Abstracts of the Emerging Scholars Program Research Projects

Fall 2009

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

In a city that is moving forward with the rest of the world in matters of sustainability, a project arose to try and facilitate the way we grow and acquire fruit and vegetables in our cities. Researching and studying green roofs and greenhouses as well as other farming methods, we came upon the idea of creating a new dynamic way of farming that would serve as a prototype module, potentially, to be used within all major cities –primarily New York City- making use of the space available to us: The building façade.

We began by studying specific topics such as soil, hydroponics, irrigation systems, and plant species. During the research period we visited different urban planting facilities. Most of them had developed green roof systems with various types of soil and plants. They use light weight soil that consists in a mixture of shale, foam, clay, and/or organic materials; the depth of the soil layers depends on the type of plant they grow. We have identified three categories for local products: small (up to 6 in), medium (6 to 12 in) and large crops (12 to 18 in). Another method for plant growing is hydroponics, where plants can grow without soil by using nutrient solutions and a growing medium. Some of the advantages of using hydroponics instead of soil are: plants use less water than traditional methods, they take less planting space therefore more plants can be grown in an area, it is easier to control the quality of products since the farmer would know what nutrients the plants are getting. On the other hand, some of the disadvantages are high electric consumption, and the nutrients can be expensive.

After the extensive research of farming systems and procedures, growing mediums, and vegetation life span in regards to our proposed location in New York, we designed a three-level trough with the required size and space to house small, medium or large crops on each level. These levels or pods would be attached to a frame structure from where it can be removed and changed for a different size pod or to tend to the plants. The trough has a passive irrigation system which allows for water to zip through from the top pod to the bottom. There is also a storage compartment to capture excess water as well as rain water and a small sprinkler system to reuse the water it collects. The trough is attached to a track system on the façade of the building where several rows will be placed in the horizontal intervals between the windows, or spandrels. When time to harvest the crops, the track system will lift each row to the roof of the building or bring them down to a terrace depending on the building configuration.

The vertical farm project is to install a farm on unused real estate in existing buildings in the inner city. The potential of the increased area of space created by our high building and skyscrapers have more area on the vertical than what was lost on the horizontal. But why would a building owner be motivated to farm on its buildings face? The property owner or the apartment owner could lease its vertical space to the vertical farmer. The vertical farmer would pay to use the area from his revenue generated from the vertical farm.

This system will provide larger farming areas within the city; it will grant more access to healthy, organically grown vegetables; potentially open up new field in the job market in the city and provide an overall new and natural aesthetic to our buildings in an effort to help the environment. Vertical farming would increase urban quality by decreasing heat island effect, less pollution and an improved urban aesthetic. Vertical farming would also need less distance to travel from rural areas to our supermarkets. Less carbon monoxide gas from the delivery trucks to our supermarkets. The improved aesthetic in the urban fabric would change from stone and glass to green and colorful like a landscaped environment which would be more pleasing to the inner city people.

Our project for the future will include a physical prototype of the trough and system to be tested on a chosen building and monitor the growth of our plants and catalog our progress to further develop and improve our system.

Title: (re)housing (hu)man(ity)
Student Researcher: Carlos Quinones
Faculty Mentor: Profs. Illya Azaroff, Gregory Marinic

For centuries, (hu)man(ity) has looked within for answers on truth, knowledge, and beauty. The purpose of our research for this scholarly project utilized similar introspection in order to develop anthropomorphic structures. Based on structural composition of the human body, we then applied this research to the development of small related constructs. These studies would act as prototypes for the creation of furnishings, structural modules implemented within the buildings they occupy, or further studies into alternative structural systems. Working alongside Professors Illya Azaroff, Gregory Marinic, Mary-Jo Schlachter, and Sanjive Vaidya, as well as a sizeable team of thirteen architectural students, my work has wandered more toward the theoretical through research into ferrofluids and magnetically-created structures, as well as operable constructs. By implementing mechanical movement, simple physical interactions between materials can create something that could be used for various functions.

Title: re(HOUSING): Culture + Technology
Student Researcher: Florim Kukaj
Faculty Mentor: Profs. Gregory Marinic, Mary-Jo Schlacter

Culture and technology shape the way we live and work, thus, exploring and applying their assets creates opportunities for sustaining, developing and reimagining their function in our society. By employing these practices, we adopt and build a cross-cultural vocabulary that would allow for a system of rods and plains to control, restrict, and allow movement of joints. Purpose-derived joint designs, each performing its conventional function as well as contributing in a multi-joint system allowed for more complex functions to arise. Performance, adaptability, and sustainability influenced the development of functional, yet aesthetic systems, repurposed materiality, new building strategies, and their kinetic opportunities in space. This hybridization of anthropomorphic and environmental inputs from our culture and our own bodies, empowered us with a language of connectivity and movement that reflected origins identified within the design process. Employing historic and cultural techniques of wood joinery we unearthed possibilities for reapplying, repurposing, and reimagining these global resources.

Title: Anthropomorphic Connectivity: A Kinetic Exploration of Architectonic Bodies in Space
Student Researcher: Javier Santos
Faculty Mentors: Profs. Gregory Marinic, Mary-Jo Schlachter

Fabricating a live/work environment for the future may begin with an investigation into the human body. Understanding how the body moves and what it requires for comfort and optimal productivity are key components of this inquiry. Only then can we fully design a successful environment that can be sufficiently connected to our own human existence. Studying the inter-connectivity and interdependence of structural systems of the body helped us to understand its ordering and how each system related to the next, as well as movement capacities of individual joint connections. We are now able to translate that information into an architectural system that mimics the body's flexibility and its response to a set of rules. Thus, we may create a construct that responds to the body and natural environment by employing repurposed resources.

