images per day. The first four channels are called visible channels. These channels measure the rate of reflected sun light by the observed surface. This reflectance is measured at different frequencies or wavelengths ranging from 0.6 to 3.2 micrometers. Each type of earth surface and land cover reflects differently. This difference can be used to discriminate between different observed mediums types such as water, ice, clouds. When these two channels are compared it is possible to say with certainty which is cloud pixels. If a pixel can be determined not to be a cloud it could then be classified as either water or ice.

The temperature difference between the water and the land surfaces create a convective condition over the Caspian Sea that generate a frequent cloud cover making a major constraint to the use of optical satellite data. With some rare exception, it is impossible to have a clear sky condition over the Caspian Sea during the cold season. Therefore, it is important to use all available tools to reduce the number of unclassified pixels. In some cases there is too much cloud cover to classify all pixels during day-light hours. In these situations the temperature channels, which measure the energy emitted by earth surface day and night, can be used to take advantage of some clear sky conditions at night. Such approach could certainly reduce the number of unclassified, or cloudy, pixels.

To classify the pixels based on reflectance, the data must be compensated to account for the earth's curvature, and the time in the year. As you go from north to south, data changes, and the earth revolves around the sun, the data also changes accordingly. For the first issue, there are 3 channels that measure angling, of the satellite, of the sun, and of the azimuth, that will be used to process each image, "flattening" it. The second issue is a pattern in direct relation to the earth position in orbit. Dynamic thresholds can take this equation into account so the "same" thresholds can be used year round; making the algorithm modular, less dependant on surface geometry.

To calculate these dynamic thresholds a series of stepwise regressions were used to identify key data and to create Bidirectional Reflectance Distribution Functions (BRDFs). Separating the data set into two groups – one group with solar angle above 60° and the other group with solar angle below 60°, demanded the creation of two BRDFs. This technique of using two BRDFs gave results that are more accurate than those obtained from the use of one lumped BRDF. These functions will be written into an algorithm and be fully validated by existing data. If the functions are capable of correctly "flattening" the images, the existing images can be reclassified, hopefully yielding much more conclusive results than before.

We are designing this modularly, so that it can be used and reused. Hopefully NOAA will utilize these algorithms as envisioned.

Title: Development of a computerized forensic evaluation equipped with a graphical user interface
Undergraduate Researcher: Giuseppe Macaluso
Faculty Mentor: Dr. Daniel Capruso

Aim: The faculty sponsor is the author of a DOS-compiled, keyboard interface program that provides computerized fitness evaluation and training to forensic patients committed as not fit to proceed (not competent to stand trial) under NYS CPL § 730. The aim of the project was for the emerging scholar in Computer Science Technology to collaborate in the creation of a new version of the program which would feature a graphical user interface (GUI) and full compatibility with current operating systems.
Method: The new version of the program was created using Visual Basic 2005. Each module of the program was specifically designed to accommodate the needs of forensic patients, all of whom suffer from some type of "mental disease or defect," including psychiatric, neurologic, or developmental disabilities such as mental retardation.

Result: A working prototype of the computerized fitness evaluation program has been produced. The program consists of multiple GUI forms for: (1) Input of identifying information and demographic data; (2) Selection and administration of 12 multiple choice questions gauging knowledge of courtroom personnel and plea options; (3) Selection and administration of 12 true/false questions gauging rational legal judgment; and (4) Numerical and graphic feedback regarding overall patient performance. The 24 questions are randomly drawn by the program from a larger item pool to permit multiple fitness evaluation and training sessions with the patient.
Conclusion: The program will be distributed to metropolitan New York's Kirby Forensic Psychiatric Center. The forensic hospital has requested copies of the program to address the clinical needs of their treatment refractory patients committed under NYS CPL § 730. Demonstration of the computer program is available from the emerging scholar or faculty sponsor. A Spanish version of the program is in preparation to accommodate those patients of Hispanic immigrant background with limited English comprehension and fluency.

