



Abstracts of the Emerging Scholars Program Research Projects

Spring 2010

Supported by CUNY Compact Funds

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Title: Urban Agriculture: Architectural Design for Inner City Farming
Student Researchers: Silvia Portilla, Philip Morgan, Carlos Limongi
Faculty Mentors: Profs. Carmen Trudell, Jenny Broutin

The beginning of this endeavor took place last semester when a research project for a Vertical Farm arose. Fellow students and professors from the Architectural department jumped on the opportunity to develop the idea into a marketable prototype that would hopefully change architecture and adapt new farming techniques in urban settings.

The previous semester we entered the challenges of our project with innovative eyes to create a system that would be our vertical farming system on the façade of an existing building. After doing the necessary research to find the required elements for the project, this semester we began designing and conceptualizing in a clearer way our prototype. Our vertical farm would consist of a structural unit that would be attached to the members or skeleton of a building wall and exterior façade which becomes the farming space.

Having a clear idea of what should be used in our system, we began to put together drawings and details describing how our unit was to be assembled and attached to the building structure. The unit will be a light gauge steel frame that will house different size planters for growth. The frame will have a deck with a track system where farmers will be able to move along the farm to tend to the plants and pick their crops.

When designing the unit we took into consideration several different factors that one must consider in the farming field and tried to incorporate it into our design. The systems will work as a greenhouse filtering and using natural light to grow the plants within the space allowing farmers to have their business in the city. The system will be able to use water that will be collected from rain water, and also use municipal water when needed. Looking into the farmer's needs and preference for farming, the planters will also be adaptable for either soil-growing plants or hydroponic method of growing.

Furthermore, with our system we wish to bring more organic and healthy food to our cities and make them more accessible to the public. With a more definitive view of our structure, we will move forward to build a prototype of the system and thus, make the necessary adjustments to have it a better and a more efficient farming option.

Title: Better Protein Folding Potential Functions from Optimized Use of Structural Databases
Student Researchers: Sheldon Matthews, Lori Younge
Faculty Mentor: Prof. Armando D. Solis

Computational protein structure prediction requires potential functions that can identify the correct chain conformation out of an ensemble of incorrect folds. Our project seeks to make a significant contribution to our ongoing effort to build optimized knowledge-based potential functions, a class of functions derived solely from empirical data. For this project, we have begun to develop and evaluate a rigorous bioinformatic methodology, based on information theory, to systematically harvest as much structural information that is available in protein structure databases, so as to better estimate the probability distributions that serve as necessary components of folding potential functions. Typically, these probability distributions are estimated using a nonredundant subset of protein structures from the Protein Data Bank (PDB) in order to limit

database bias due to uneven representation of some protein folds. We believe that this widely used method, however, throws out potentially valuable information. Our initial data show that, indeed, there is a substantial recovery of mutual information when a more complete PDB is used, compared to traditional non-redundant data sets. Specifically, in measuring the influence of the local trimer sequence on the dihedral angle pair of the backbone, we see a dramatic increase of more than 50% in mutual information. Based on our previous work, this type of increase in mutual information should bring about a significant improvement in the corresponding folding potential. These initial results prove that our continuing efforts will lead to the full development of a new method that utilizes all the structures in the PDB database to construct the most informative folding potentials. The resulting optimized potentials, the ultimate result of our work, should help advance our own efforts, as well as others', toward better protein structure prediction.

Title: Basis and Principles of Alternative Medicine System

Student Researchers: Damaris Riveros, Mamie Jakob

Faculty Mentor: Prof. Laina Karthikeyan

Ayurveda, India's traditional, natural system of medicine has been practiced for more than 5000 years. Ayurveda views health as a balance of mind, body and spirit, and depicts disease as something out of balance. This system of medicine has a prevention focus, emphasizes individualized nutrition, and takes into account the entire lifestyle.

Humans are so biochemically varied that no one diet, drug, remedy or health regimen will work for everybody. According to Ayurveda, each person has a constitution created at conception that determines basic physiology and personality. This constitution is the inherent balance of three doshas, or subtle biological forces which govern the functions of the body, known as Vata (motion), Pitta (metabolism), and Kapha (cohesiveness). There are infinite combinations and permutations of these three basic energies, and each person's constitution is a unique expression.

Ayurveda is a huge canvas that includes among other things, Yoga and Panchakarma. These purification procedures known as *Panchakarma* remove toxins from the body. A study at the Institute of Science, Technology and Public Policy at Maharishi University of Management in Fairfield, Iowa in collaboration with a special laboratory at Colorado University demonstrated that classical Panchakarma treatment eliminated up to 50% of the detectable toxins in the blood.

The cornerstone of research on Ayurveda continues to be in the area of herbs and herbal drugs. Herbs used in Ayurvedic medicine, such as tumeric, ginger, and neem, are now recognized as beneficial for heart health and as antioxidant-boosters. The comprehensive nature of Ayurveda and its primary emphasis on prevention are key features that should be investigated. Research into how diseases may be effectively prevented would be of immense value to a world accustomed to "disease cures" as opposed to "disease prevention."

Research conducted on Ayurveda have shown encouraging results for its effectiveness in treating various ailments, including chronic disorders associated with the aging process like depression, anxiety, sleep disorders, hypertension, diabetes mellitus, Parkinson's disease, and Alzheimer's disease. In both North America and Europe the past few years have seen a dramatic rise of interest in Ayurveda but Western knowledge is still in its infancy. This research project was an eye-opener for us and it really taught us a lot about a system of medicine that was alien to us, and led to an appreciation of the system.

Title: Multi Drug Resistance in Nosocomial Infections in Brooklyn - A SENCER Based Project
Students: Jessica Obidimalor, Cintiana Exceus, Efraim Hassan
Faculty mentor: Prof. Liana Tsenova

This project is a continuation of the study from the fall semester of 2009. We performed extensive literature search on Nosocomial Infections (NI) in Brooklyn hospitals. NI are infections acquired during hospitalization and did not exist before the admission to the hospital. They are the eighth leading cause of death in US. The rapid emergence of multi-drug resistant (MDR) pathogens is responsible for the increased mortality associated with NI. The wide and inappropriate use of antibiotics among patients increased dramatically the antibiotic resistance in the last few years.