Title: Anthropomorphic Connectivity: A Kinetic Exploration of Architectonic Bodies in Space
Student Researcher: Joseph Magalahech
Faculty Mentor: Prof. Sanjive Vaidya

Fabricating a live/work environment for the future may begin with an investigation into the human body. Understanding how the body moves and what it requires for comfort and optimal productivity are key components of this inquiry. Only then can we fully design a successful environment that can be sufficiently connected to our own human existence. Studying the inter-connectivity and interdependence of structural systems of the body helped us to understand its ordering and how each system related to the next, as well as movement capacities of individual joint connections. We are now able to translate that information into an architectural system that mimics the body's flexibility and its response to a set of rules. Thus, we may create a construct that responds to the body and natural environment by employing repurposed resources.

Title: Structures for Architects
Student Researcher: Rodrigo da Silva
Faculty Mentor: Prof. Ramsey Dabby

"Structure for Architects" is a proposed textbook by Professors Ramsey Dabby and Ashwani Bedi on the fundamentals of structural design. The book's premise is to present complex structural theory in a simple, intuitive form to architectural college students as well as graduate architects preparing for the architectural licensing exam. The objective of my project was to take the hand-sketch drawings done by the professors, and create computer-generated graphics of the drawings. During the process I had to research several architectural programs' capabilities, such as Auto cad, Sketch up and Rhino, to see which one best fit the needs of the book. I then re-drew the sketches and submitted them to Professor Dabby. He reviewed the drawings and made additional corrections and comments. During the process of reviewing and discussing the drawings I learned a lot about communication and how to correspond professionally on the project. Another aspect of this project I enjoyed was learning how structure works in a building. This was a great project for me because of the opportunity and experience of working with a professional in my area of studies outside of school. Professor Dabby was a great mentor by making himself available to me to discuss my current projects in school, as well as my future as an architect.

Title: The Pathogencity of *Streptococcus Pyogenes*
Student Researcher: Abu Sadat M Shahriar
Faculty Mentor: Prof. Zongmin Li

Streptococcus pyogenes is a bacterium commonly found in the respiratory tract in many people, but usually does not cause severe infections until the person's natural defenses to disease is weakened. However, this bacterium should not be taken lightly, since it does have the potential to cause both mild and severe diseases. While most people only suffer from mild infections, such as Strep throat or impetigo during childhood, others suffer severe infections and many lives are claimed by this potentially dangerous bacterium every year. The purpose of this project is to summarize the full pathogenic potential of *Streptococcus pyogenes*, for a better understanding of how to identify, treat, and avoid these infections.

Streptococcus pyogenes (Group A streptococcus) is a Gram-positive, non motile, non-sporeforming coccus that occurs in chains or in pairs of cells. Many factors, such as its cellular composition and

metabolism confer this bacterium the ability to evade, colonize and damage host cells. These factors include its production of exotoxins and streptokinase, the M proteins on its surface, and its hyaluronic acid capsule. *Streptococcus pyogenes* is the leading cause of uncomplicated bacterial pharyngitis and tonsillitis, commonly referred as Strep throat. Other respiratory infections include sinusitis, otitis, and pneumonia. Infections of the skin can be superficial (impetigo) or deep (cellulitis). Invasive streptococci cause joint or bone infections, destructive wound infections (necrotizing fasciitis) and myositis, meningitis and endocarditis. Two post streptococcal sequelae, rheumatic fever and glomerulonephritis, may follow streptococcal disease, and occur in 1-3% of untreated infections. Scarlet fever and streptococcal toxic shock syndrome are systemic responses to circulating bacterial toxins.

Penicillin is still uniformly effective in treatment of infections caused by *Streptococcus pyogenes.* It is important to identify and treat *Streptococcus pyogenes* infections in order to prevent sequelae. No effective vaccine has been produced yet.

Title: Epidemiologic Study on Nosocomial Infection
Student Researchers: Aionga Pereira, Rona Gurin, Jennifer Chan Wu
Faculty Mentors: Profs. Liana Tsenova, 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 a healthcare environment. These infections are spread from unclean and non-sterile environment surfaces and equipments or from healthcare providers not practicing sterile techniques while caring for patients. They are the eighth leading cause of death in the United States, claiming the lives of 99,000 people each year and approximately10% of all hospital patients acquire some form of NI. The rapid emergence of multi-drug resistant pathogens is responsible for the increased mortality associated with NI.
After an extensive literature search we found that there are 12 pathogens that are associated with NI. The most common ones are Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter baumannii, Klebsiella pneumonia and Clostridium difficile. They account for 93% of all NI cases.

Those at risk of contracting NI are burn patients, surgical patients, patients needing invasive procedures, such as catheters, trachea- ventilators and intravenous therapy, and trauma patients. Immunocompromised patients are by far the most at risk because of pre-existing health conditions and possibly prolonged antibiotics treatment. Newborns and elderly are also at risk due to an underdeveloped immune system and diminished resistance, respectively. Surgical and medical ICU patients are twice as likely to acquire NI. Length of the hospital stay is a factor that relates to incidences of nosocomial acquired respiratory infection, especially lower respiratory infections which directly correlate with longer hospital stay.

In this project, we also experimented with the data presented in [Ding et al. BMC Infectious Diseases 2009 9: 115]. These data are obtained from an intensive care unit of a tertiary hospital in China. Based on this data, we found that lower respiratory tract infections (LRTIs), urinary tract infections (URIs), and bloodstream infections (BSIs) are the most common infections in China. A chi-square distribution test is used for the analysis. We assume that there exists no significant difference in the infection rates during the five year period from 2003 to 2007 as the null hypothesis (H0). We find for $\alpha=0.05$ and degree of freedom df = 4, the critical value of x^2 is 9.488 and the calculated value of x^2 is 10.12 which is similar to the value that Ding et.al presented in the paper. Since the calculated value of x^2 is greater than the critical x^2 value, therefore, there exists sufficient evidence to reject the null hypothesis.
Preventive measures are also discussed in this project.

This is an interdisciplinary project built as a collaborative effort between Microbiology and Mathematics students. Currently, we plan to collaborate further to study the effects of NI in the city of Brooklyn, NY.