Title: Digital artwork for a computerized forensic evaluation equipped with a graphical user interface
Undergraduate Researcher: Michal Dulski
Faculty Mentor: Dr. Daniel Capruso

Aim: Digital artwork was needed to improve the interactivity of a computer program intended to evaluate and treat fitness to proceed in persons with psychiatric, neurologic, or developmental disabilities committed to forensic hospitals under NYS CPL § 730.
Method: Whereas the original version of the forensic computer program made use of a keyboard interface and limited monochrome graphics, the new version of the program was designed with a graphical user interface (GUI). In order to accommodate the needs of forensic patients afflicted with illiteracy, psychiatric, developmental or neurologic disabilities, the GUI buttons of the new program were labeled not only with text, but also with digital illustrations created in JPEG format with Adobe Illustrator CS3 software.
Results: The completed illustrations were designed with sufficient detail to allow easy identification, and to engage and hold the attention of patients easily distracted by both external and internal stimuli. At the same time, the illustrations were kept as simple as possible to avoid confusing patients with compromised mental status. The completed illustrations reflect the gender and ethnic diversity typically found in the NYS Justice System.
Conclusion: The program will be distributed to metropolitan New York's Kirby Forensic Psychiatric Center. The forensic hospital has requested copies of the program to address the clinical needs of their treatment refractory forensic patients committed under NYS CPL § 730. Demonstration of the computer program is available from the emerging scholar or faculty sponsor. A Spanish version of the program is in preparation to accommodate those patients of Hispanic immigrant background with limited English comprehension and fluency.

Title: Stability Analysis of Bird-Flu Propagation
Undergraduate Researcher: Jian Li
Faculty Mentor: Dr. Urmi Ghosh-Dastidar

In this project, a bird-flu propagation model is built using mathematical tools. A predator-prey model is modified to incorporate an SIR (susceptible-infectious-recovered) infection among humans and SI (susceptible-infectious) disease propagation among bird populations in an endemic environment. Several assumptions were made for simplicity: 1) Disease first initiates from birds. 2) Bird-to-bird, bird-to-human, and human-to-human transmission are possible. However, human cannot transmit the disease to birds. 3) The birth rate is assumed to be same as the death rate for each species; however, this rate is assumed to be higher for birds than to humans. 4) The human may recover from the disease; once recovered humans obtain permanent immunity. However, the birds may not recover from the disease. This assumption is

epidemiologically reasonable since because of availability of medical treatment humans have chances to recover. 5) Although the recovered, susceptible and infectious population is assumed to be varying with time, the total populations for both species are taken as constant. The stability of the system is studied by linearizing the system about the equilibrium points. Numerical simulation is also performed for comparison with analytical solutions. We found that, for a fixed birth and death coefficient for birds, if we increase the birth and death coefficient of humans the number of infectious humans decreases eventually while the number of susceptible humans increases. This is probably because of high death rate, chances of contracting the disease gets lower and also due to high birth rate, the number of susceptible population increase. Similar pattern is also observed if we increase the birth and death rate coefficient of birds while keeping this parameter fixed for human population. We also observed that initially the disease propagates very fast for both birds and humans; however, eventually the infectious and susceptible populations for both species reach their respective limiting values.

Title: Microbial Diversity in the Gowanus Canal
Undergraduate Researchers: Maraïka Jean-Noël
Faculty Mentors: Drs. Niloufar Haque, Nasreen S. Haque

Microbial diversity is the key player in the evolutionary and the biogeochemical processes that comprise the biosphere. 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. In our initial pilot study we have focused on the Gowanus canal in New York City because of the high level of toxicity as determined by the Army Corp. of Engineers. With the help of underwater video monitoring the scuba divers have documented the benthic floor. Initial observations show the habitat as a green mat with various grey/white (milky) outgrowths with characteristic fluorescence. This is a remarkable observation specific to the Gowanas Canal and is not prevalent in other waterways monitored around the region.

We aim to identify the unknown groups of microorganisms in the benthic populations. 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 includes isolation of genomic DNA, PCR-based restriction enzyme digestion and sequence analysis of 16S rDNA and the 16S-23S internal transcribed spacer. Identification and characterization of the estuarine microbial community will provide the knowledge to safeguard the environment against pollutants which affect the natural selection and propagation of microorganisms and tilt the balance towards development of \varied pathological species.