The four common pathogens, associated with NI in Brooklyn hospitals are: *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Klebsiella pneumoniae* and Methicillin resistant *Staphylococcus aureus* (MRSA). Out of the four, the most common is *K. pneumoniae*. "Since the early 1990s, extended-spectrum B-lactamase (ESBL) possessing *K. pneumoniae* has rapidly emerged". The collected data from the 15 hospitals in Brooklyn were analyzed statistically. Susceptibility and resistance to the most important antibiotics were studied as follows: Amikacin, Gentamicin, Ciprofloxacin, Imipenem, Clindamycin, Azithromycin and Tigecycline.

Some of the risk factors for NI are catheters in premature babies, artificial breathing machines, patients who are taking steroids or who have HIV, prolonged hospitalization stays and prolonged use of intravenous line systems. We suggest preventative measures for reducing the risk of NI.

Title: The Pathogenicity of Shigellosis.
Student Researcher: Hui Meen Ong
Faculty Mentors: Profs. Majeedul H Chowdhury, Zongmin Li, Alam Nur-E-Kamal, MEC

Abstract: Shigellosis is a gastrointestinal infection caused by *Shigella* bacteria, typically via fecal-oral route. The global morbidity and mortality caused by infection with *Shigella* species is a major public health concern that kills hundreds of thousands of children in many developing countries. Infection by a small amount of 10 to 100 *Shigella* organisms is enough to cause symptoms in humans, which could be moderate to severe dysentery, fever and abdominal pains. In young children, infection by this organism results various types of complications, such as leukemoid reaction, hemolytic uremic syndrome, seizure, encephalopathy, abdominal cramps, rectal pain and septicemia. *Shigella* species have four serogroups: Serogroup A: *S. dysenteriae*; Serogroup B: *S. flexneri*; Serogroup C: *S. boydi*; Serogroup D: *S. sonnei*. At present *S. flexneri* is the most prevalent serotype found in shigellosis. In recent studies in Bangladesh, it has been shown that *S. flexneri* is linked to more than 50% of shigellosis. Our literature review on the pathogenicity of shigellosis showed that the 31-kB region of 140 mDa plasmid of *Shigella flexneri* virulence plasmid encodes the Ipa-A, -B, -C, and -D proteins. We are interested to understand the role of cytotoxic, neurotoxic and enterotoxin factor(s) associated with the development of clinical complications in shigellosis. The pathogenicity of *S. flexneri* 1c was studied in HeLa cells. It was found that culture filtrate of the strain had strong cytotoxic activity and caused morphological alteration of HeLa cells. Although neurologic manifestations are frequent during childhood shigellosis, their pathogenesis is unclear and the role of Shiga toxin as a neurotoxin is controversial. In future we intend to identify the neurotoxic factor(s), if any, in shigellosis and study its mechanism of action.

This work is a part of ongoing collaborative research project between New York City College of Technology (Dr MHC) and Medgar Evers College (Dr ANK), the City University of New York.

Title: Analysis of Neural Activity in Primary Auditory Cortex in Response to Natural Sounds

Student Researchers: Mejeena Constant, Taheefa Stephen

Faculty Mentor: Prof. Maria Ter-Mikaelian

The goal of this research is to understand how vocal communication, particularly language, is processed in the mammalian brain. While it is currently impossible to study the activity of the human brain at the single-cell level, we can use the Mongolian gerbil *Meriones unguiculatus* as an animal model. The gerbil is a convenient model for studying sound processing because of its ability to hear low-frequency sounds similar to those found in human speech. In addition, gerbils communicate with each other using a variety of acoustic signals, such as aggression calls, alarm calls, and mating calls.

In a prior phase of this project, gerbil calls produced in different social contexts were recorded and analyzed. Each type of call has a characteristic frequency and duration. To understand how these are processed in the brain, the calls were played to adult gerbils in a soundproof room while recording brain activity with a microscopic electrode.

The basic functional units of the nervous system are nerve cells called neurons. Neurons in the auditory brain centers respond to sound with electrical impulses known as action potentials or “spikes”. They use a specific code to send information to one another; our aim is to decipher the code by which neurons in the auditory cortex (AC) signal information about communication sounds. It has been suggested that AC neurons use a “rate code”; in other words, that the rate of spike production over time carries information about the type of sound the gerbil heard. We tested this hypothesis by comparing spike rate evoked by different calls as well as non-communication sounds.

Title: The Importance of Zebrafish in Studying Gene Mutation in Conjunction with Stages of Development

Student Researcher: Lynn Jean

Faculty Mentors: Nasreen S Haque, Niloufar Haque

Zebrafish or *Danio rerio* are tropical fresh water fish that belongs to the minnow family. Zebra fish are very popular aquarium fish; they are sold under the name zebra Danio. They are important vertebrates that are used in scientific research, particularly cardiovascular research. One can locate such a fish in the wonderful tropical streams of southeastern Himalayan region countries like Pakistan, Bangladesh, Nepal, and Myanmar. Zebra fish are named for their five striped, pigmented, horizontal blue strip on the sides of the body, which begins from its head and ends at its fin.

Zebrafish are torpedo shaped; the males possess a much more torpedo shape with gold stripes between the blue stripes, however females on the other hand have a much more pronounced large whitish belly and silver stripes instead of gold – but yet it is still hard to point out the differences between the two sexes. Zebrafish can grow up to 6.4 centimeters (2.5 in inches). Their lifespan can last up to 2-3 years but if cared for properly they can last up to 5 years. The Females can lay

up to hundreds of eggs in 2-3 days, and when the eggs are fertilized the initiation of embryonic development begins and in the absence of sperm, proliferation terminates after the first few cell divisions.

Zebra fish are omnivorous. They primarily consume zooplankton, insects and insect larvae, and phytoplankton. Such fish can eat an array of things such as worms and small crustaceans, however if they reside in the aquarium alternatively their source of food are flakes and Tubifex worms. Zebra fish are transgenic thus allowing them to express green, red, and yellow protein fluorescence – which is known as Glofish. The pigment mutations of zebra fish come in a variety of forms such as golden, sandy, long fins, and leopard spots and etc.