Title: Cellular Waste: The Future of Stem Cell Research and Regenerative Medicine?
Student Researcher: Denise Saroda
Faculty Mentors: Profs. Nasreen Haque, Niloufar Haque

In today's world, we are always looking at ways to recycle old and unwanted materials. I believe that we could take a cue from this philosophy and recycle our "cellular waste", in the hopes of improving our lives through regenerative medicine. My proposal is to look at the remnants of discarded "cellular waste", like dental tissue, to determine their viability to work in lieu of embryonic stem cells to grow new tissue and organs that could possibly be used in regenerative medical treatments.

Induced pluripotent stem cell (ipsc) research began in 2006, when Japanese Scientists Takahashi and Yamanaka successfully reprogrammed adult mouse fibroblasts to an embryonic stem cell stage (1). In 2007, they reported the success of creating Human Induced pluripotent stem cells h(iPSC) (2).Their method was a tremendous breakthrough toward solving the extremely controversial debate over stem cell research. Their research resulted in the development of different methods of reprogramming adult stem cells. Typically, these studies focus mainly on the use of skin fibroblast as the source of iPSC cells (3). Through my research, I have found two sources of tissues generally discarded after surgical procedures; that of Dental and Adipose tissue, both of which researchers has shown to be excellent sources for the creation of iPS cells (4, 5). My immediate goal is to research the possibility of working in conjunction with the Dental Department at City Tech, to create a repository of Dental tissue that could be shared within the CUNY system, accessible to scientists involved in Stem Cell research.

Title: Brain and Mind: The Learning Process
Student Researcher: Iman Farraj
Faculty Mentor: Prof. Nasreen Haque, Niloufar Haque

The brain and mind are two different though interdependent units. The brain is an organ of soft tissue which occupies the cranium of humans and other vertebrates. The mind is the characteristic of consciousness and intellect experienced through perception, learning, memory, in addition to the unconsciousness cognitive processes. To subsume these two descriptions, the brain is the projector and the mind is the image. The brain is the central processing unit and learning unites the entire physiology. Learning is viewed as the acquisition of new information or skills. It involves a permanent change in mental representation or associations resulting from an external experience. On the contrary, memory is related to the ability to recall information that has been previously learned. For knowledge to be absolutely understood and retained, it must be tied to something previously learned. One's previous knowledge and experiences reinforce one another and can be linked to enhance the learning process. Behavioral patterns portray patterns that refer to a change in behavior. This is an external change that one may observe. In addition behavioral patterns focus on a change in mental representations or associations. This is an internal change that one cannot see. The mind is a developing property of the brain. Therefore, mental proceedings are the individuals own experiences of the physical events that occur in our brains. Details of learning patterns, formation of an association with recall and its ultimate role in behavioral patterns will be discussed at the conference.

Title: Living Things, Light and Bright
Student Researcher: Julia Zanchenko
Faculty Mentors: Profs. Nasreen Haque, Niloufar Haque

Stem cell research has become a widespread controversy within the general public, the political spectrum, and the scientific and religious communities. Though almost everybody in our society has heard about human stem cells, not everybody knows exactly what this is all about.

Stem cells in general have the remarkable potential to develop into many different cell types in the body during early life and growth. In addition, in many tissues they serve as a sort of internal repair system, dividing essentially without limit to replenish other cells (1).

Studying stem cells will help us understand how they transform into the array of specialized cells that make us what we are. Some of the most serious medical conditions, such as cancer and birth defects, are due to problems that occur somewhere in this process. A better understanding of normal cell development will allow us to understand and perhaps correct the errors that cause these medical conditions (1).

Another potential application of stem cells is generating cells and tissues for medical therapies. Today, donated organs and tissues are often used to replace those that are diseased or destroyed. Unfortunately, the number of people needing a transplant far exceeds the number of organs available for transplantation. Each day in the U.S., there are about 79 organ transplants taking place and an average of 132 people being added to the nation's organ transplant waiting list. Each day, about 77 people receive organ transplants. However, 18 people die each day waiting for transplants that can't take place because of the shortage of donated organs (2). There are 104,761 people currently in a waiting list (3).

Pluripotent stem cells offer the possibility of a renewable source of replacement cells and tissues to treat a myriad of diseases, conditions, and disabilities including Parkinson's disease, amyotrophic lateral sclerosis, spinal cord injury, burns, heart disease, diabetes, and arthritis (1).

For many years this vitally important research was outlawed. In March 2009, President Barrack Obama issued an Executive Order, removing barriers to responsible scientific research involving human stem cells. Keeping in mind that cancer (the second most common cause of death in the US), is killing more than 1,500 Americans each day and it is accounted for 1 of every 4 deaths, there is an uncontestable need for continuation of stem cells research (1).

Title: Modeling and Simulation of 3-D Virtual Cell as a Game
Student Researchers: Dolores Calle, Efrah Hassan
Faculty Mentor: Prof. Wallied Samarrai

During the past decade, biology has witnessed a transition from being a low-throughput to what is now a high-throughput science. From a typical data-gathering and data-poor era scientists have moved to a more data-interpreting and data-rich era. This has made it possible to develop a holistic view of the cell, cellular components and biochemical pathways. In this project we used Second Life as a modeling tool and platform to design, build and simulate a virtual 3-D cell, and laboratory setting. A cell is a highly

complex factory that organizes thousands of different molecules to perform specialized functions. Advances in biological sciences have allowed biologists to catalog a wealth of data on the structure of cells and cellular components such as mitochondria, nucleus and so on. There are many animations and digital movies that show these structures and activities. However there is no 3-D virtual cell that would allow the user to actively interact with cellular components and as a video game become part of the molecular and biochemical pathway. In this project we used second life as platform and second life scripting language to model a virtual 3-D cell and the process of osmosis, diffusion and active transportation across the plasma membrane.