Title: Microbial Diversity in the Gowanus Canal
Undergraduate Researchers: Fejzije Bala, Arifa Ali
Faculty Mentors: Drs. Niloufar Haque, Nasreen S. Haque

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 the microbial population on the estuarine ecosystem, the relationship between the estuarine surfaces 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 has made this are 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 the changes in physical condition (2) effect of these changes on the microbial populations. We have monitored marine life in Gowanus Canal with Urban Divers, NY which include 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 e levels over the years. Bacterial samples were collected at the site both from the top and bottom of the estuary. These were bought to the lab and cultured on different media. We have observed differential patterns 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 it is important to be further tested. An understanding of the microbial diversity will help in understanding of the food chain and address health issues of population directly affected by the constantly changing environments in our waterways.

Title: Regulation of vascular cell migration by CCR8
Undergraduate Researchers: Mykhaylo Tsepukh
Faculty Mentors: Drs. Niloufar Haque, Nasreen S. Haque

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 CCLI receptor 8 (CCR8) is expressed on monocytes and T -lymphocytes and is the sole receptor for the human CC chemokine CCLI (1-309) and for the viral chemokine vCCLI (vMIP-I). We have previously shown that human vascular cells possess functionally active CCR8 which indicates a potential role of CCL-I 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 (I) 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 CCL I and its receptor CCR8 in vascular pathology. We have successfully isolated zebra fish DNA as a first step in this process.

Title: How I diagnosed my cat: some remedy measures
Undergraduate Researchers: Luis Calzadilla
Faculty Mentors: Dr. Niloufar Haque

Ringworm is a fungus that is very contagious and spread very rapidly in the animals' body if left untreated. There are no obvious symptoms in the animals' behavior but they tend to loose their hairy coat at the areas infected and the skin becomes of a pinkish color that shows an elevated lesion that looks like a ring. Usually the infection is transmitted by an animal that is infected or an area the animal frequently goes to look for food such as trash cans or dirty places that are humid and with a lot of moist – a environment where fungus thrives. Humans are easily infected when they pet an animal that has ringworm. The most common treatment to kill the ringworm is to apply anti-fungal cream for at least six weeks. Some veterinarians advise to treat the infected animal with an oral antifungal medicine at the same time the cream is applied. A home remedy that it is very commonly used to kill the ringworm is lemon. The lemon is placed on top of the stove or inside the oven to roast for few minute or until it gets a little brown. Then the lemon is sliced an applied (rubbed) to the animal affected area. This treatment has to be repeated at least three times a day for at least three weeks or until the animal infected skin shows improvement or starts to heal.

Our cat had been showing signs and symptoms of irritability and appearance of scaly rashes; so based on my knowledge of biology and microbiology I decided to diagnosed the cat and found out the cause of the rashes. On preliminary analysis I found the following: (principal characteristics) Biochemical/microbiological analysis (gram stain). Based on the findings I set out to heal the cat. Experiments were made with the animal's hair sample to monitor the growth of the fungus. I trimmed an area of the pet's infected area to analyze a small sample.

Samples were analyzed periodically for a period of six weeks by which time the rashes were gone and the skin had returned to the normal texture and hair had regained its healthy sheen. So from these findings I concluded that lemon is a good and safe antifungal treatment for eradication of rashes due to ringworm invasion.

Title: Role of Chemokines in the Pathogenesis of Alzheimer's disease
Undergraduate Researchers: Biao Long
Faculty Mentors: Drs. Nasreen S Haque and Niloufar Haque

Alzheimer's disease (AD) is the most common cause of dementia in the elderly, which is estimated to affect five million Americans and the fourth leading cause of death in the United States. Its pathological changes include amyloid beta deposits, neurofibrillary tangles and a variety of 'inflammatory' phenomenon such as activation of microglia and astrocytes. The pathological significance of inflammatory responses elicited by resident central nervous system (CNS) cells has drawn considerable attention in recent years. Chemokines belongs to a rapidly expanding family of cytokines, the primary function of which is control of the correct positioning of cells in tissues and recruitment of leukocytes to the site of inflammation. Study of this very important class of inflammatory cytokines may greatly help our understanding of inflammation in the progress of AD, as well as other neurodegenerative diseases. Therefore, immunoreactivity for chemokine (MCP-l) and chemokine receptor (CCR8) have been demonstrated in resident cells of the CNS, and upregulation of some of the chemokines and receptors are found associated with AD pathological changes since Alzheimer's most infamous culprit is a protein called amyloid beta. It aggregates into poisonous plaques in the brain, killing neurons, that should induce immune system to make a reaction. We find out the CCR8 taking a acting at blood formation

Title: Key exchange problems
Undergraduate Researcher: Kazi Islam
Faculty Mentor: Dr. Delaram Kahrobaei

In this poster, I will present two important problems from public key-encryption, namely Diffie-Hellman key-exchange and Elgamal key exchange, including examples and analyzing their securities. Here is the idea: Two people want to communicate their information confidentiality over insecure channel. They want to agree on a key so that they use this for later communication. They share a message encrypted with a recipient's public key cannot be decrypted by anyone except the recipient possessing the corresponding private key.