The Zebrafish model is currently implemented in many scientific studies. This model is important due to its ability to regenerate and ease of manipulation and control. Scientists are utilizing gene regulation in Zebrafish in trying to design cures for alleviation of human suffering. Such benefits can possibly cure hearing impairment in conjunction to providing treatments for cancer, and may possibly impede the progression of Alzheimer's disease etc.

The objective of the present project is to study the effects of gene mutations in Zebrafish to study vertebral injuries and developmental stages in Zebrafish development. Preliminary results will be presented and discussed.

Title: Gene Regulation in Development and Growth in Zebrafish Model Systems

Student Researcher: Shavon Clenkian

Faculty Mentors: Nasreen S Haque, Niloufar Haque

Zebrafish, also known by the name of *Danio rerio* is a freshwater fish that has the ability to regenerate skin, fins, heart and the brain in larval stages. Zebrafishes also have the ability to regenerate photoreceptors and retinal neurons after injury. Having the ability to regenerate sparked the scientific community in trying to find out the mechanics of this phenomenon. In recent discoveries, a study was conducted where scientists were able to clip a portion of the zebrafishes' heart (Mary Jane, G et. al. 2010). In doing so scientist Kenneth Poss was able to see cardiac cells along the outer wall of the ventricles fluorescing. Cells near the removal site began to combine into the wound, ultimately to take the place of the injury clot. The zebrafish embryo provides numerous opportunities to examine cellular processes in early development. One can culture cells from embryos in vitro to study cell signaling pathways and analyze gene and protein expression. Zebrafish mutants will provide useful models of human diseases. The embryos are touch-sensitive and their hearts will start beating. If the fish need be placed under the microscope, they must first be chased and caught. The objective of the present study was to maintain and establish zebrafishes in captivity. The long term goal is to study zebra fishes in their embryological stages to better understand their abilities of regeneration. In order to keep the zebrafishes stable, we had to construct a good living environment. In doing so water temperatures in their tanks had to be regulated as well as feeding schedules had to be maintained. The main focus was maintenance of the tanks because that was the target of all observations between the male and female zebrafish. A light and dark cycle is important for circadian rhythm. So we had to ensure the zebrafishes were receiving fourteen hours of light and ten hours of dark cycle. Zebrafishes have very specific requirements of maintenance. The water temperature for these fishes has to range from eighty to eighty-two degrees Fahrenheit. However, the temperature that was used in the beginning of this experiment was sixty-nine degrees Fahrenheit. Many males and females were dying and we did not know the cause for this. After observing a brown spot on

the belly of the fish we investigated and found that there was a lack of oxygen. It was not clear as to why they were lacking oxygen, so we started to observe behaviors in the male and female fishes. Observing these fishes made us aware of abnormal behavior as well as signs to look out for. We quickly learned the reason why they were dying was because the water was not de-chlorinated. We learned how to breed the zebrafishes as well as to distinguish the different stages of the eggs development. Observing the zebrafish development stages under the microscope was a way one way of learning and distinguishing certain characteristics. There was a visible transparency to study and know the stages. A significant observation that was noticeable was that most of them were in the "germ stage." However, they were never able to pass that stage. The zebrafish embryo provides numerous opportunities to examine cellular processes in early development. One can culture cells from embryos in vitro to study cell signaling pathways and analyze gene and protein expression. Zebrafish mutants will provide useful models of human diseases. Further research was carried out to study the different stages of the zebrafish development. Results will be presented and discussed.

Reference

Cebra-Thomas, J. (2001). Care and Maintenance of Zebrafish. Retrieved April 26, 2010, from http://www.swarthmore.edu/NatSci/sgilber1/DB_lab/Fish/fish_animals.html Mary Jane, G. (2010). Scientists find cells that mend broken heart. http://www.swarthmore.edu/NatSci/sgilber1/DB_lab/Fish/fish_animals.html The Information Company.

Title: Gene Regulation in Development and Growth in Zebrafish Model Systems

Student Researcher: Ravneet Singh

Faculty Mentors: Nasreen S Haque, Niloufar Haque

The Zebrafish commonly known as *Danio rerio* is a tropical freshwater fish found around the Himalayan region (i.e. India, Pakistan, Nepal and Bangladesh) and can breed throughout the whole year. They are omnivorous. There are ten stages of development of Zebrafish and these developmental stages are known as the zygote stage, cleavage stage, blastula stage, gastrula stage, segmentation stage, pharyngula stage, hatching stage, larval stage, juvenile stage, and last but not least the adult stage (Kimmel et. al., 1995).

The Zebrafish can be implemented as an ideal model in studying cardiovascular disease. It can also be utilized for understanding the biological mechanisms of regeneration of certain organs like the heart. Heart injuries in human do not regenerate as a substitute therefore, the damaged myocardium is replaced by the fibrotic scar tissue. However, in the Zebrafish on the other hand possesses the ability to regenerate its heart from cardiac injuries to a certain level. It can totally regenerate 20% of its heart within a period of two months from the initial time of the injury (Poss et. al., 2002). The Zebrafish embryo provides numerous opportunities to examine cellular process in early development. One can culture cells from embryos in vitro to study cell signaling pathways and analyze gene and protein expression. Studying Zebrafish mutants will provide useful models of human diseases.

The embryos are touch sensitive and their hearts will start beating. If the fish need to be placed under the microscope, they must first be chased and caught. In the present study we standardized the conditions for Zebrafish culture in our lab and maintained a tightly regulated protocol to monitor the light and dark cycle, water temperature and feeding routine. Further studies are

undergoing to study gene regulation at various developmental stages. Results will be presented and discussed.

References

Poss K, Wilson L, Keating M. Heart Regeneration in Zebrafish. *Science* [serial online]. December 13, 2002;298(5601):2188. Available from: Academic Search Complete, Ipswich, MA. Embryonic stages are modified from Kimmel et al., 1995. *Developmental Dynamics* 203:253-310

Title: Identification of a PcG Proteins' Homologs in *T. Thermophila*

Student Researcher: Ms. Christina Valore

Faculty Mentor: Prof. Rachele Arrigoni-Restrepo

Polycomb group (PcG) proteins play an essential role in the transcriptional regulation of developmental genes. Specifically, members of this large group of proteins are responsible for applying repressive marks on histones at selected genes, and for translating these marks into long-term gene silencing. The final steps of such PcG-mediated silencing process, however, still remain elusive.

