



Book of Abstracts

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Title: Exterior Development [DURA Solar Decathlon 2015]

Student Researchers: Desiree Andrade, Farhana Rahman, Alondra Ramos and Aura Tejada

Faculty Mentor: Prof. Alexander Aptekar

Department: Architectural Technology

Problem posited by the Department of Energy: How to design, build and transport a net-zero solar powered house that is fiscally attainable and sustainable? This project exhibits the design of a façade, ramp and planters working in conjunction with structural components of a modular residence. Challenges we will encounter range from the design, to the mechanics of making an eco-friendly home and weather durable façade that is also easily transported from New York City to Irvine, CA.

FAÇADE: The Solar Decathlon competition, which takes place in October 2015, requires each team to design and build a cost-effective, energy-efficient, and attractive home. Besides the obvious challenges that come with building a structure, another main challenge is building the DURAhome in under 2 weeks, which is one of the Solar Decathlon competition rules. Due to these time constraints, the DURA team will be building the house at the Brooklyn Navy yard and disassembling it in pieces to be able to transport it in trucks across the country to Irvine, CA. The difficulty with this is finding a secure way to transport already done pieces of the home, like the façade, in a secure way for it to arrive in California ready to be inserted in its place.

RAMP AND DECK : DURAhome ramp and deck must meet ADA requirements, help support the weight of the planters and must be adjustable to fit it any place so as to be able to be placed on a sloped site. The main goal of the ramps design is to avoid having to use an extra footing, which will be cost effective.

LANDSCAPE: DURAhome embraces a new kind of living by using recyclable and sustainable materials. DURAhome aims to bring awareness of a new healthy life style by prioritizing healthy habits while also minimizing a carbon footprint. The planters surrounding the DURAhome will be constructed of wood, as is the entire structure of the DURAhome.

Solution: DURAhome façade will be built at the Brooklyn Navy yard and disassembled in pieces which will be secured in a truck with cables and custom-made tools to control the location and/or motion of the façade while the truck is moving. The route to Irvine, CA has been thoroughly examined to avoid high slopes and other undesirable situations. The ramps' length was adjusted to fit both the slope in the New York city and the California site. The ramp also meets both states' code requirements and is structurally fit to hold the planters' weight. The DURAhome landscape will have a variation of vegetation which will be placed according to the users' needs. Aromatic plants will be grown in the front porch to provide a more welcoming and relaxing entrance. The back porch, which has an entrance to the kitchen, will have the vegetable garden so that it's easily accessible to anyone cooking. Plants are an essential part of our ecosystem and it is now widely accepted that plants also have the ability to improve outdoor air quality by removing airborne toxins and releasing oxygen. A challenge was designing multipurpose planters. To solve this, a planter was created to also serve as storage space and include an irrigation system that will water the plants by gravity. The rest of the planters were designed to act as a support system for the handrail.

Title: Augmented Reality – The Role of AR in DURA Home
Student Researcher: Nwaram-Billi H. Ugbode
Faculty Mentor: Prof. Alexander Aptekar
Department: Architectural Technology

The scope of this project is to discover varying uses of AR models—in particular, ways in which said models may be integrated in the construction of DURA Home to make the visitors’ learning experience less didactic and more experiential.

The ability to control your home from wherever you may be with the use of your smart mobile device (e.g. Smartphone, iPad or other devices utilizing an advanced mobile operating system) is fast becoming the norm for most people as our lifestyles become increasingly digitalized.

DURA Home (New York City College of Technology entry for the Solar Decathlon) will incorporate home automation hardware by *Smart Things*, such as interior room trackers and a centralized HUD to gather live information generated as the home is operated (i.e. light levels, interior temperature and humidity levels inside vs. outside)

DURA Home will also utilize AR software *Juniao*—an Augmented Reality browser application developed by Metaio (www.metaio.com/products/juniao) to bring the experience of visitors who are either inside or outside the home to life, with 3d models, renderings and animated .gifs that further elucidate the inner workings of this sustainable **D**iverse, **U**rban, **R**esilient and **A**daptable home.

Title: Precedent Studies
Student Researcher: Edisson Garcia
Faculty Mentors: Profs. Jill Bouratoglou and Lia Dikigoropoulou
Department: Architectural Technology

Precedent Documentation: Gather the precedent study work of many semesters and compile into a document.

Precedent Analysis: Develop clear diagrams showing the nine different methods of analyzing each building with written text.

As designers we benefit from a comprehensive understanding of precedents. We use diagrams to convey information and relationships in a building. By researching and examining examples of similar work, and similar conditions we evaluate and interpret and translate for our own use.

The nine areas of analysis are: Massing, Hierarchy, Geometry, Symmetry, Approach and Circulation, Natural Light, Structure, Public versus Private, and Parti (Concept).

Title: 11 Broadway, Past and Present
Student Researcher: Aaron Hollander
Faculty Mentor: Prof. Joseph Humann
Department: Architectural Technology

Sitting next to the famous charging bull statue at Bowling Green, 11 Broadway clearly has a prominent location. Today it is a bustling office building, with many workers passing through its doors. Is the building itself significant in any way? When was it built, and why? In what style? Is there anything it can teach us about buildings, construction, or materials? Is it utterly forgettable or worth preserving into the future? Through site visits, library research, and other methods, this project attempts to answer these questions and help us learn more about the architectural history of New York City. As an early example of an “office” building, and one that is still in use today we see early innovations in the type, what is different about offices today, how building adapt with the times.