Diffie-Hellman key exchange is a cryptographic protocol that allows two parties that have no prior knowledge of each other to jointly establish a shared secret key over an insecure communications channel.

El Gamal cryptosystem is an asymmetric encryption algorithm for public key cryptography. It can be viewed on Diffie-Hellman key agreement in key transfer mode. Its security is based on the interact ability of the discrete logarithm problem and Diffie-Hellman problem. It is widely used in the free GNU Privacy Guard software, recent versions of PGP, and several other cryptosystems.

Title: Mouse model of early onset Parkinson's disease
Undergraduate Researcher: Francis Pabarue
Faculty Mentor: Drs. Laina Karthikeyan and Pullani Shashidharan

Early-onset Parkinson's disease (PD) is caused by mutations in PINK1 (PTEN-induced putative kinase 1).The expression of this protein is induced by a tumor suppressive gene PTEN, hence the name PINK1. The mutation is a single amino acid substitution at position 309, replacing aspartic acid residue for glycine. PINK1 is ubiquitously expressed and has been localized to mitochondria within the cells. We are in the process of generating a transgenic mouse by overexpressing mutant PINK1 protein in dopaminergic neurons. We hypothesize that this model will help us better understand the role of PINK1 in the etiopathogenesis of Parkinson's disease and will allow us to gain new insights into the mechanism of this disorder.

Title: Impact of Rayleigh Backscattering Effect on Bidirectional Optical Communication
Undergraduate Researcher: Thinh H Le
Faculty Mentor: Drs. Lufeng Leng and Roman Kezerashvil

Due to the effect of Rayleigh backscattering in optical fiber, light propagating in optical fiber is scattered back and interferes with light propagating in the opposite direction. The effect of Rayleigh backscattering in a bi-directional passive optical network (PON) and the degree of degradation of signals caused by such effect are studied in this project. Two light sources—one is a distributed feedback (DFB) laser, and the other is a tunable laser—are involved in our measurement. The effect of Rayleigh backscattering is measured for the downlink signal, and shown to be maximal when the two sources are at the same wavelength. In addition, the interference of light, which accounts for the degradation of bit error rate (BER) of the downlink signal, decreases with the wavelength shift between the bi-directionally transmitted optical signals.

Title: Viral protein structure prediction in the the optical biosensor development
Undergraduate Researcher: Tamelia Spence
Faculty Mentor: Dr. Vasily Kolchenko

Viral detection is an important problem in modern medicine and biology. Our research is on viral protein structure prediction in the optical biosensor development. Basically we are going to use bioinformatics to continue and improve the collaboration between CityTech and Polytechnic University in developing the most sensitive optical biosensor. Viruses are parasites that contain some genetic information, either DNA or RNA, which they inject into their host cell, human, animal, plant or even bacterium, and then they have taken over their victim. We are focusing on our understanding of the structure of the viral coat (capsid), which is made of protein subunits. So far we have done some research using protein structure prediction tools available on the internet and have gained greater understanding of viral capsid protein structure, such as the primary, secondary, tertiary and quaternary structure, and better understanding of viruses, particularly bacteriophages. We will be comparing computer programs and algorithms for protein structure prediction that may take as an input amino acid sequences of the viral proteins from online databases. This research is very important due to the fact that viruses are getting more aggressive and advanced, and we need to improve viral detection methods in order to defend ourselves against viruses as one of our top adversaries. This has been a very rewarding experience for me because I have always been intrigued by the ongoing debate on whether or not viruses are living or nonliving, and it is fascinating that viruses have the ability to adapt to almost any environment.