Our research project involves a series of bioinformatics-based approaches aimed at finding conserved PcG proteins in the ciliated protozoan *Tetrahymena thermophila*. The reasons for choosing this organism include its being easy to work within our laboratory settings, and the relative simplicity of its gene knockdown process. Once we will have found PcG homologs, we plan on engineering strains of *T. thermophila* that either over-express or completely lack such proteins, to further study their effect on the normal functioning of the cell. Our studies will provide further insight on the function played by PcG proteins in cells, and may help our understanding of how they regulate key processes such as transcriptional repression and long-term silencing.

Title: Designing a Genomic Knockout of *MYO13*, a divergent Unconventional Myosin Gene in *Tetrahymena thermophila*.

Student Researchers: Steven Moise Jr., Dave Jean Baptiste

Faculty Mentor: Prof. Selwyn A. Williams

Many forms of movement within biological systems are powered by the activity of enzymatic motor proteins. Myosins are a superfamily of molecular motors that catalyze an ATP-dependent interaction with actin filaments, generating chemo-mechanical force. Thirteen myosin genes have been identified in the ciliate protist *Tetrahymena thermophila*, twelve class XIV myosins and one divergent motor. The functions associated with most of these myosins are largely undetermined. In this study, molecular and genetic tools will be used to create knockout strains of *MYO10*, a class XIV unconventional myosin heavy chain gene and *MYO13*, a divergent unconventional myosin heavy chain gene that does not belong to any of the previously established myosin classes. The project will design and create disruption constructs using recombinant DNA technologies. The disruption constructs will contain an antibiotic resistance cassette flanked by genomic sequences corresponding to the *MYO10* and *MYO13* motor domains. Oligonucleotide primers will be designed to amplify the flanking genomic DNA sequences by Polymerase Chain Reaction (PCR). The amplified regions will be cloned into plasmid vectors and subsequently assembled into the disruption construct using standard recombinant DNA protocols including genomic DNA isolation, restriction digest, gel electrophoresis, DNA ligation and bacterial

transformation. The recombinant construct will then be used to genetically transform wildtype *Tetrahymena* by macronuclear-targeted gene disruption.

Title: Identifying the Micro-organisms of an Aquarium Pond Ecosystem

Student Researchers: Christine Kim, Emmanuel Gutierrez

Faculty Mentor: Tatiana Voza

Spring has just started, summer is approaching and, people are rushing to cool off in ponds and lakes swimming carelessly beyond these mysterious bodies of water. They have yet to be informed that there is an ecosystem in motion within the pond water. The purpose of our work is to study and identify microorganisms collected from New Jersey ponds. A tank to mimic the life within the body of water is set up for observation. Within weeks of close scrutiny, we have discovered disturbing yet informative results. Out of the many organisms we have observed, one of the most intriguing specimen is the copepod. Cyclopoida from the subclass of Copepoda are small crustaceans found mostly in the sea and every freshwater habitat (ponds, streams, and rivers). They are to the naked eye tiny microscopic dusk-like white bugs swimming swiftly filling the aquarium tank. Not only are they the largest biomass on earth as well important to the carbon cycle, but also they are the major food source for small fish, crustaceans and other marine mammals. The next abundant specimen found hidden within the plants is the planarians. *Dugesia* sp. a non-parasitic flatworm belonging to the family of planariidae of class of Tubellaria and of the phylum Platyhelminthes. These paper thin structure organisms can be found in any freshwater environment and, have the ability to regenerate lost body parts as well as to reproduce asexually. Our first largest protozoa found within the artificial reservoir is the *Spirostomum* which pertains to the class Spirotrichea of the phylum Ciliophora. This organism is very long, ciliated, flexible and extensible which can contract extremely fast. The most interesting phenomena is the ability of *Spirostomum* to hibernate itself during cold weather by forming round bodies resulting in a large cluster of organisms. Thus, these unicellular specimens who feed on bacteria are mainly known to be thriving under warm freshwaters aside the beech leaves. Our last specimen found is the family of Chydoridae from the order Cladocera and the phylum of Arthropoda. Similar to the Copepoda, they are microscopic transparent crustaceans at first sight and yet flat, round shape like under compound microscope. Chydoridae are also known as water fleas inhabiting freshwaters due to their ability to propel itself and swim at a rapid rate when facing any threat or predators. These findings will provide an adequate amount of live microorganisms available all year long for biology laboratories to observe under microscope and, to permit prospective students to study many of the specimens collected in depth.

Title: Protein-Porphyrin Interactions: "Piggy-backing"

Student Researcher: Talha J. Uddin

Faculty Mentor: Prof. Diana Samaroo

Photodynamic therapy (PDT) is a treatment involving light, a drug (photosensitizer) and oxygen which destroy malignant cancer cells. There are several photosensitizers currently in clinical trials and a few that are FDA-approved for the treatment of different types of cancer. Most photosensitizers are porphyrin-based compounds. This area of research presents many unanswered questions and problems. One of which is the mechanism of drug delivery and uptake. The exact molecular mechanism of the different types of drug entry is unknown. The literature points to several ways. One of those ways is by protein interaction. It is hypothesized that the

drug binds to proteins, which is then taken up by the cells. This way is referred to as “piggy-backing”. Using fluorescence microscopy, we will show that more glucose-porphyrin photosensitizer is taken up (binds) when there is a higher percentage of proteins present in the cell’s surrounding

Title: Ink formulation for Digital Printing of Solid Oxide Fuel Cells

Student Researcher: Sade Barnett

Faculty Mentor: Prof. Jay Deiner

In this research project our objective is to use observations of the solubility of different types of liquid solvents as guiding principles for the formulation of inks. These inks, colloidal dispersions of Nickel Oxide, Strontium-doped Lanthanum Manganate and Ytria-stabilized Zirconia will then be used to print the layers of solid oxide fuel cells. During this semester, we conducted a literature investigation to define our solvent test set, and we conducted our first solubility tests. These initial tests indicate that we need to expand our solvent test set in order to provide sufficient information for ink formulation.