Title: The Effect of Garlic on *Tetrahymena Thermophila* Gene Expression
Student Researchers: Oluwatobi Ajayi and Leslie Brown
Faculty Mentor: Prof. Ralph Alcendor
Department: Biological Sciences

Tetrahymena thermophila is a type of free-swimming freshwater protozoan that are surprisingly useful for multiple interesting functions in biology. They are predatory species that will take in anything that fits in their “mouth” or oral apparatus. These cells have cilia all over their external surface. The cilia help get them through their environment and also help get food into their “mouths”. *T. thermophile* is well established as a model for studying eukaryotic cells. Garlic, *Alluvium sativum*, is well known all over the world, not only for its flavor in food, but also for its health benefits. Numerous studies have shown that garlic is good for diabetes, chronic inflammation, parasitic and bacterial infections and heart diseases. Although the number of cell and animal models used for studying the effect of garlic is significant, there are very few studies using *T. thermophila*. Therefore, the goal of this project was to examine the effect of garlic on *T. thermophila*. We hypothesize that garlic would increase the expression levels of genes involved in key cellular processes. Cells were exposed to various concentrations of filtered garlic for 30, 60 and 120 min. Expression levels of GAPDH, a gene involved in glycolysis, and catalase, MnSOD, GAPDH, TRX and PRX, genes involved in oxidative stress, were examined. Our results showed that both sets of genes were differentially affected by the concentration and duration of exposure to garlic. The expression level of GAPDH decreased after 30 and 60 minutes of exposure but increased when cells were exposed to 120 minutes of garlic. On the overhand MnSOD, Trx and Prx expression levels increased at 60 and 120 minutes of exposure. Catalase expression only increased at 120 minutes of exposure. These results suggest that garlic differentially affects the expression levels of genes involved in important cellular processes.

Title: Effect of Unfiltered Garlic on *Tetrahymena Thermophila*

Student Researcher: Jeff Toussaint

Faculty Mentor: Prof. Ralph Alcendor

Department: Biological Sciences

Tetrahymena thermophila are ciliated protozoan that thrive in fresh water environment. *T. thermophila* is an organism which has binuclear dimorphism: that is the special characteristic of having two different kinds of nuclei in a cell. They have a bigger, non-germline macronucleus and a small, germline micronucleus in each cell at the same time. The macronucleus is transcriptionally active while the micronucleus is active only during conjugation. This unique versatility allows scientists to use *Tetrahymena* to identify several key factors regarding gene expression and genome integrity. In addition, *Tetrahymena* possesses hundreds of cilia and has complicated microtubule structures, making it an optimal model to illustrate the diversity and functions of microtubule arrays. Garlic or *Allium sativum*, has been used by humans for thousands of years and originated in Asia. The primary benefit from garlic comes from the release of the molecule Alliin. Alliin releases hydrogen sulfide, which gives garlic its unique smell and taste. Garlic contains germanium and selenium, which are sulfur-containing antioxidants that boost the immune system. Garlic also contains antioxidants that support the body's protective mechanisms against oxidative damage. High doses of garlic supplementation have been shown to increase antioxidant enzymes in humans. The purpose of this experiment were to examine the effect of garlic on *T. thermophila* ability to survive in oxidative stress. These cells can survive under harsh conditions such as high temperature, low oxygen levels, and several other stresses. Garlic provides protection from oxidative stress, therefore examining how garlic affects these cells can provide very interesting information. Genes such as MnSOD (Manganese superoxide dismutase), catalase, GAPDH (Glyceraldehyde 3-phosphate dehydrogenase), TRX (Thioredoxin), and PRX (Periredoxin) were examined for expression levels when cells were exposed to unfiltered garlic. MnSOD is a mitochondrial enzyme that plays a key role in protecting the cell from oxidative damage. Catalase is a key antioxidant enzyme in the body that fights against the toxic form of oxygen. Both TRX and PRX are redox proteins known to function in neutralizing the toxic form of oxygen. In our experiment we exposed *Tetrahymena* to unfiltered garlic for 30 minutes, 1hr and 2 hrs. mRNA expression of these genes were then analyzed. Unfiltered garlic resulted in increased levels of MnSOD, TRX and PRX. On the other hand GAPDH expression levels showed some reduction. These results suggest that garlic can affect important genes in *T. thermophila*.

Title: Molecular Evolution of the Rattlesnakes

Student Researcher: Serifat Adebola

Faculty Mentor: Prof. Christopher Blair

Department: Biological Sciences

We utilize multi-locus DNA sequence data to better understand the evolutionary relationships and divergence times of rattlesnakes to determine if rattlesnakes show signs of elevated speciation during Pleistocene glaciations or if diversification was a result of older geologic or climate processes. We also test the hypothesis that choice of tree prior (Yule versus coalescent) influences phylogenetic relationships, node support, and divergence times. We assemble a multi-locus data set from GenBank consisting of the nuclear genes RAG-1, C-mos and NT3 and the mitochondrial genes (ATP6,8 and cytochrome b) for the majority of *Crotalus* species and both species of *Sistrurus*. Sequences from the closely related *Agkistrodon* are also included for temporal calibration. Bayesian phylogenetic analyses indicate that rattlesnakes diverged from

Agkistrodon ~20 Mya and diversification within *Crotalus* began ~12 Mya. The majority of speciation occurred prior to Pleistocene glaciations suggesting the importance of older evolutionary processes. We also find evidence for undescribed species of rattlesnakes. Substantially different results are obtained using different tree priors, with a coalescent prior generally yielding more recent divergence times and higher support for relationships, most of which are concordant with other recent studies. Our results suggest that further systematic work for rattlesnakes is needed, and that a coalescent tree prior may be more suitable for data sets consisting of multiple individuals for multiple species.

Title: Molecular Characterization of “Deep -Sea Anemones” from the Arctic

Student Researchers: Craig Dawes and Omnia Hassan

Faculty Mentor: Prof. Mercer Brugler

Department: Biological Sciences

Sea anemones (Order Actiniaria) are aquatic animals that belong to the phylum Cnidaria, a group that also includes corals, jellyfish and hydras. These benthic marine polyps attach to rocks and dock pilings; some are even found living on the shell of hermit crabs or in a symbiotic association with fish. Anemones have historically been classified based on their physical traits, or absence thereof. A recent genetic comparison of these animals revealed new relationships and modified preexisting, morphological-based hypotheses, leading to a reclassification of the order and further changing our understanding of these understudied relics of the sea. As part of an ongoing effort to elucidate the diversity of sea anemones, we recently collected three specimens that were tentatively identified as *Kadosactis rosea*, *Allantactis parasitica* and an unknown species, the latter of which is presumed to be a member of the order Actiniaria. These samples were collected from the Beaufort Sea, outlying the Arctic Ocean, at a depth of 1,000 meters. Using three genetic markers, mitochondrial 12S rDNA, 16S rDNA and *cox3*, we sought to confirm the morphological identification of the first two specimens and reveal the identification of the third specimen. Future work will place these three species in a phylogenetic context.