Title: MS2 Virus – Prediction & Detection Methods
Undergraduate Researcher: Barbara Culver
Faculty Mentor: Dr. Vasily Kolchenko

The goal of this project is to contribute to the efforts that are being made to improve the technology used in viral detection. Viruses are submicroscopic infectious agents that hide within protein capsids. I have been researching information regarding bioinformatics methods of protein structure prediction for the MS2 bacteriophage. MS2 protein structure is ideal for this project since it is a simple small structure. This project has been very informative and interesting and can lead to better understanding of viral protein prediction methods in other viruses.

With the guidance of Dr. Kolchenko, I have learned about the worldwide Protein Data Bank and have made attempts to retrieve protein structure predictions from a variety of web sites. This process involves entering the amino acid sequence of a protein into the appropriate field within the web site. Upon retrieval, the results are compared to the actual structure provided by the Protein Data Bank. It is possible to request structure predictions for secondary, tertiary and quaternary structure levels. This project focuses on the secondary protein structure of MS2. I have retrieved predictions that are very similar to the PDB structure, as well as predictions that are dissimilar.

We will continue to research information regarding actual viral detection and learn more about the viral adsorption process with the use of micropheres. I have been advised to research information on photonic atoms. There is limited information on this process due to the microsphere prediction being a fairly new method.

This research is undoubtedly a step in the right direction, considering the recent evolution of viruses that are afflicting our population. Each week there are news stories relating to viruses that are killing people. It is important for us to be knowledgeable about research that is being done. We should always know what options are available. I feel that this is an opportunity to help in research that makes a difference. It is a true privilege to be part of it.

Title: The treatment of juveniles as adults in the criminal justice system
Undergraduate Researcher: Ed Bear
Faculty Mentors: Drs. Jean Kubeck and Vera Albrecht

In the United States juvenile offenders (under 18, and in some rare cases as young as 13) can be treated as adults in criminal court. We argue that this practice is morally unacceptable, presents legal inconsistencies, and is biased in application. On a retributive account, the infliction and severity of punishment is determined by just desert. Just desert, in turn, is directly linked to culpability. Trying juveniles as adults presumes juveniles to be fully culpable, which implies that they are competent, autonomous agents. Based on evidence from psychology, we first argue that juveniles are neither fully competent, nor can they be considered as fully autonomous agents. Nearly all studies reviewed showed age-related deficits in competence. From a utilitarian standpoint, punishment is justified if it results in greater overall benefit for society. We maintain that no benefit is achieved if juveniles are tried as adults. First, criminalizing juvenile offenses has not deterred crimes committed by juvenile offenders (e.g., Risler, Sweatman & Nackerud, 1998; Singer & McDowall, 1988) likely due to age-related cognitive immaturity. Further, research shows that only a small percent of juvenile offenders proceed to committing crimes in adulthood, and these individuals had significant criminal histories prior to adolescence (Reppucci, 1999). Second, rehabilitation is less likely for juveniles sentenced by adult standards (e.g., long sentences, life without parole). Society would be best served if juvenile offenses are dealt with in a juvenile justice system. We next argue that legislation is inconsistent in two ways when treating juveniles as adults. First, legislation provides a legal excuse for adults that results in less punishment for diminished responsibility (such as duress or entrapment) or even special treatment in cases of insanity. Similar factors are not taken into account when treating juveniles

as adults. Second, the law deprives juveniles of rights (such as voting, purchasing tobacco and alcohol) by denying competence and autonomy while at the same time attributing full responsibility for criminal acts by affirming competence and autonomy for the same age group. By comparison, European legislation has taken the opposite approach by giving full rights to 18- to 21-year-olds while still treating them as 'young adults' with limited responsibility. Lastly, we argue that the practice of treating juveniles as adults is arbitrary and biased. Legislation that automatically moves offenders at the age of 16 and above to criminal court is politically motivated (to be 'tough on crime'). Judges who transfer cases are not competent psychologists, juries are biased, and more black juvenile offenders are treated as adults than their white counterparts. Miranda warnings have been found to be more difficult for juveniles to understand (Kahn, 2006), and juvenile offenders in adult courts are sentenced more severely than their young adult counterparts (Kurlychek & Johnson, 2004). Implications are discussed.

Title: Documentation of sructural sstems: The Timothy Knapp House, Rye, NY
Undergraduate Researcher: Chen "Bryan" Tan
Faculty Mentor: Dr. Shelley Smith

The Emerging Scholars program gave me the opportunity to work with Prof. Shelley Smith on her Timothy Knapp House Project. This house is located in Rye, upstate New York.