Title: Revisiting Two Anti-Malarial Drugs
Student Researcher: Edwin Hernandez
Faculty Mentor: Dr. Tatiana Voza

Artesunate and primaquine are two common anti-malaria drugs used because of their effect on the blood and liver stages, respectively, of *Plasmodium* parasites. Although artesunate is one of the first choice treatments for malaria infected persons, little is known on its effect on the liver stages of the parasites. Primaquine is widely used in malaria endemic area but also in the lab by scientists studying malaria. However, to date there is no precise available data on the reduction in the liver burden a primaquine treatment induces in malaria infected mice. In this study, using mice experimental models and two different rodent *Plasmodium* parasites, *Plasmodium yoelii* and *P. berghei*, we investigated the role of artesunate on the liver stages, aka pre-erythrocytic stages, of malaria parasites. We also provided quantitative data relative to the effect of primaquine on the pre-erythrocytic stages of these two parasites.

Title: Modeling of Chemokine Signaling Pathway
Student Researchers: Jeanne Mathieu, Nesrine Houam, Richard M Walker
Faculty Mentor: Prof. Isaac Barjis

During the last decade many of the molecular mechanisms of chemokine signaling have been examined and elucidated. A systemic understanding of chemokine signaling pathway 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. One way of understanding the nature of biological process is modeling and simulation. Therefore problems in system biology and structural biology increasingly require researchers to move between models of low resolution and detailed atomic models to fully explore and exploit experimental information. In this project we used Petri nets to model, simulate and analyze molecular interactions and mechanisms of signaling pathways. In order to model the signaling pathway we introduced some extensions to the graphical notation of ordinary Petri nets. Than we used the extended Petri net to model, simulate and analyze the chemokine signaling pathway Furthermore we introduced color Petri nets and showed how color Petri nets could be used in modeling biological process in general and signaling pathway in particular.

Title: Deriving Information-Optimized Reduced Amino Acid Alphabets for Protein Structure Prediction
Student Researchers: Jeryl Jamir, Saera Fernandez
Faculty Mentor: Prof. Armando Solis

The fundamental axiom of protein folding states that the information about the three-dimensional structure of protein molecules is contained completely in its specific amino acid sequence. Protein

sequences that constitute the sequence space are generated by a 20-letter alphabet representing the 20 naturally occurring amino acids. The existence of proteins that share significant structural similarities even though their amino acid sequences are widely divergent is evidence that protein sequence space is highly redundant compared to protein structure space. The strategy implemented in this work is to condense those 20 letters into a simplified alphabet, eliminating much of the redundancy, and in the process making procedures based on sequence comparison much faster.

Our goal is to find the best reduction of the 20-letter amino acid alphabet into a smaller alphabet while still maintaining structural specificity. Among the many techniques that have been used to compress sequence space, our information-based strategy has proven to be the most effective in maintaining vital information while minimizing structural information loss. Applying information-theoretic concepts, we set out to find the amino acid alphabet clustering that maximizes mutual information between sequence and structure. In our ongoing study, we employ a Monte Carlo procedure to search across a vast array of possible clusterings, to find the clustering that returns the higher mutual information. In order to find the global maximum, we repeat the Monte Carlo procedure from different starting points, to ensure proper coverage.

Protein stability comes from a combination of local and nonlocal energetic interactions. Solis & Rackovsky used this information-based methodology previously to find the best reduced amino acid alphabet that characterizes the *local* relationship between local backbone structure and the local sequence. We intend to complement their study to find the best alphabet for *nonlocal* interactions, involving amino acid residues that are in contact in the three-dimensional fold, but occur far apart in the linear sequence. We will attempt to combine their results with ours, in order to come up with the best reduced amino acid alphabet that is simultaneously consistent with both local and nonlocal interactions. Such a reduced alphabet should prove superior in a vast array of protein structure prediction efforts that require sequence comparison.

Title: An Overview of Dystonia: Genetics and Treatment
Undergraduate Researchers: Noor Ennab, Olga Dzhurayeva
Faculty Mentor: Prof. Laina Karthikeyan

The objective of this project was to research the neurodegenerative disease dystonia, its evolving classification, and recent genetic data, as well as its clinical investigation and treatment. Dystonia is characterized by abnormal involuntary excessive muscle contractions that cause twisting and repetitive movements or abnormal postures. Dystonia may be idiopathic (primary) or associated with lesions of many etiologies (secondary), including many rare diseases. Although age at onset, anatomic distribution, and family history are essential elements in the evaluation of dystonia, new classification increasingly relies on etiologic and genetic data. There is strong evidence that disordered basal ganglia circuitry plays a role in the etiopathogenesis of dystonia, but the details of the dysfunction remain obscure.

Dystonia linked to the DYT1 gene, also known as primary generalized torsion dystonia (PTD), dystonia musculorum deformans, or Oppenheim's dystonia, is one of the most severe forms of the inherited dystonias. The symptoms usually start in an arm or leg in childhood, and generalize by adulthood. Occasionally onset is in later life, with the symptoms typically presenting in the cranial structures (e.g., neck, larynx, upper face), and tending to stay more localized. Although the disease mutation is most prevalent in Ashkenazi Jews due to a founder mutation, it can appear in most ethnic populations,

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including African-Americans and Asians. The treatment of dystonia has continued to evolve to include newer medications, different forms of botulinum toxin, and various surgical procedures.

Title: Endocrine Disrupting Chemicals and its effect on puberty and reproduction.
Student Researcher: Vincent Palmieri
Faculty Mentor: Prof. Sanjoy Chakraborty

The endocrine system that regulate our body's major functions, including normal growth, maturation, and reproduction is consists of many hormones. Hormones, the chemical messengers, work through specific receptors that are expressed all over the body. There are chemicals found in nature that can disrupt the normal functions of the body by mimicking the activity of the hormones. These man-made chemicals are called Endocrine Disrupting Chemicals (EDC) or Estrogen-like endocrine disrupting chemicals (EEDC), are found abundantly in the environment are polychlorinated biphenyls, brominated diphenyl esters,various pesticides and phthalate esters. EDC has recently drawn immense attention to the scientific community as it is now recognized as potentially hazardous factors for human health. Over the years these concerns grew with the advancement of biochemical, biomedical, and biotechnological industries and with the increasing possibility of bioterrorism and chemical-warfare. EDC are found abundantly in the environment are on residential buildings, cars, furniture, plastics, products such as baby feeding bottles, lining in tin-food containers and even in children's toys. In this project, we plan to study some specific EDCs and their profound effect on the puberty and the reproductive functions.