Title: Interactive Iconography: Scaffolding Writing Across Cultures

Student Researcher(s): Anjelin Martinez, Meleny Perez

Faculty Mentor: Prof. Reneta D. Lansiquot

Last year, we explored how reading interactive iconography affects critical writing skills. Using an online interactive iconography application created by Prof. Lansiquot, students in her “English Composition I: Writing Across Cultures” class were assigned to create museum labels for ancient artifacts from Egypt, Peru and Rome. They wrote these labels in groups. Since these artifacts were new to them, with their group, students studied the “visual language” of the artifacts and guessed at the meaning the original artists wanted to communicate. Because, interestingly the chosen artifacts’ meanings are open to interpretation even to experts, groups had to work hard to convince others of their valid interpretation. Groups realized that they could use online sources to support their interpretations. For example, when given an artifact from Egypt they used scholarly articles for reference and to state facts. Now one year later, we took into consideration the experience learned from the previous semester and decided to build on it. We helped Prof. Lansiquot improve her online application by brainstorming ideas to expand the resources available as well as connect these resources to a new theme: Seven Wonders of the World. As the reader knows, there are Seven Wonders in many different categories such as the Wonders of the ancient world, medieval world, natural world, underwater world, and modern world. Involving the Seven Wonders creates a connection across cultures. Students are able to gain knowledge researching other cultures and interpreting iconography. At the same time they learn to value their initial reactions to work and their unique interpretive voice. We plan to use Wonders from the ancient, modern, and natural world in order to keep the theme of the study “Writing Across Cultures.” We chose a Wonder from every continent that taps into its history and tells a story about that civilization. From Asia: The Great Wall of China; from Africa: The Great Pyramid of Giza; from North America: Chichen Itza; from South America: Machu Picchu; from Antarctica: The Aurora Borealis; from Australia: Sydney Opera House, and from Europe: The Roman Coliseum. In selecting these Wonders we considered that although students may have heard of these Wonders, they likely do not know details about each Wonder’s history. The aim of the project is to encourage students to actively refine their current knowledge and reactions to

wonderful works. In their journey to become expert, like real experts, they must write, synthesize, defend, and develop convincing arguments.

Title: Sustaining an Online Writing Center

Student Researcher(s): Stephen Amachee, Kenyasoweta Bowman

Faculty Mentor: Prof. Reneta D. Lansiquot

Last semester, students in Prof. Lansiquot's composition class served as first or second readers to their peers' writing under facilitation in an online writing program, called Academic Counseling Expert (ACE). The ACE method involves online asynchronous co-construction of advice by two students and, then finally, by a professor. Students learned criteria for quality feedback such as attention to the writer's question, quality language in advice, and the encouragement of more writing through the recommendation of appropriate Web resources. Students who gave the best feedback according to these criteria, and who applied, were selected as the Peer Reviewers to writers in this semester's composition class. This semester built on the fall semester of peer review training with the understanding that expertise develops over time and with repeated practice. In light of this success, and since writing is a way to understand problems, further study and analysis was carried out in terms of how this program can continue over the next semester and beyond. While the online writing program and the services it provides has performed well in developing the student-reviewers' skills, this project moves next, to the question of how the service can work to what complement the existing writing center. As researchers we used our own experiences as students who have received feedback on our writing, Stephen's perspective as a Peer Advisor, and observations of tutoring at the College Learning Center to investigate this question. We found that the student tutors at the Learning Center focused mainly on sentence structure, grammatical errors, and punctuation. There the professors' critique focused on the context and validity of arguments in an essay. ACE Peer Advisors focused not only on sentence structure, but they also commented on the tone of the essay. Overall, the perspectives of all three sources were very valid, but submitting essays online is preferred by the students we talked with because this can be anonymous. Essays are reviewed more than once by more than one perspective, which would only ensure that writing advice would be the best it could be. Next fall, the plan is to once again use the online writing program to support students enrolled in the learning community themed "The Narrative of Computing" that will include English Composition, Introduction to Computer Systems, and Problem Solving with Computer Programming.

Title: Along the Shore: Preserving and Changing Brooklyn's Industrial Waterfront

Student Researcher: Geralynn Scott

Faculty Mentor: Prof. Richard E. Hanley

The only constant for Brooklyn's industrial waterfront is change. This project investigates the ways in which the changes—and preservations—of Brooklyn's industrial heritage can be charted through the use of various digital mapping technologies. A collection of some of these digital maps will be studied and categorized according to their focus, their ease of use, their seriousness," their ability to "tell a story," and their utility in policy studies.

Title: Visual Attention to Complex Scenes
Student Researcher: Christopher Jimenez
Faculty Mentors: Prof. Sandra Cheng

Objective: The aim of the study was to measure visual attention to complex scenes. Method: Normal subjects (n=26) were exposed to a series of complex visual scenes involving various types of dramatic interpersonal interactions or portraits. Result: For visual scenes set either inside or outdoors, visual attention was almost entirely allocated to the presence of humans or human interaction. Architectural or natural landscape features received relatively little direct visual attention. Conclusions: Visual attention is distributed across complex scenes in a multifocal, rather than a comprehensive manner. Human and dramatic elements of a scene are of primary visual interest, whereas architectural, landscape, or incidental features are largely ignored.

Title: Why Chosen Ciphertext Security Matters
Student Researchers: Makenson Dupas, Sereta Scott
Faculty Mentor: Prof. Delaram Kahrobaei

This research motivates the importance of public key cryptosystems that are secure against chosen cipher text attack. It also discusses the cryptosystem developed by Cramer and Shoup which is secure against chosen cipher text attack.

Title: Unraveling the Mysterious Google Search Engine
Student Researchers: Thomas Cheung
Faculty Mentor: Prof. Satyanand Singh

We will examine the Google page algorithm and consider its Markovian properties. We will also use stochastic matrices and reveal Google's uncanny ability to extract the perfect page.

Title: Special Functions and Optimizations
Student Researcher: Eti Akter
Faculty Mentor: Prof. Satyanand Singh

We will minimize a function of two variables by applying the properties of conic sections. This is in lieu of the standard multivariate calculus methods. We will also use the Maple software to illustrate our results.