Title: A Bootstrap-Based Repository for Epigenetic Signature of Autoimmune Diseases

Student Researcher: Janatul Mawa

Faculty Mentor: Prof. Evgenia Giannopoulou

Department: Biological sciences

Epigenetics refers to heritable changes in gene activity, without changes in genotype. Epigenetic changes, such as DNA methylation and histone modifications, can modify gene activities, without altering DNA sequences. Methylation involves small molecules called methyl groups, which are added to specific genomic regions, turning genes on or off. Another epigenetic mechanism is the modification of histones such as acetylation and methylation. Modifications of the histone tails regulate the accessibility of transcription factors.

These modifications, mainly located on lysine and arginine residues, are called marks and together determine the histone code, which may regulate transcriptional activation; certain autoimmune rheumatic diseases like systemic lupus erythematosus (SLE), rheumatoid arthritis (RA) and Scleroderma and Systemic Sclerosis (SSc), have been linked to epigenetics modifications such as DNA methylation. Our goal is to create an *online repository for*

epigenomic signatures of autoimmune-related diseases (e.g. RA, SLE and SSc) collected from the literature.

We use Bootstrap (<http://getbootstrap.com/>), a free, powerful and user friendly interface for fast and easy web development, to design and develop a front-end for the repository. We use HTML and CSS-based design templates for common user interface components like Tables, Navigations, Dropdowns, and Tabs. This repository, which will be continuously populated with epigenomic signatures, will assist researchers interested in understanding the epigenetic implications of autoimmune rheumatic disorders and elucidating their pathogenesis.

Title: Studying DNA Methylation of Lupus in Identical Twins

Student Researcher: Dhavin Singh

Faculty Mentor: Prof. Evgenia Giannopoulou

Department: Biological Sciences

Since the completion of the Human Genome Project in 2003, a wealth of knowledge has been accumulated regarding diseases and the genes that code for them. To fully understand the complexities of the human genome, *Next Generation Sequencing (NGS) technology* has been employed. Here, we analyze NGS data from *Reduced Representation Bisulfite Sequencing (RRBS-seq)*, a technology used to systematically capture the genome-wide methylation profiles on a single nucleotide level. The evidence for potential role for DNA methylation in SLE comes from studies in which small compounds that cause decreased DNA methylation induced lupus like symptoms and lead to the production of autoantibodies in humans and animal models.

Title: Visualization Methods of Personal Genomics

Student Researcher: Anwar Uddin

Faculty Mentor: Prof. Evgenia Giannopoulou

Department: Biological Sciences

There are many diseases that do not have a specific means of treatment or prevention across all individuals. Precision, or personalized medicine, is a surfacing approach for the treatment of several diseases including cancer, takes into account an individual's genetic variability, lifestyle, as well as environmental factors. Precision medicine aims to detect changes and patterns in diseases that may lead to the discovery of a personalized therapy. Genetic variation is a key aspect since it allows for the understanding of traits, genetic indicators of heredity and ancestry. Any two individuals are 99.9% genetically alike and 0.1% different, while the human genome consists of approximately 3 billion nucleotides. Therefore the 0.1% genetic variability can affect a huge number of nucleotides. One of the most common variabilities is Single Nucleotide Polymorphisms (SNPs): a nucleotide changes into another. Other genetic variations include Insertions/Deletions (Indels), Repeat polymorphisms, Copy number variations (CNV) and structural variants (SVs). One of the goals of Precision Medicine is to capture the genetic variabilities in each patient, which may be linked to specific diseases, and potentially suggest a personalized therapy. In this project, we study the visualization methods used in a precision medicine setting, to depict SNPs as well as other types of genetic variations. We review the literature to find tools and programs used for the visualization of personal genomes. In particular, we describe tabular views, genomic browsers, ideograms, as well as functional maps

and plots. For each of these visualization methods, we summarize their use and functionalities, and present their advantages and limitations.

Title: Organophosphate Induced Delayed Neurotoxicity [OPIDN]

Student Researcher: Victor O. Adedara

Faculty Mentor: Prof. Niloufar Haque

Department: Biological Sciences

The nervous system regulates body function. Its normal development affects all body physiology, metabolism and growth. Dichlorvos is highly toxic by inhalation, dermal absorption and ingestion. Because Dichlorvos is volatile, inhalation is the most common route of exposure. As with all organophosphates, Dichlorvos is readily absorbed through the skin. Skin, which has come in contact with this material, should be washed immediately with soap and water. Acute illness from Dichlorvos is limited to the effects of cholinesterase inhibition. Compared to poisoning by other organophosphates, Dichlorvos causes a more rapid onset of symptoms, which is often followed by a similarly rapid recovery. This occurs because Dichlorvos is rapidly metabolized and eliminated from the body. A Person with reduced pulmonary (lung) function; convulsive disorders, liver disorders, or recent exposure to cholinesterase inhibitors will be at increased risk from exposure to Dichlorvos. Our study was conducted to study the effect of Dichlorvos 3mg/kg b.w applied dermally, daily for 27 days on the CNS of hen. The following regions were studied: Cerebral, Hemisphere, Cerebellum, Optic Lobe, Brain Stem and Spinal Cord. Total lipids showed significant increase ($P < 0.001$) in all regions of the CNS studied. The phospholipid content showed significant decrease in all the regions of the CNS. The cholesterol content showed a significant increase ($P < 0.001$) in all regions except Optic Lob, there was no change. The alteration in the ganglioside profile showed a significant increase ($P < 0.001$) in all regions. The rate of in the lipid peroxidation showed a significant decrease in all region of the CNS. Study of gene regulation at different time points will provide an interesting insight into the brain plasticity and neurogenesis at the developmental level. Further studies to study the long-term effect of Dichlorvos in different species is underway.

Title: Motivation in Microbiology: How can Peer Led Team Learning Help with Student Motivation

Student Researcher: Faizan Malik

Faculty Mentors: Profs. Janet Liou-Mark and Davida Smyth

Departments: Biological Sciences and Mathematics

Our previous studies have shown that students struggle with reading the textbook in biology. The reasons for this include, lack of student interest, lack of student reading skills, and difficulties with scientific vocabulary. One of the approaches to helping our students to read at City Tech is through the use of peer led team learning to introduce reading skills to the students. The workshops have been applied to the students in Biology 1101 and have shown some promise. To try and reach a larger audience, these workshops have been expanded, and implemented in the library, offering workshops everyday. Despite all our efforts, few students have attended the workshops despite their need. This leads us to ask the question, how can we motivate students to take control and actively address their struggles with reading in microbiology.