Title: Design and Construction of a Spectro-electrochemistry Apparatus
Student Researcher: John Cichocki
Faculty Mentor: Prof. Jay Deiner

Abstract: Many important electrochemical reactions happen on electrode surfaces. These include reactions related to fuel cell catalysis and remediation of ground water. Infrared spectroscopy is one way to understand which species are present on electrode surfaces during electro-catalytic reactions. In order to perform infrared spectroscopy of the species on electrode surfaces, we are modifying an existing Fourier transform infrared spectrometer to include the proper sample compartment, mirror configuration, and detector for surface infrared spectroscopy measurements.
This semester, we took measurements of the sample compartment, obtained photos from a different infrared spectrometer that has already been modified for surface measurements, and began to draw plans for our modifications using computer aided design. We also read about the basics of electrochemistry. Next semester we will finalize our design and begin modifying our spectrometer.

Title The Literature of Place and the Place of Literature
Student Researcher: Marcos Pichardo
Faculty Mentor: Prof. Caroline Hellman

I have been working on a novel that is heavily concerned with the importance of place and the idea of belonging. The novel takes place in a fictional town in Louisiana and follows the lives of five teenagers who view their town and circumstances as difficult –something that is common in all New Yorkers of every background and class. With the Emerging Scholars program, it is a great opportunity for me to examine what defines various places, fictional and non-fictional, Louisiana or New York. I will be

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assisting Prof. Hellman in connection with the "Water and Work" book collection to come out of the NEH grant. We will be examining New York City and its surrounding parts, in particular: its denizens, its quotidian existence, and the interpretations of it through short story, novella, and novel form. What defines the city? What common conceptions, therefore, tensions exist between residents and non-residents? What are the common conditions of all municipalities and how does New York City differ? Also, how does Brooklyn benefit, or suffer? My work on this project will elucidate the importance of place in literature on a variety of planes. How does the borough's growth in the aspects of finance and property affect the average Brooklynite and where, in terms of how Brooklyn is to be perceived, is it moving? I will be studying Brooklyn's past, in the context of understanding the borough's recreation or reinvention after the demise of the waterfront, as well as understanding my own role in the legacy of the area around City Tech.

Title: "Joy Wouldn't Feel So Good if it Weren't For Pain: Sam Shepard's Fool for Love"
Student Researcher: Steven Manon
Faculty Mentor: Prof. Annette Saddik

Have you ever had something that made you feel terrific but, at the same time, made you feel horrible? Sam Shepard portrays this situation in his play Fool for Love, a tragic love story that takes place in a run-down motel on the edge of the Mojave Desert. Eddie and May are the main characters in the story; they met each other in high school and fell madly in love. They seemed to have the perfect relationship. However, like in all relationships, they had their problems, and Shepard shocks the audience with the particular obstacle that plagued May and Eddie. It turns out that the two were siblings, with the same father but different mothers. They found this out after they had already fallen in love, or, as Eddie says shamefully: "Well, by the time I found out we'd already - you know - fooled around" (44). Instead of stopping the relationship, they carried on for sixteen years. In Fool for Love, Shepard uses this incest motif to symbolize that no relationship is perfect; it is inevitable that some things are bound to go wrong. Joy cannot exist without sadness, and sometimes love comes with a little bit of shame.

The play takes place on the edge of the Mojave Desert, in the middle of nowhere. This is important because it gives the audience a sense of being lost and confused, and for most of the play that is exactly what one might feel. By doing this, Shepard gives his audience a taste of how Eddie and May themselves feel, lost and confused. They feel lost because they keep going back and forth about whether or not they should be together, and they remain confused because the love they share is not socially accepted. Therefore, they feel ashamed for being in love with one another, which is probably why they go in and out of the relationship with each other.

Significantly, there are two moments in the play where Eddie and May share intimate moments followed by disturbing instances. In the beginning of the play, Eddie tracks down May in a low rent motel. After harsh words are exchanged, Eddie attempts to leave, but May calls to him: "Wait" (19). They move close together and embrace in a long tender kiss, which is followed by May kneeing Eddie in the groin with a "tremendous force"(19). The second moment occurs toward the end of the play and involves Eddie's and May's father, who appears in the play as The Old Man. Shepard specifies that "He exists only in the minds of MAY and EDDIE, even though they might talk to him directly and acknowledge his physical presence" (11). At one point, The Old Man is listening to May's recollection of her relationship with Eddie before and after they found out they that they were related. Her story enrages The Old Man, and impels him to tell Eddie to set her straight on a couple of facts: "This story doesn't hold water. You're not gonna' let her off the hook with that one are ya'? That's the dumbest version I ever heard in my whole life"(52). As The Old Man carries on, Eddie and May once again embrace in a long and tender kiss, finding comfort and solidarity in one another. However, as they kiss, one of Eddie's ex-lovers sets fire to

his truck, causing Eddie to leave May's embrace. Once he leaves to check on his truck, May flees, prompting Eddie to search for her once more. These two examples exhibit the climax of happiness followed by anguish, as joy is tied to pain.

One of the main implications of this play is that we cannot have pleasure without pain. And when we suppress something as pure as an emotion, it is bound to build up and explode. This is exactly what happened when the Old Man divided his life between Eddie's and May's mothers, essentially living a double life as, for several years, neither woman knew about the other. The Old Man tells Eddie that "It was the same love. Just got split in two, that's all" (45). He refused to take responsibility for his actions and the pain they caused. Instead of dealing with a problem, he put the blame on something else. Eddie and May became victims because the Old Man would not face the reality of having two children by two different women. The Old Man had loved both women, but could not stand both realities clashing, so he tried his best to keep the façade going, only causing more pain to himself and his children. Fool for Love illustrates that when we deny reality and try to suppress pain, it only builds up and consumes our lives; we need to accept the sorrow in order to experience joy.