The Timothy Knapp House is a wood frame structure that has gone through four additions to the original house. Because it has gone through so much, its roof has four different types of layers of roof framing. This is possibly the cause of mysterious movement in the frame and cracked plaster. With the house's age it is very difficult to find the blue print of the house. Without the structure blue print, it is hard to discover the cause of the movement. This is what my Emerging Scholars project is about. I work with Prof. Smith to create a 3D frame structure drawing for the house with the original floor plan. With the floor plan that Prof. Smith provided it, I was able to set up the room layout of the house. However, to go further, I had to measure every single frame of the house to create the structure drawing. We set up a house visit during the process of the project. It was a wonderful experience to actually visit the site. I saw a lot of original frame and the new frame of the house. Prof. Smith gave a descriptive overview of the structure. For example, she talked about how they determined the age of the house by the wood material they used and also, how the original house was built without metal. All the attachments are created by wood joints (called Pegs and Tenons). It was a wonderful experience to be there and measure the wood frame. Although most of the structure was covered (or hidden), I understood a lot about the wood structure through the exposed framing in its roof and basement. After the trip, I knew that showing all the detail of its original structure would open people eyes, because it's something they don't see everyday.

The Emerging Scholars program gave a chance to understand what to expect in an architectural firm, and what is meant by historic preservation. The most interesting aspect of this project is to be able to see four different time period's wood frame in one single house.

Title: Nanotechnolgy to cure bindness
Undergraduate Researcher: Iman Farraj
Faculty Mentor: Dr. Suresh Tewani

Blindness, a major concern today, is the condition of lacking visual perception due to the neurological or physiological or factors. Blindness may be partial, or with very limited vision, or with no awareness of light. The causes of visual loss are glaucoma, macular degeneration, diabetes, Vitamin-A deficiency, cataracts, and accidents. Retinal is a light sensitive retinene molecule that is cited in the photoreceptor cells of the retina. Retinal is the basic chromophore that is involved in the transduction of light into visual signals. Using the Cis and Trans isomerization of retinal, scientists used HR-TEM, an imaging mode that allows the imaging of the

crystallographic structures of a sample at an atomic scale. In an effort to find a cure for blindness, scientists have attached a retinal molecule to a C60 fullerene and placed it into a single walled nanotube. This produced a Ret-C60 compound. The nanotube aids as a specimen cell separating the individual's molecules from the other molecules isolating the motion of molecules in the nanotube. The C60-fullerene operates, as a marker so the retinal molecules can be distinguished from the other carbon contaminates that may be present. Naturally, in the human eye, when a retinal photo pigment absorbs a photon, a part of the molecule that is in the outer part of a receptor, which is the chromophore, endures a change, which is called isomerization. The chromophore unbends at the 11-Cis (prior to light stimulation) to the all-Trans state (after light stimulation). In the dark, the molecule goes back to the 11-Cis state with the illuminating the nanotube with an electron beam, scientists observed the cis-retinal to trans-retinal isomerization. They observed the same cis to trans retinal that plays a significant role in vision. Here "Nanotechnology" comes into play. In addition to the imaging of retinal chromophores inside nanotubes, there is also a solar powered nano implant that squirts neurotransmitter chemicals that stimulate retinal cells that can restore sight to the blind. As opposed to the other nanotube that applies and electrical charge directly to the retinal cells, the nano device consists of a flexible silicon disc that is 1.5 millimeters in diameter and 15 micrometers thick. When the visible light hits the silicon solar cell next to the disc, it produces a very small voltage. The solar cell is attached to a layer of piezoelectric material also called lead zirconate, which modifies its shape when reacted with the voltage, and pushing down on the disk. In prospect a reservoir will be underneath the disc and this will squeeze the neurotransmitter chemicals onto the retina cells, which will enable the patient to visualize normally.

Title: Professional juvenile entertainers in America: Two centuries of child labor on stage
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 lives of various child performers and the laws that were enacted to protect them and future performers. As her assistant, my duties were to read through archives of the 19th-century newspaper the *New York Clipper* and select information that is related to the topic of her book. 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*, 1862-63. After reading through the theatre section I documented certain information from advertisements and articles that featured child performers. 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. In conclusion, what I learned personally from this experience was how to be thorough, concise and orderly.