This project explores some of the techniques that we've used to encourage students to attend, what strategies could be used to motivate microbiology students (how we've learned from previous semesters) and how we could encourage students to attend in future semesters.

Title: Difficult Vocabulary and Peer Led Team Learning Workshops

Student Researcher: Janatul Mawa

Faculty Mentor: Profs. Janet Liou-Mark and Davida Smyth

Department: Biological Sciences and Mathematics

Our studies have shown that students struggle with reading the textbook in biology. The reasons for this include, lack of student interest, lack of student reading skills, and difficulties with scientific vocabulary. One of the approaches to helping our students to read at City Tech is through the use of peer led team learning to introduce reading skills to the students. The workshops have been applied to the students in Biology 1101 and have shown some promise. To try and reach a larger audience, these workshops have been expanded, and implemented in the library, offering workshops everyday. This semester, we have also attempted to recruit microbiology students to attend the workshops. In microbiology, an area of major difficulty is scientific vocabulary and the names and classification of organisms.

This project explores some of the techniques that we've used to encourage students to be able familiar with and understand the scientific vocabulary associated with microbiology, what strategies could be used for microbiology vocabulary and what others are doing to help students with vocabulary.

Title: Cloning and Expression of Human Taste Receptors

Student Researcher: William Bennett

Faculty Mentor: Prof. Jeremy Seto

Department: Biological Sciences

The human taste receptor Tas2r38 is a model system in biology education to demonstrate heredity and sequence structure/function. This taste receptor function is non-essential to survival and displays classic Hardy-Weinberg equilibrium. The single exon gene will be amplified from DNA samples of non-tasters and super-tasters and subcloned into an expression vector to observe the functionality of the protein to external stimuli. This receptor also has a correlation with respiratory infecting bacterium. The use of fitness models can better help demonstrate the potential benefits and harms of having the allele for this taste receptor.

Title: Protein Interaction Networks from Mouse Forebrain Sample Following T. Gondii Infection

Student Researcher: Emmanuel Coulanges

Faculty Mentor: Prof. Jeremy Seto

Department: Biological Sciences

Recent studies done on animal models have shown that cephalic infections by *Toxoplasma gondii* considerably regulate putative genes, in addition to effects on human beings manifested as flu like symptoms, mental retardation and death in immuno-compromised individuals with no

cure for any of these infections. However, while a few studies analyzed this pathogenesis in animal models with brain infection using transcriptome analyses (microarray, RNA-seq), very limited studies specifically explore the protein interaction in an animal with cephalic infections. The purpose of this proposed study stands as developing a protein interaction network from brain infected mouse forebrain samples with *T. gondii* during acute and chronic phase. This micro-organism is an obligate intracellular parasite that invades a wide range of vertebrate host cells to ultimately cause chronic infections with its cysts when they modulate neuronal function directly or indirectly. Our preliminary translational network analysis of previous data points to signaling pathway modification in the host brain during acute phase. Further analysis of ontological networks and translational network from transformed cells line will help in testing this hypothesis. Conducting this study will help researchers understand the basic theoretical framework of Molecular Biology, as well as having rudimentary exposure to laboratory techniques in this field and to fulfill partial requirement for Bioinformatics course. The outcomes of this research may facilitate the development of appropriate hypothesis testing paradigms of protein interaction network in the context of cephalic infections in animals. Moreover, the results of this study may benefit medicine at large in the way the findings will apply to human cell brain infections.

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Title: Differential Gene Expression In a Neuron-Like Culture

Student Researcher: Daenna Joseph

Faculty Mentor: Prof. Jeremy Seto

Department: Biological Sciences

PC12 cells are derived from the Pheochromocytoma of the rat adrenal medulla. They have their own embryological origin with neuroblastic cells, which make them easily differentiate into neuron like cells. PC12 cells share properties similar to neurons, specifically releasing neurotransmitters by vesicles. The ectodermal lineage of PC12 cells reveal a neuronal phenotype when treated with Nerve Growth Factor (NGF). These signals result in gene expression changes that occur when differentiating and provides a unique opportunity to understand a genetic switch in a program that balances a mitogenic versus mitostatic outcome. This study will look at the changes during the time course of this genetic switch using quantitative Real-Time PCR to better understand the opposing pathways.

Title: Effects of Sequence Change in the Structure of C-Lignin

Student Researcher: Veronica Elizabeth Hurtado

Faculty Mentor: Prof. Mai Zahran

Department: Biological Sciences

Lignin is an amorphous polymer that binds to cellulose fibers and provides structural integrity to the cell wall of plants and it represents a steep challenge in the conversion of plant biomass into liquid transportation fuels. [1]. A new type of lignin called C-lignin was discovered from vanilla seeds containing a Catechyl homopolymer. However, information of the molecular structure of C-lignin and how it varies to “normal lignin” is currently lacking. Computer simulation is a powerful tool for complementing experiment in obtaining an understanding of the molecular-level structure and dynamics of C-lignin. This research investigates the conformations, shape, rigidity and chemical groups exposed based on the three dimensional (3D) of C-lignin. My results will be compared to data from Oak Ridge National Laboratory where the main research experiment is being conducted.

Title: Computational Design of a Drug Against Alzheimer Based on VEGF-D

Student Researcher: Christopher Mason

Faculty Mentor: Prof. Mai Zahran

Department: Biological Sciences

VEGF-D is a part of vascular endothelial growth factor family. VEGFs' family normally function as creators of new blood vessels in the body. When VEGF-D found to be overexpressed, it can contribute to diseases like cancer by supplying the necessary blood supply to the tumor. Recently VEGFD has been found to regulate the total length of dendrites [1]. The study was done with applying VEGFD through intraventricular injection to bypass the blood barrier in the mice brain.

The goal is to understand the interaction of VEGFD with its receptor but there is a lack of data on these molecules interaction. So we are modeling the interaction of VEGFD with its receptor and performing molecular dynamics simulation to identify the conformation flexibility and conformation ensemble of VEGFD complexed to its receptor VEGFR-3 domains D1-2.