Title: The Narrative of Computing
Undergraduate Researcher: Donald Lubin
Faculty Mentor: Profs. Reneta D. Lansiquot, Candido Cabo

I am a Computer Systems Technology major who, so far, has had a positive experience. However, during my introductory computer programming course, the examples used did not intrigue me, and consequently, I was not engaged. I used Visual Basic in this course, and not only was it boring, but I did not understand what I had done until it was completed, that is, if it was done correctly. If I needed to debug a program, getting the program to run was very frustrating. Unfortunately, students who are introduced to programming in this way may feel a bit intimidated by the prospect of training to become a programmer. After the required introductory programming course, several of my classmates decided not to choose programming modules in their majors.

Although my research on how the learning community themed "The Narrative of Computing" has affected enrolled students is not complete, I have been able to identify certain information that may influence a change concerning which introductory program to use by observing and interviewing students to gain a sense of their feelings toward computer programming in this setting. Students enrolled simultaneously in Prof. Lansiquot's English Composition and Prof. Cabo's Problem Solving with Computer Programming courses were taught to use a narrative perspective that required them to create a background story and a side-quest for a videogame and program a portion of the narrative as a prototype using Alice. Alice is an educational software program that teaches programming in a 3D environment. When I spoke to the students, they told me it was fun to come up with stories and bring them to life in Alice. Only a few students had trouble solving their problems, but they knew those problems could be solved because the program was set up to help them tackle their errors.

I also briefly interviewed the only other class using Alice. Even the students who were not in the learning community—and, therefore, not using narrative to support their learning—reported that programming is fun and easy to understand with Alice. Students who had programming experience prior to Alice said that Alice is a great introductory program for beginners. Alice also helps students transition to programming with Java. Students in the learning community reported that they wanted to continue taking programming classes and did not express any negative feelings toward programming. As part of my future research, I would like to observe these learning community students in subsequent semesters to find out whether they

are more successful and continue to take programming classes as compared to students who did not experience using Alice, with narratives or not.

Title: The Narrative of Computing
Undergraduate Researcher: Meleny Perez
Faculty Mentor: Dr. Reneta D. Lansiquot

This semester, I was given the chance to interview all students in the learning community themed "The Narrative of Computing." My main research question addressed whether videogames have hidden lessons or if they are simply meant to be fun. Students were assigned connected writing narratives in their English Composition course to create a storyline for a videogame, and because the courses were connected, in their Problem Solving with Computer Programming course, they were given a related project of creating a setting, character, and interaction using Alice, which is educational software that teaches students programming in a 3D environment. Students gave the following responses to five questions I asked.

When asked how videogames influence them, more than half of the students indicated that they were significantly influenced by videogames. As one student put it: "This is the reason I chose this major." Another student said, "It [game-playing] makes me competitive." Further, when asked whether they play a game to see how the story ends or just for the fun of the game, students tended to respond that both reasons motivated them.

Moreover, students were asked whether they preferred videogames with more realistic settings as opposed to those with fantasy or fairy-tale settings. Most seemed to prefer realistic settings. One student indicated that the realism made the plot more interesting while another said, "Everyone can relate to it." Yet another student indicated that more realistic settings offer "a person motive to seek revenge." In response to the question of what makes a gamer love a videogame character, one of the students responded, "I love the main character of a video game because I get to control the character and go through a journey together."

Finally, when asked what made them dislike a videogame, the students' responses were quite varied. They indicated that they dislike a game if it is "too hard or too complicated to play" or "the storyline is short or not good." One student indicated that "if the character has no personality" a game would probably not be very popular. After listening to the students' responses to these questions, I have concluded that videogames have hidden meanings that the players may or may not be aware of.

Title: Applications of Plasmonics in Optical Communications
Student Researcher: Vitaly Sukharenko
Faculty Mentor: Prof. Djafar Mynbaev

The volume of telecommunications traffic keeps growing at the exponential rate. To meet the demand of delivering this ever-increasing traffic, optical communications industry must continue to improve the quality of its components and networks. One of the major problems the industry encounters is the demand for increasing density of components at the sending and receiving ends of communication links. As the number of wavelengths in DWDM configuration getting greater, the number of transmitter and receivers that could be placed on one board must increase too; hence, the density of packaging comes to micro- and even nano-scale. At that scale, the operations used in a regular optical-communications technology, such

as launching light into optical fibers and directing output light on an array of photodiodes, becomes a problem because of the diffraction limit. One of the possible solutions to this problem is the use of plasmonics as waveguides. There are number of other problems that could be solved by the application of plasmonics. In this paper we discuss the nature of surface palsmons polaritons (SPP) and conditions of their excitation. We also discuss several possible schemes of using SPPs for wavelength-division demultiplexing and directing light out of optical fiber onto an array of photodiodes in nano-scale.

Title: Representations of New Orleans Pre-Katrina
Student Researcher: Ryan Moore
Faculty Mentor: Prof. Justin Davis

This pilot study seeks to better understand public memory surrounding the city of New Orleans pre-Hurricane Katrina. The researchers use close textual analysis focusing on two artistic works, The Americans (Frank, 1958) and A Streetcar Named Desire (Williams, 1947), each recognized for both its wide distribution and New Orleans related subject matter. One could argue that, given the American cultural shift of the fifties and sixties, each work had the potential to shape cultural understanding about race, place, and American life. In doing so, the artistic representations also had the potential to shape public memory about the South in general, New Orleans specifically, as well as the people who lived there. The research concludes that the cultural images of Jazz musicality, sexually erotic, racially explosive, anything goes atmosphere, what Williams (1947) himself coined a "raffish charm," are produced and reproduced by culturally significant texts (p. 13). The study begins to reveal consistencies between representations evident in the two focal artistic works and the types of representations available in news coverage of Hurricane Katrina. Such consistency is important precisely because the drawing upon always already available cultural images by news coverage served to normalize that coverage. This pilot study suggests the need to explore additional culturally significant texts—spanning both other media and other time periods—that reproduce and rearticulate public memory of New Orleans and the people who live there.