We will program maple to animate the minimal distance between a curve and a point away from the curve. We will show how this method can be extended to solve problems of this type.

Title: Nosocomial Infection and Our Community – A SENCER Based Project
Student Researchers: Farjana Ferdousy, Aionga Pereira
Faculty Mentor: Prof. Urmi Ghosh-Dastidar

Nosocomial infections (NI) are infections that are usually transmitted to the patients during the course of receiving treatment for other conditions within healthcare facilities. Infections are declared as nosocomial if they are identified within forty eight hours or more after hospital admission or within 30 days after discharge. These types of infections usually occur when healthcare personnel do not maintain healthy practices. According to Center of Disease Control, NI infections are one of the top ten leading causes of death in the United States [<http://www.cdc.gov/ncidod/dhqp/healthDis.html>].

Antibacterial resistance is an emerging problem in many bacterial infections and in particular, in NI infections. With the increased levels of antibiotic usage among humans, livestock, and crops, antibiotic resistance bacteria increased dramatically in past few years. In this project, we studied three of the most common pathogens responsible for NI infections: Klebsiella, Pseudomonas, and Acinetobacter. Single patient isolates were collected from fifteen different hospitals in Brooklyn during a three-month period in 2006 [for further information please consult: JAC 2007; 60:78-82]. Susceptibility and resistance to five of the most important antibiotics are studied. The antibiotics that we studied here are as follows: amikacin, ceftazidime, piperacillin-tazobactam, ciprofloxacin, and imipenem. We assumed our null hypothesis as no significant differences exist between different Brooklyn hospitals and susceptibility rates to these five antibiotics used for Klebsiella, Pseudomonas, and Acinetobacter bacterial infections. A chi-squared test was performed on susceptibilities for all five different antibiotics. The test revealed that there exist significant differences among different hospitals and antibiotic resistance (significant exception: for Acinetobacter bacterial infection we were not able to reject null hypothesis for most antibiotics that we discussed above). Now the question that we need to answer is as follows: what are the underlying causes of these differences?

Acknowledgement: We thank Dr. John Quale from SUNY Downstate Medical Center for providing data and his valuable time for us. We thank Dr. Liana Tsenova from the Department of Biological Sciences (City Tech) for sharing her knowledge and expertise with us. We also like to thank Dr. Arnavaz Taraporevala for valuable discussion and sharing her insights with us.

Title: Building a Virtual Computer – From Gates to Operating System
Student Researcher: Elisa Elshamy
Faculty Mentor: Prof. Victoria Gitman

A modern computer can carry out a plethora of multifaceted computations. Realizing this, one would be led to believe that computer hardware is built to be as complicated as machinery can get. Instead, it turns out that the structure of computer hardware is really a sophisticated concatenation of elementary Boolean gates. In this project, we used the Hardware Description Language (HDL) together with hardware simulator software to virtually build the components of a simple computer's hardware platform. Using the single fundamental building block NAND gate, we started out by building chips (concatenations of Boolean gates) to carry out the most basic logic functions such as AND, OR and NOT. From these chips, we in turn built the ALU, RAM, CPU and put it all together into a functioning hardware platform. Since the bare bones of computing come down to functions of binary patterns, we implemented the fundamental set of

such functions in the ALU. The first advanced function we built was multi-bit binary addition. Next, the Arithmetic Logic Unit (ALU) brought together the elementary Boolean logic gates along with the addition function to become the chip that performs all basic binary functions required for program execution. To implement the storage and processing of data, the computer hardware requires an inbuilt clock. It is realized by an oscillator that alternates between two outputs, 0 and 1 to signal tick and tock. The synchronization and time delay provided by the clock is exploited for data storage and manipulation by the fundamental Data-Flip-Flop (DFF) gate that implements the time-based behavior $out(t) = in(t-1)$, where output is the input from the previous time unit. We used the DFF gate to build a basic unit of data storage that 'remembers' a bit of information by constantly cycling its value between input and output until instructed to modify what it stores. These basic chips were glued together to form registers of which the Random Access Memory (RAM) is composed. The master behind computer operation is the Central Processing Unit (CPU). The CPU, which is composed of the ALU, several registers and a program counter chip designed to keep track of program execution, synchronizes computer functionality by decoding, executing, and fetching program instructions. The instructions the CPU receives from the instruction memory or ROM (which is identical to the RAM memory except it is used to store instructions and not data) are decoded to determine what actions the ALU will take to execute each instruction, and where in the RAM memory the ALU's output will be stored. Upon completion of the CPU, we now have a fully functional computer hardware. We are continuing the project to implement the software end of the computer by writing the assembler, virtual machine, compiler, and operating system programs.

Title: Understanding the Relationship Between Dark Matter and Known Particles

Student Researcher: Jiarong Mei

Faculty Mentor: Prof. Giovanni Ossola

As a continuation of the research work done last semester, I am planning to go more in depth on the characteristics of dark matter. In particular, I will read about some of the theories to explain dark matter with the purpose of understanding the differences between known particles and dark matter candidates. Using Feynman diagrams we can describe how different particles couple to each other, leading to the production of dark matter.

Title: Modeling Noise and Rayleigh Backscattering in Raman Amplification

Student Researcher: Thinh H Le

Faculty Mentor: Prof. Lufeng Leng,

The effects of amplified spontaneous emission noise (ASE) and Rayleigh backscattering are significant in Raman amplification in optical fibers and have drawn much research attention. In this project, they are included in a full mathematical model of Raman amplification, and investigated numerically using MATLAB. The presence of both backward and forward propagating signals and ASE noise in this model leads to a complex boundary value problem. Therefore, a two-step method is employed to solve the large number of coupled equations. Results from the numerical simulation will be compared against experimental data. Once proved a working code, it will be used to guide the designs of efficient and high-performance Raman amplifiers.