In addition due to the potential ability of VEGFD in curing neurodegenerative disease such as Alzheimer, we are modeling peptides that would replicate the interactions of VEGF-D, together with chemists [2]. We will analysis the interaction between each modeled peptide/receptor to compare to the strength of interaction of VEGF-D/receptor to be test experimentally.

Furthermore, in the long run observing how the VEGF-D/receptor moves over time will give us a deeper understanding of how it performs its function and may propose further research to examine the dynamic behavior of VEGF-D.

[1] Mauceri, D., Freitag, H., Oliveira, A., Bengtson, C., & Bading, H. (n.d.). Nuclear Calcium-VEGFD Signaling Controls Maintenance of Dendrite Arborization Necessary for Memory Formation. *Neuron*, 117-130.

[2] D'andrea, L. (2005). Targeting angiogenesis: Structural characterization and biological properties of a de novo engineered VEGF mimicking peptide. *Proceedings of the National Academy of Sciences*, 14215-14220.

Title: Copper Binding Properties of Chelating Polyphenols

Student Researcher: Rebecca McCurdy

Faculty Mentor: Prof. Alberto Martinez

Department: Chemistry

Every 4 seconds there is a new case of Alzheimer's disease (AD), a neurodegenerative disorder. There is no cure for AD and only symptom assuaging medications available. The disease is characterized by the accumulation of Amyloid- β ($A\beta$) plaques and tau protein tangles. There is significant evidence that abnormally high concentrations of copper (Cu^{2+}) contribute to oxidative stress and increase the propensity of toxic $A\beta$ species to aggregate. Metal ion chelation therapy has the potential to be an effective treatment for AD by reestablishing normal physiological level of Cu^{2+} . Five novel metal ion chelating polyphenols (1-5), resveratrol and Clioquinol (CQ) were tested for their ability to bind to Cu^{2+} through spectrophotometric UV-Visible titrations. Results from this experiment suggest that these novel compounds form 2:1 complexes with Cu^{2+} and display a moderate-low binding affinity. The result of these preliminary experiments suggests potential for a future AD therapy and warrants the further investigation of these compounds in vivo.

Title: Engaging Autism Spectrum (ASD) Students in Engineering

Student Researcher: Areeba Iqbal

Faculty Mentors: Profs. Melanie Villatoro and Diana Samaroo

Departments: Chemistry and Construction Management & Civil Engineering Technology

The CUNY Service Corps is a program that brings CUNY students, faculty and staff to work on projects that improve the short and long-term civic, economic and environmental sustainability of New York City. The project has been hosted by Daniel Hale Elementary School under the supervision of Professor Villatoro from the Department of Construction Management and Civil Engineering Technology and Professor Samaroo from the Department of Chemistry, and Ms Narine the Magnet STEM Specialist at the school. The Service Corps project included in-class STEM exposure to 3rd and 4th graders. The purpose of this research was to explore different teaching methods to engage Autism Spectrum Disorder Students in Engineering. Different teaching methods that are effective in ASD classes were researched and implemented in the classroom. One teaching method that is being implemented in the ASD classroom is the E-Word Wall, where students from one classroom are introduced to key engineering terms during each lesson with a definition and a picture. This is an ongoing research project that shows students who are introduced to E-Word Wall in each lesson are more engaging with engineering terminology than students who are not introduced to E-Word Wall during lessons. ASD students generally give strong responses to visual images including visual representation and/or written words, especially when they access it via a computer. The E-Word Wall make students more attentive and interested while learning new engineering vocabulary.

Title: Spherical Aerial Craft for Navigation Aid
Student Researcher: Jean Delgado-Caceres
Faculty Mentor: Prof. Xiaohai Li
Department: Computer Engineering Technology

In this project we aim to design and develop a spherical aerial craft for assistive navigation system that can aid people who have difficulty in navigation due to physical impairment or environmental constraints. For a reliable use, we propose a novel design to make the aerial vehicle crash free. As a result, the person in control of this platform will receive a live feedback of the surrounding environment for the navigation. Previous studies have shown that a platform of this capacity is achievable; however weight distribution and material characteristics can yield different outcomes. In order to achieve a crash-free platform, a robust outer frame that utilizes the gimbal idea will be developed. This frame will play a critical role in protecting the electronics and computing components inside, for which a series of meticulously tests are to take place to determine optimum results.

Title: Modular Quadcoptor for Distributed Coordination
Student Researcher: Victor Liang
Faculty Mentor: Prof. Xiaohai Li
Department: Computer Engineering Technology

In this project we aim to develop a modular quadcopter that can be used in civilian and security applications in urban areas such as landscape mapping, security surveillance, crowd control and emergency response. The quadcopter can be deployed in a team and around the clock to help provide information where traditional air vehicle or land vehicle may not be reachable due to environmental constraints or the danger the scenario possess.

In order to make the quadcopter more efficient to suit a higher performance standard we tested and analyzed the data taken from different experiments. In order to maximize efficiency we modified different parts such as the Electronic Speed Controllers (ESC) of the quadcopter to gain maximum efficiency. The 3d printed quadcopter frame and the firmware modified ESC gave the quadcopter a higher efficiency where the quad copter is lighter leaving more room for payload capacity. The modular design enables the copter to easily expand its functionality and coordinate within the team for different application tasks.

Title: Improving Java Virtual Machine Memory Utilization
Student Researcher: Egor Kozitski
Faculty Mentor: Prof. Raffi Khatchadourian
Department: Computer Systems Technology

When the Java was first introduced, it was meant to replace previous languages with new concepts. However, as the popularity of Java grew, so did the fact that the Java Virtual Machine (JVM) has its own problems, which can slow down or even crash a Java program. An example is the “Stop the World Event”. It first occurs when the space for young generation objects gets filled. Afterwards, the JVM stops all running threads and examines all objects. If the object is unused, then it gets destroyed, but if it is still in use, then it gets moved to the old generation area. My hypothesis is that this slowdown can be prevented by using automatic reference

counting (ARC), which can record the JVM address of objects that are no longer in use. By doing this, we will be able to prevent the JVM from iterating through all objects. This may improve the speed of object transitions from young to old generations, resulting in improved JVM overall performance.