Title: A Web Design for the Actuary Club of New York City College of Technology
Student Researcher: David Persico
Faculty Mentor: Prof. Satyanand Singh

We will illustrate the design of an interactive web page that will be linked to the mathematics department website to provide important information for potential students and current students in all things Actuarial. Extensive use will be made of the Dream Weaver software. Various links will be embedded in the main page of the clubs website.

Title: Unraveling the Mysterious Google Search Engine
Student Researcher: 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 their properties to reveal Google's uncanny ability to extract the perfect page.

Title: Building a Blogging Platform
Student Researcher: Elisa Elshamy
Faculty Mentor: Prof. Victoria Gitman

When one thinks of blogging, the first thing that may come to mind is someone's personal online opinionated notes on Facebook or Twitter. However, there is much more to blogging than that which meets the eye. Blog a term which is derived from weblog (web diary) has become a calling for some companies to push their business and a strategy for top journalists to document their media. Recent advancements in blogging platforms have become attractive and the mobile industry is working hard to keep up with the times on their devices. We built a basic blogging platform using the scripting language for web development PHP and the database MySQL together with the Apache server. The platform allows the administrator (blog owner) to post and modify blog entries and supports a community of users around the blog. The platform implements basic tools of dynamic websites. These include personal user accounts, ability to post comments, displaying online community of users, etc. While designing how user accounts are to be implemented, we encountered and resolved many security issues involved in handling sensitive user data and allowing user access to website content. We plan to continue adding on more sophisticated features. Our future plans include adding a forum and a chat to the platform to allow real time interaction for the online community of users. We will also delve deeper into security issues to prevent unauthorized individuals from gaining access to information associated with the site. Finally, we will consider the issues surrounding optimizing the computing resources employed such as eliminating unnecessary overhead with the database and the server.

Title: Fusion-Fission Reactors and Nuclear Waste
Student Researcher: Alan Markov
Faculty Mentor: Prof.. B. A. Gelman

The continuing economic growth and development depends on developing environmentally clean and safe sources of energy. One of such sources is the energy stored in atomic nuclei. This energy is due to the strong interaction between the constituencies of a nucleus---neutrons and protons. Two different processes are used to extract the nuclear energy---fission and fusion. In fission, a heavy nucleus splits in two lighter nuclei while in fusion two lighter nuclei combine to create a heavier nucleus. The former process is the foundation of the chain reaction used in nuclear power plants for energy generation. Nuclear fusion process liberates much larger amount of energy, but it requires an extremely high temperature which prevents it from being used on a commercial scale at present time. Nuclei which are produced in a nuclear fission are radioactive and referred to as nuclear waste. Presently, this waste is stored near in various locations near nuclear reactors. In this project, I research currently proposed methods of addressing the issues related to the nuclear waste. In particular, I focus on a proposed mechanism of fusion-fission reactors.

Title: Nuclear Fusion and Stellar Nucleosynthesis
Student Researcher: Boris Santos
Faculty Mentor: Prof. Boris Gelman

An atomic nucleus is a complex interacting system of neutrons and protons collectively referred to as nucleons. These nucleons are held together by a powerful force---the nuclear or strong force---which is one of the four fundamental interactions in nature. As a result, an atomic nucleus is a great source of energy. One manifestation of this energy is the radioactive decay of certain nuclei which was observed even before the discovery of a nucleus itself. Nuclear energy can be librated and used for peaceful

purposes using two processes---fission and fusion. In this project, I explore the nuclear structure and interactions responsible for fission and fusion. In addition, I study how thermonuclear fusion in stars produces heavy chemical elements from the light ones. Activities:

1. Two weekly meetings with an advisor, on Tuesdays and Thursdays, for total of about two hours. These meetings consist of discussion of relevant material.
2. Three to four hours per week of independent research. Books I use include, E. M. Rogers, *Physics for the inquiring mind*, (Princeton University Press, Princeton, 1966); V. Acosta, C. L. Cowan, B. J. Graham, *Essential of Modern Physics* (Harper and Row, New York, 1973).

Title: Superfluidity of Magnetoexcitons in Bilayer Graphene
Student Researcher: Gary Mai
Faculty Mentor: Prof. Oleg Berman

Graphene, which has two-dimensional honeycomb structure of carbon atoms, is exceptionally strong and versatile. Its unusual properties make it ideal for applications that are pushing the existing limits of transistors, microchips, chemical sensing instruments, biosensors, ultra capacitance devices, flexible displays and other innovations.

Title: Bose-Einstein Condensation of Trapped Polaritons in Graphene in a High Magnetic Field
Student Researcher: Lucas Salzwedel
Faculty Mentor: Prof. Oleg Berman

Recent advances in fabrication techniques have made it possible to produce graphene, which is a two-dimensional (2D) honeycomb lattice of carbon atoms forming the basic planar structure in graphite. Graphene has stimulated considerable theoretical interest as a semimetal whose electron effective mass may be described by an unusual massless Dirac-fermion band structure. Graphene has a number of interesting properties as a result of its unusual band structure which is linear near two inequivalent points in the Brillouin zone.

Title: GalaxyStats.com project
Student Researcher: Hussain Akbar
Faculty Mentor: Prof. Ari Maller

The sizes of galaxies are one of their most basic properties and thus can give us great insight into their formation. We have gathered together all of the available measurements on galaxy sizes in the literature to compare them to one another and determine what is really known about galaxy sizes. What is well known is that galaxy size is a strong function of galaxy luminosity and we here examine this relation and how it depends on the wavelength that the luminosity is measured in and the morphological type of the galaxy. These results have been added to the website www.GalaxyStats.com so that other researchers can use them in constraining their theoretical models.