Title: Superconductors and Their Applications in Technology
Student Researcher: Gilbert Center
Faculty Mentor: Prof. Oleg Berman

The critical temperature of superconductivity for different superconducting materials was analyzed. The superconductors are the conductors that lost all of their electrical resistance when cooled to extremely low temperatures ranging at about -273 degrees Celsius. One tremendous application of superconductivity is that if conductor resistance could be eliminated entirely then there could possibly be no power losses or inefficiencies in electric power systems due to stray resistances. This application shows how important the research on superconductivity and zero resistance has on the real world and how it relates to our everyday life. Various possible applications of superconducting materials in technology were studied.

Title: Phase Transitions in Superconductors.
Student Researcher: Jorge Paucar
Faculty Mentor: Prof. Oleg Berman

Superconductivity occurs in a wide variety of materials, including simple elements like tin and aluminum, various metallic alloys, some heavily-doped semiconductors, and certain ceramic compounds containing planes of copper and oxygen atoms. In conventional superconductors, superconductivity is caused by a force of attraction between certain conduction electrons arising from the exchange of phonons, which causes the conduction electrons to exhibit a superfluid phase composed of correlated pairs of electrons. Besides, the other type of superconductors is formed by a class of materials, known as unconventional superconductors, that exhibit superconductivity but whose physical properties contradict the theory of conventional superconductors. Type I and type II superconductors were analyzed. The phase transitions of superconductors in magnetic field and Meissner effect are studied.

Title: The Technical Applications of Conventional and High Temperature Superconductors
Student Researcher: Gerard Alexandre
Faculty Mentor: Prof. Oleg Berman

The critical temperatures of various superconductors were studied. For superconducting materials the electric resistance is zero at the temperatures below the critical one. The Bardeen-Cooper-Schrieffer (BCS) theory of superconductivity was analyzed. This microscopic theory provides the insight of the electron collective properties of type-I superconductors at low temperatures. The type II superconductors formed by various alloys have been studied.

Title: Three-dimensional Block Construction in Normal College Students
Student Researchers: Mikhail Petrychenko, Mei Fong Wong
Faculty Mentors: Profs. Daniel Capruso, Holly Carley

Objective: The aim of the project was to determine the three-dimensional constructional ability of normal college students. **Background:** Petrychenko et al. (2009) found that only 53% of normal college students were able to accurately construct a 15-block three-dimensional model to copy an image of the completed stimulus. Because perfect performance had been assumed when that study was designed, less complex models were not used as initial items. Furthermore, the

fifteen-block design had been presented oversized on a computer monitor, and with shadow cues removed. These factors may have contributed to poor performance. **Method:** Normal college students ($n=26$) were tested using a three-dimensional block construction task created from a set of German Anchor Blocks (Anker Steinbaukasten). Subjects were shown stimulus models with shadow cues and asked to construct a six-block cube, then a more spatially complex seven-block design, followed by the fifteen-block design that had been used by Petrychenko et al. (2009) for a total possible score of 28 blocks correctly placed. The Information and two-dimensional mosaic Block Design subtests of the WAIS-IV were also administered to determine if there was a relationship between performance and intellectual functioning. **Results:** Mean total score for the three-dimensional block construction task was 25.65 ($SD=2.79$; range = 18 to 28). Mean total time to build the three designs was 242.40s ($SD=111.83$; Range = 81s to 534s). The proportion of subjects attaining perfect performance for the three design models was 89%, 58%, and 89%, respectively. The number of subjects attaining perfect performance on all three designs was 42%. Mean completion times were 42s, 95s, and 104s respectively. Correlations of the three-dimensional block task with Information ($r(n=25) = -.06$) and two-dimensional Block Design ($r(n=25) = .24$) were not statistically significant. There was a significant relationship between Block Design and the speed of three-dimensional block construction ($r(n=24) = -.43$). **Conclusions:** Provision of two initial items and stimulus shadow cues, along with a more appropriately scaled stimulus design improved the three-dimensional block design performance of normal college students from 53% correct to 89% correct for a fifteen-block design. The seven-block design proved most difficult, indicating that spatial complexity was a greater factor in performance than was the number of blocks in the design. The test needs to be revised so that the intermediate item is not the most difficult of the three designs. The lack of a relationship between the accuracy of three-dimensional constructional task and the WAIS-IV subtests suggests that the task measures a specific cognitive ability, rather than general intellect. Higher Perceptual-Reasoning intellect as measured by Block Design is related to more rapid and efficient performance on three-dimensional block construction.

Title: Development of a Computerized Test of the Effect of Landscape Background on Perception of the Mona Lisa

Student Researcher: Olabode Oladokun

Faculty Mentors: Profs. Daniel Capruso, Michael McAuliffe

Objective: To develop a computerized test to objectively measure the effects of altering the landscape background on the perception of the Mona Lisa human observers. **Background:** The notebooks of Leonardo daVinci demonstrate that he possessed a profound capacity for visual perception. For that reason, scholars have puzzled over the apparent incongruity in the background landscape of his most enigmatic and celebrated work, the *Mona Lisa*. The planar elevation on the left side of the canvas does not match the planar elevation on the right side. Capruso's hypothesis is that the planar disparity in the landscape background functions as a type of "Poggendorff illusion" that is produced when a vertical surface (the Mona Lisa herself) interrupts two collinear oblique lines (the planar perspective), causing an appearance of misalignment. This misalignment may account for the apparent perceptual instability of the Mona Lisa's smile. **Method and Result:** A Visual Basic program was created for use with human subjects. The program collects demographic data, then randomly displays for 10s either the original Mona Lisa, or two alternate versions in which the background was altered to be completely symmetrical. Subjects must then select a version of the Mona Lisa's mouth from memory. Response choices include the original mouth, or versions with the edges of the mouth exaggerated upward or downward. **Application:** The computer program is capable of

empirically testing Capruso's hypothesis that rendering the landscape background as symmetrical will alter perception of the Mona Lisa. If the disparate planar elevation of the original does distort the mouth in the viewers' perception, then viewers should select a slightly exaggerated version of an upward smile. Conversely, a symmetrical planar elevation should stabilize the viewer's perception and cause them to select the unaltered mouth.