Title: Cloud Security Analysis
Student Researcher: Preeti Gurung
Faculty Mentor: Prof. Xiangdong Li
Department: Computer Systems Technology

Today, the use of cloud technology is commonly seen in business. With the ever growing use of cloud in today's business, we should be concerned about the security it provides, therefore our research is focused on the use of cloud, its purposes and the security advantages it provides.

Title: WebGL
Student Researcher: Hibba Abbas
Faculty Mentor: Profs. Elizabeth Milonas and Marcos Pinto
Department: Computer Systems Technology

The new trend in current websites designs are geared towards improving graphical interfaces. The introduction of WebGL or Web Graphics Library has proved to enhance the users' interaction and experience when they visit a website. The Web Graphics Library (WebGL) is a Javascript application programming interface (API) that can be applied in order to create interactive music videos, games, data visualization, art, 3D design environments, 3D modeling of objects and space, plotting mathematical functions, and creating physical simulations without the use of plug-ins. This project will explore the intricacies of using the WebGL technology to display real-time interactive 3-D graphics in Web browsers which will be able to run on many different devices, such as desktop computers, mobile phones and TVs. The purpose of this research project is to design and implement a Web page that shows advanced 3 dimensional modeling on an application programming interface. This research project will focus on knowledge of several aspects of 3D graphics in browsers using the WebGL technology.

Title: XML Data Transfer in Android Application
Student Researcher: Khachatur Arutyunyan
Faculty Mentor: Prof. Marcos Pinto
Department: Computer Systems Technology

We are going to study and examine android application which allow users to interchange data with Web Services (such as Twitter and Facebook). Our goal is to find out what problems can appear, when the program tries to communicate with the Web Service. Some of the results we expect to find are the limits of connections and time which requires for the process. Also we will try to make a sample Web Service on the local machine to test the app.

Title: Creating Storage in Mobile Devices: iBeacons
Student Researcher: Khadijah Okoh
Faculty Mentor: Prof. Marcos Pinto
Department: Computer Systems Technology

iBeacon is Apples version of the Bluetooth-based beacon concept, which allows Bluetooth devices to broadcast and receive tiny information within short distances. The broadcaster is always advertising a location, while the receiver detects these beacons and do whatever it needs to do based on how close or far it is from them. Normally, the observer is an iOS app, while the broadcaster/transmitter can be one of the popular beacon devices available on the market, a USB Bluetooth dongle, a computer with Bluetooth Low Energy-compatible adapter, an iPad or an iPhone. It consumes extremely low energy (allowing beacon broadcasters and apps to work consuming spending a huge amount of power), making it ideal to deploy applications where proximity is the only meaningful factor. During the process of the research assignment, I did research of information on the iBeacon technology as well as testing it using my own personal beacon. Although I wasn't able to actually code and create my own application for my beacon, due to the timing of the project, I was able to find other software that used less technical procedures to create quick tester apps and wireframes for the beacon.

Title: Mobile Advancement
Student Researcher: Elvis Sanchez
Faculty Mentor: Prof. Marcos Pinto
Department: Computer Systems Technology

Cellar and mobile phone, when they were introduce, became an important milestone in today's technology; it has also help show how fast technology has improve over the years. From big bulky phones to the thinnest phones that can fit inside your pants, mobile devices has drastically change into what is now seen today. Also, thanks to other features, such as the internet, social media, and mobile gaming and applications, the mobile market is an important one to keep hold on, in order to success in the technological field.

Title: Estimating Risk Costs in Construction
Student Researcher: Amanda Hayley Abrew
Faculty Mentor: Prof. Sean O'Brien
Department: Construction Management & Civil Engineering Technology

The allocation of risks in a construction project can significantly influence the behavior of the project participants and the impact of project performance or completion and financial costs. Risk management is essential to construction activities in minimizing losses and enhancing profitability. The construction industry perceives its own processes, procedures and relationships as the greatest risks to a project. However, the contractor has the ability to control risks itself. Estimation risks in construction may arise from inadequate informational details, inaccurate view of the complete project scope and lack of coordination in design discipline. Prior research shows risk analysis and management techniques are rarely used due to a lack of knowledge and concerns with the effectiveness these techniques have for construction industry activities.

Therefore, to reduce or eliminate risk general contractors with the means to do so, should have an incentive to undertake research as part of the strategies to reduce risk associated with their construction business activities. To avert and minimize construction estimation risk, it is required that the team members of the project practice transparency among themselves. This concludes that risk management should deal with events that influence project objectives of cost, time and quality which depend mainly on intuition, judgment and experience far more than the extent to which the industry uses risk analysis and management techniques.

Title: Public Housing Envelope Restoration

Student Researchers: Amanda Hayley Abrew and Claudia Tupayachi

Faculty Mentor: Prof. Sean O'Brien

Department: Construction Management & Civil Engineering Technology

Public Housing is underfunded, poorly maintained, energy inefficient and symbolic of poor government management. As a result, there is insufficient capital to repair or upgrade antiquated systems and other problems that have accumulated in these buildings that are 50-70 years old on average. Poor maintenance has resulted in health related problems, such as mold and poor indoor air quality. All are growing concerns that have yet to be fully addressed by the city of New York. Modernizing the existing housing stock will reduce annual energy expenditures, improve living standards and promote public housing as a beacon of sustainable design in the city. Our research argues that substantial savings in energy costs, a result of *deep retrofit* approach to restoration of public housing, will offset the cost of capital improvements over a twenty year life-cycle. Software will be used to analyze the existing and proposed building envelopes.

The focus is to eliminate construction methods that cause thermal bridging and air infiltration; two areas that contribute to poor energy performance. To perform this analysis, a universally accepted building science known as Passive House will be used to calculate energy efficiency and ventilation requirements. By applying this standard, a reduction in energy use by up to 75% can be expected. Therm tests will show the anticipated surface temperatures and PHPP, Passive House Planning Package, will calculate the annual energy demand based on the building's new facade characteristics. Envelope restoration is a modern approach to developing buildings; it is the practice of creating healthier and more resource-efficient models of construction, renovation, operation, maintenance and lifespan.