Title: A Simple Model for Dark Matter
Student Researcher: Jiarong Mei
Faculty Mentor: Prof. Giovanni Ossola

For this research project, I have decided to study Dark Matter (DM). I am going to identify its characteristics, review the experimental evidence for this invisible kind of matter, while critically analyzing its behavior. Also, I will study the competing roles of matter and energy in the current picture

of the Universe, in order to understand the differences between the concepts of dark matter and dark energy. In order to further develop my understanding of dark matter, I will first build a toy-model of how dark matter works, and use the knowledge I have gained through physics class to calculate the velocities at which matter rotates in galaxies. This is one of the most striking facts in support of the idea of dark matter. I will sum up all the research data from the calculations, books, and videos and present it on a poster at the end of this semester. The research project could be continued in the next semester, by studying the current candidates for dark matter and how these theories can be tested at the Large Hadron Collider.

Title: Raman Scattering: Concepts and Applications
Student Researcher: Thinh H Le
Faculty Mentor: Prof. Lufeng Leng

Raman scattering is a non-linear process in optical fiber which has played an important role in amplification of light signals in optical communication. The main objective of this project is to understand the physics of Raman scattering and Raman amplification processes. Applications of Raman amplification, which are Raman amplifiers, and their advantages are also explored in the project. Furthermore, the mathematical model of Raman amplification is understood and implemented with a Matlab code as well.

Title: The Moral Basis for Treating Juveniles as Adults: An International Perspective
Student Researcher: Jesse Lyon
Faculty Mentors: Profs. Jean E. Kubeck, Vera Albrecht (LaGCC)

Juvenile justice is an important area of law, with far reaching consequences. Young offenders could become productive citizens or, conversely, recidivist criminals depending in part on how they are processed in penal system. While it is not the only consideration, the fact that these individuals are children is of paramount concern to some. To others, it is the punishment for the crime that matters, not the defendant's age or prospects for rehabilitation. The purpose of this project is to give an international perspective on the age at which children in conflict with the law are punished as adults, or are given a chance for rehabilitation in an age-appropriate system.

Two aspects of juvenile justice, Minimum Age of Criminal Responsibility (MACR) and Minimum Age of Transfer (MAT) are focused upon. MACR is the age at which a child can be held legally responsible for unlawful action. The second concerns the age at which a child can be prosecuted in criminal or "adult" court, referred to as Minimum Age of Transfer (MAT). Records were searched for all independent countries in the world and at least partial data were obtained for 99 of 195 countries.

MACR is fairly high for most of Europe. European juvenile justice tends toward a welfare-based approach where the focus of the juvenile courts is on the young offender, rather than on the crime they committed. However, MACR varies greatly from country-to-country. For example, France and many of the states in United States have no MACR. MACR in Mexico is six-years-of-age but in Luxembourg and Brazil, MACR is age eighteen (when legal adulthood typically begins).

MACR is related to MAT and, as the data show, children are often treated as adults long before reaching legal adulthood. Countries with a lower MAT tend to take a more retributive approach to juvenile justice,

where emphasis is placed on the severity of the crime committed, not the offender's age or prospects for rehabilitation. In the United States, children as young as thirteen (and sometimes younger) are tried as adults. It was not until Roper V. Simmons in 2005 that the U.S. Supreme Court deemed the execution of defendants under age eighteen unconstitutional.

There are also gender based disparities in certain regions in MACR and MAT. In Saudi Arabia, where a sentence may include amputation, there exists a MACR for boys but not for girls meaning that girls could technically be tried as infants whereas boys would not be tried until their MACR. Similarly, in Iran the MACR is fifteen for boys, but only nine for girls.

In 1989, the United Nations advanced their previous work on children's welfare with *The United Nations Convention on the Rights of the Child.* This document outlines universal children's rights and rules for the administration of juvenile justice. It also calls for eighteen as the age at which legal adulthood should begin, making that the Minimum Age of Transfer in those countries that choose to ratify it. Oddly, the document does not recommend a specific Minimum Age of Criminal Responsibility, but it does.

Title: Visual Perceptual Factors in Three-Dimensional Block Construction
Student Researchers: Mikhail Petrychenko, Mei Fong Wong
Faculty Mentors: Profs. Daniel Capruso, Holly Carley, Kara Pasner

Objective: To determine the effects of spatial vision and perception of line junctions on the ability to construct a three-dimensional object.
Background: The construction of a three-dimensional object to copy a model has long been used to measure the perceptual and executive functioning of the human brain. In recent decades, two-dimensional mosaic block tasks such as the Block Design subtest of the Wechsler Intelligence Scales have largely supplanted the use of three-dimensional tasks. This study was an attempt to revive use of three-dimensional constructional tasks in the measurement of human cognition. Experimental hypotheses were that (1) Spatial vision would predict constructional performance; and that (2) Visual attention would be concentrated on trihedral line junctions as these areas contain the greatest amount of depth information.
Design/Methods: Subjects were 30 normal college students (11 male, 19 female). Mean age was 25 years (SD = 7.45), with range from 18 to 49 years. All had near-point visual acuity of 20/50 or better in at least one eye. Spatial vision was measured using Benton's Judgment of Line Orientation test. Subjects were given 15 bonded sandstone blocks and asked to construct a solution to copy a stimulus model presented as an axonometric projection on a computer monitor. The stimulus model featured block and planar line junctions, but no shadows. The completed solution was scored for number of blocks correctly placed.
Results: Perfect constructional performance was attained by only 53% of the sample (M = 10.93, SD = 4.97). Many of the incorrect solutions offered by subjects represented gross spatial distortions of the stimulus model. There was no correlation with age, r = -.01, not significant. The association of spatial vision and three-dimensional block construction was weak, r = .23, not significant. Convex dihedral angles and planar surfaces, rather than concave trihedral angles, were the areas of greatest visual interest to subjects.
Conclusions/Future Directions: Only half of normal subjects were able to construct a three-dimensional 15 block design. Future studies need to determine which factors led to constructional limitations. Subject difficulty in interpreting an axonometric projection of the design may have limited accurate performance. Use of a photographic or actual physical stimulus model may yield different results.