Title: Children in Penal Systems: An International Comparison

Student Researcher: Jesse Lyon

Faculty Mentors: Profs. Jean E. Kubeck, Vera Albrecht, LaGCC

At what age can a child be held responsible for a criminal action? This study presents a search of penal codes pertaining to the treatment of children (individuals under age 18 years old) in countries around the world. Data were collected from a variety of sources including the International Monetary Data Fund (2009), Wikipedia.org, UNICEF, and CIA World Factbook. Variables included: MACR, Minimum age of Transfer (MAT) to adult court, Religion (Christian, Muslim, other), GDP (in millions), Adult Literacy rate (proportion of the adult population aged 15 years and over which is literate), Constitutional Authority (republic, monarchy), Per Capita Income, and Intentional Homicide Rate (per 100,000). MACR was coded as a dichotomous variable (no MACR to 13 years and 14 years and older). Full data were available for 124 countries.

Based on available data, the median MACR was lowest for Asia (9.5 years) followed by Oceania (10), North/Central America (12), Africa (13), Europe (14), and South America (14.5). The median MAT was lowest for Oceania (13.5 years) followed by Asia (15), Africa and South America (17), and North/Central America and Europe (18). Noteworthy was the finding that lower literacy rates were associated with lower MACR. Similarly, type of constitutional authority was also related to MACR, with monarchies tending to have younger MACR. However, religion (Christian, Muslim, Other), income (GDP or per Capita) and homicide rate were not associated with MACR.

The young ages at which a child can be held criminally responsible or tried in an adult system around the world are noteworthy. Trying juveniles as adults presumes that juveniles to be competent, autonomous agents that have the same relevant capacities and to the same degree as adults that determine decision making and behavior: comprehension, autonomy, responsibility, anticipation of consequences. However, Albrecht and colleagues (Albrecht, Kubeck, & Bear, 2007; Albrecht, Kubeck, & Bear, 2008; Kubeck, Albrecht, & Lyon, 2010) have argued that based on evidence from developmental psychology, juveniles are neither fully competent, nor can they be considered as fully autonomous agents.

Title: The Strange Case of Noel Field

Student Researcher: Jacek Ramotowski

Faculty Mentor: Prof. Kyle Cuordileone

Generally speaking, this book project examines the intriguing case of Noel Field, a US State Department official in the 1930s who covertly assisted the USSR as an agent and later became its unwitting victim. Field, who organized aid for refugees as a Unitarian Service Committee official during World War II, mysteriously vanished behind the iron curtain in 1949, as did his wife, brother and foster daughter. On Moscow's orders, all were arrested and charged with being part of

a Western imperialist plot to undermine Communist rule in the “peoples’ democracies” of the east. Field was in truth a devoted Communist, yet government officials in the Soviet bloc claimed that Field was an American “masterspy” serving Allen Dulles, the future CIA director. While Noel and wife Herta Field were imprisoned in Hungary, brother Hermann Field was imprisoned in Poland and adopted daughter Erica Glaser Wallach eventually landed in a Soviet labor camp in the Arctic. This semester, we are focusing on one aspect of the larger project: a search for government records in Poland (including state security files which are very difficult to access) pertaining to Hermann Field. Web and archival searches, and inquiries to the Institute for National Remembrance (the archives containing official state security files), will yield fresh information regarding the circumstances surrounding the arrest and imprisonment of Hermann Field as well as the rest of the Field family.

Title: Dental Hygiene and Well-Being

Student Researchers: Isabel Barreiro, Stephanie Hoyos

Faculty Mentors: Profs. May Chen, Anty Lam

Is there a real link between stress and oral health? Some research suggests that there’s a definite positive correlation between these two subjects. Although not affecting directly, stress can impact our oral well being when it affects our overall health. Some research suggests as our stress level increases our oral hygiene compliance decreases. Other research suggests that there is a direct psychological link that associates stress with the progression of periodontal disease. This is related to the increase levels of cortisol and glucocorticoids during stress episodes, which alter the immune function (1). This alteration in immune function is associated with the acceleration of periodontal destruction (1). Additional research suggests that is the increment of risky behaviors what in fact contributes to oral disease. These include, drinking and smoking (2). In order to test the hypothesis, a study was performed in the Dental Hygiene Clinic from New York City College of Technology. 37 human subjects were used to test the hypothesis. The data collection method was random sampling and a face-to-face interview (questionnaire). The questionnaire was designed to assess different stress levels including: Perceived stress scale, depressive symptoms scale, religiousness, and social support scale. Upon these assessments, the dental implications were added. These were determined to assess the patient’s periodontal status, and include: Missing teeth, clinical attachment loss, recession, decay, gingival bleeding, etc. The stress scale variables were then correlated to the dental hygiene variables using SPSS. The correlation coefficient analysis was performed and revealed the following: Fillings increase as age increases; Number of crowns increase as social support decreases; Number of missing teeth increases as number of children increases; as social support decreases, amount of recession increases; etc.

Title: Emotional and Religious Processing in Relation to Trauma Adaptation

Student Researchers: Natalie Oakley, Olena Romanyshyn

Faculty Mentor: Prof. Pa Her

Research demonstrates written emotional expression about a traumatic experience is associated with well-being. This study examined trauma writings from individuals participating in an intervention study to understand the role of religion and emotions in trauma adaptation. College students were randomly assigned to one of three experimental groups. One group was given conventional emotion instructions for writing about a traumatic experience; another was instructed to write about the trauma from a religious/spiritual perspective; and a control group wrote about a trivial topic. Narratives in the writing conditions for the conventional and religious

group were coded for religious orientation, emotional tone, and benefit-finding. Reliability was good ($K=.70$). There were no significant differences in baseline measures for religiosity, optimism, and depressive symptoms. However, t-tests showed that participants in the religious writing group showed a more positive orientation towards religion when writing about the traumatic experience compared to the conventional writing group. Additionally, for the religious writing group, religious orientation and the emotional tone of the narrative was positively associated with their self-reported optimism during the last writing session. Moreover, optimism was associated with less depressive symptoms at one-month follow up in the religious writing group. In contrast, the emotional tone in the conventional writing group was associated with less depressive symptoms at one-month follow-up. No relations were found for religious orientation in the conventional writing group. For both groups, there were no associations with benefit-finding. These findings suggest that religious orientation and positive emotions may augment the health-promoting effects of written narratives.