Title: Exploring a Laboratory Component in the PLTL Statics Workshops and How it Affects Student Success

Student Researcher: Roger Mason

Faculty Mentor: Prof. Melanie Villatoro

Department: Construction Management & Civil Engineering Technology

The Construction Management and Civil Engineering Technology (CMCE) Department at NYC College of Technology has implemented PLTL Statics since 2012. Statics is a freshman engineering courses with an average of about 50% of students passing with a C or better prior to the implementation of PLTL. The percent of students receiving a grade of C or better has increased continuously from 52.4% in 2012 to 79.5% in 2014; The withdrawal rate has decreased steadily from 33 to 17%. Recognizing the success of the program, the CMCE

Department increased the class hours from 3 to 4 to include the PLTL workshop as a laboratory component of the course. Starting Fall 2015, all CMCE students will benefit from the workshops in statics. New workshop modules are being piloted to incorporate the use of a structures laboratory set with a computer interface to build physical models of the workshop problem.

Title: Defining the Diameter of Micropiles to Increase Structural Capacity

Student Researcher: Sharmin Sultana

Faculty Mentor: Prof. Melanie Villatoro

Department: Construction Management & Civil Engineering Technology

The use of micropiles has grown considerably since their conception in the 1950s. Micropiles have been used as elements for foundation support to resist static and seismic loading conditions. Implementation of micropile technology on projects has been stalled by lack of practical design and construction guidelines. One of the biggest hindrances has been caused by the building codes limiting the allowable capacity of piles and also the undefined diameter of micropiles. This research explores the uses, types, advantages, disadvantages, and codes related to micropiles in search for a way to define the diameter of micropiles to increase structural capacity.

Title: Radios or Sensors – Which is the Best for Semi/Non-Autonomous Traffic?

Student Researcher: Guershon Dorismond

Faculty Mentor: Prof. Zory Marantz

Department: Electrical & Telecommunications Engineering Technology

The purpose of this experiment is to determine which type of sensors will effectively and accurately result in reliable control of semi- autonomous vehicles when entering an intersection. Many corporations are investing heavily into autonomous vehicles. Semi-autonomous vehicles are slowly taking more and more responsibility from the everyday driver. We are already seeing vehicles equipped with sensors and systems that interact with external objects such as rear and side sensors, cruise control, reactive braking, and parking assist. It is expected that in the near future, more advanced communication systems will transmit real time data with vehicles (vehicle-to-vehicle, V2V) and roadside traffic signs (vehicle-to-infrastructure, V2I). It is important that the best possible combinations of sensors are on each vehicle to perform their functions safely and efficiently.

In this experiment we will be using ultrasonic sensors, gyroscopes and accelerometers to analyze data pertaining to location. For each sensor, our research team used the data sheets to become familiar with the limitations of the device. Once acquainted, we used C++ programs on the Arduino IDE (integrated development environment) to test each device.

At this point in the experiment, our team has been able to calculate the speed of a moving object, store data on an external memory card, and access that stored data. This is important because the data we record helps track the speed and distance between two vehicles. By storing and accessing the data we record, we can analyze and improve our results in the future when we integrate the sensors with an automobile.

Title: Optimization of the Spectrum of an FM Signal

Student Researcher: Ina Tsikhanava

Faculty Mentor: Prof. Djafar K. Mynbaev

Department: Electrical & Telecommunications Engineering Technology

Practical transmission of a frequency-modulated, FM, signal requires optimization of its spectrum based on various criteria because the FM signal's bandwidth is theoretically infinite. This optimization boils down to defining the signal's bandwidth based on various criteria, such as the values of the significant amplitudes, SA, and the bandwidth allotted by the FCC, BW FCC. These criteria, however, might contradict one to another. For example, the designer of an FM transmitter must restrict the FM bandwidth according to FCC's requirements, whereas the designer of an FM receiver will require a certain level of the received power, which also depends on the bandwidth. Therefore, the systematic approach must be exercised in optimizing the FM bandwidth.

In this work, I optimized the FM bandwidth by (1) the value of SA, (2) by the BW FCC, and (3) by the simultaneous application of the above criteria. In achieving this goal, I used two methods: Analytical approach to derive the equations determining the required bandwidth and MATLAB to automated the calculations and find the best possible solutions to my problems.

Using the obtained formulas and the developed MATLAB scripts I was able to create a single tone frequency modulated signal and—based on the values of SA, the BW FCC, and the combination of both criteria—automatically find not only the FM bandwidth but also the structure of the FM spectra. Then, I was able to investigate the spectrum of an FM signal where the modulating signal is the sum of two harmonically related and unrelated sinusoidal signals. I consider the detailed spectral analysis of such an FM signal as one of the main achievements of this project.

During the work on this project, I learned many new aspects about the spectrum of an FM signal, its optimization, and various approaches to solving practical engineering problems. I also greatly enhanced my programming skills, specifically in using MATLAB.

Title: Data Security in Vehicle to Vehicle & Vehicle to Infrastructure Communication using WIFI & Sensors

Student Researcher: Muhammed Abubakar

Faculty Mentor: Prof. Joe Wei

Department: Electrical & Telecommunications Engineering Technology

A major point of contention that stirs people away from the thought of having driverless cars on our streets and highways is the inability of the autonomous vehicle to efficiently react to changing traffic patterns, its inability to quickly react to obstructions in its path, as well as all other unpredictable factors that occur when interacting with human drivers. We will use NTRU polynomial authentication to encrypt data that flows between vehicle to vehicle and vehicle to infrastructure communication in order to protect autonomous or semi-autonomous vehicles from hacking vulnerabilities that can lead to accidents. The goal of the research is to test NTRU's efficiency as well as its speed during transmission of encrypted data and decryption of receiving data. We also investigate applications of object avoiding robotics as related to the autonomous vehicles in the automobile industry, the benefits of such systems to society and their applications in the near future.

Title: Ntru Lattice-Based Crypto Primitive in Embedded Systems

Student Researcher: Johnson Esenowo

Faculty Mentor: Prof. Joe Wei

Department: Electrical & Telecommunications Engineering Technology

Embedded systems exist in various forms in our lives such as in smart consumer products, medical devices, mobile phones, credit cards, passports, internet etc. therefore, authentication, integrity and verification of data in these systems are of great significance to security and privacy.

The focus of the research is on the application of the NTRU lattice based signature scheme as a more secured, high performing, cost effective alternative to the current public crypto protocol in use for the security of data in embedded systems, on existing firmware and hardware platforms. Presently, data and information security on embedded systems are based on either RSA or Elliptic Curve Cryptography (ECC) protocols. However, the established mathematical problem that makes these crypto-protocols (RSA & ECC) secured has been broken by quantum algorithm considering polynomial time, thus making them easily vulnerable to attacks.

Hence, there is a need for an alternate secured crypto-primitive for data security in the design of embedded systems; which can withstand quantum algorithms without compromising performance.

The security of the NTRU Signature Scheme (NSS) primitive is based on the assumption that there is no provable probabilistic and quantum polynomial-time algorithm for solving arbitrary instances of the Close Vector Problem (CVP) that exist in a lattice. The time complexity and the high memory requirement needed for any known pre-existing algorithm that can find the exact solution to the lattice problem (CVP) are exponential with the dimensions of the lattice.

Emphasis on the features of the NTRU (NSS) protocol will be on identification of users and devices unambiguously, data harvesting preventions, survivability at little or no cost in performance without breaking standards compliances, and reduction of failure for secure communications and chaos across communication networks.

Title: Traditions in Jhumpa Lahiri's Namesake

Student Researcher: Samiul H. Mozumder

Faculty Mentor: Prof. Katie Albany

Department: English

Emerging literature is a contemporary body of text that is gaining momentum in the global literary landscape. Emerging literature explains the value of tradition and it also highlights limitations that traditions impose on people, especially when living in a different culture. Traditions have been essential to people for a long time. In my project, I will display how the depiction of tradition in *The Namesake* by Jhumpa Lahiri helps make up the Hindu society and showcases what makes people coming from certain ethnic backgrounds unique.

The Namesake shows that everybody is just a little lost. Every character actually struggles with his or her identity and everyone really has different hopes and dreams. Gogol specifically is really torn between his parents' Indian culture and the American culture he grew up in. His family also has to struggle with it and, in the end, even Ashima, the mother, could not really

leave her Indian tradition as she goes back to India to play traditional music. *The Namesake* also deals with issues of identity as illustrated in Gogol's shuttling between his formal name Nikhil and his good name Gogol, as they were called in the Indian tradition.

Title: Sexual Harassment in the Workplace and How it Affects the Hotel Industry

Student Researcher: Lillian Vazquez

Faculty Mentor: Prof. Horace Hutchinson

Department: Hospitality Management

The results of this investigation indicate that sexual harassment in the workplace is a very serious problem that needs to be dealt with effectively. New York State law protects employees in the workplace by constituting sexual harassment unlawful. This is a critical issue that is discussed by human resources and management in general due to the overwhelming liabilities that they hold. Sexual harassment may be verbal, visual and/or physical which may include comments about attire, personality, or physical appearance; sexually explicit drawings, pictures, posters, emails; improper and unwanted touching; kissing; hugging; patting; stroking. Sexual harassment trainings have been shown to be one way that companies attempt to diminish incidents, by giving employees information on the topic. The results from this research indicate that in the US sexual harassment is still prevalent in the workplace despite attempts to eliminate it. My research and detailed findings were supported by the New York State Sexual Harassment Law, New York State Office of the Attorney General Civil Rights Bureau and the EEOC Guidelines on sexual harassment under which a critical distinction is made between types of sexual behavior in Quid Pro Quo and Hostile Environment, as well as print publications. Other statistical evidence of harassment Charges were obtained from the Equal Employment Opportunity Commission and Fair Employment Practice Agencies years, 2010-2014, Title VII of the Civil Rights Act of 1964.

Title: Internet Privacy Concerns (IPC)

Student Researcher: Jovany Bravo

Faculty Mentor: Prof. Patrick O'Halloran

Department: Hospitality Management

As long as there has been an internet, there have been methods used to keep information private. Even though internet privacy is generally regarded as a good thing, there are cases where privacy is removed in cases of unlawfulness and/or suspected malicious intentions. Whether or not the government should have the authority to take away a person's or an organization's internet privacy and use personal or private information in court cases is arguable either way.

Title: Contracting Out School Support Services: Good for the School? Good for the Community?

Student Researcher: Blanca Cortes

Faculty Mentor: Prof. Patrick O'Halloran

Department: Hospitality Management

Virtually all school districts contract for some types of services. It is practical, expedient and fiscally prudent to do so. In recent years, however, the dynamic has shifted toward major national or international corporations marketing long term contracts to provide school support services. This is different in kind and in implications. The number and types of support services now being marketed continues to expand, but transportation, food and custodial services are the major areas of attention. For some districts, for some services and with specific vendors, contracting out might make sense and provide good service for reduced costs. But in many cases, contracting out is not good for either the school district or the community. Making a wise decision depends on the degree to which school leaders review the situations and the trail effect on the school community. They must distance themselves from undue influence, particularly by vendors. Such distancing is simply good management. Careful review of financial terms and conditions, along with a review of potential cost savings, is a must. Hidden or supervisory costs, along with optimistic projections of savings, can turn what was an attractive proposal into a financial sinkhole. The social costs to the community are frequently overlooked. School leaders, in conjunction with their communities, need to closely examine the considerations posed in the preceding section and weigh all anticipated benefits against potential problems. There is a fundamental clash between the primary mission of schools and for profit enterprises. Schools exist to enhance the common good through teaching children. They also teach by modeling healthy social behavior as an institution and being a vital member of their community. Private companies focus on increasing profits. Their incentive is to expand revenues and decrease costs. Responsible corporations pay attention to customer need and community values, but that is typically a secondary focus. In some situations, with some vendors, and around some tasks, the two purposes may be mutually supportive. But in many cases, the goals may prove too divergent and basically incompatible. It is the requirement of school leaders to take a broad, expansive and careful look when considering these decisions.

Title: Fifty Shades of Equations

Student Researchers: Joe Nathan Abellard and Ricky Santana

Faculty Mentor: Prof. Samar ElHitti

Department: Mathematics

This project was focused on homogenizing, compiling and completing a pre-existing draft for an open source math developmental textbook created by a few City Teach math professors. The objectives of the original manuscript were to be minimal, clear, inviting, free of charge and effective in preparing students for credit-level math courses by addressing the unique needs of the student body at City Tech. Mastering LaTeX and utilizing Math Ed expertise were the major components of this project.

Title: Study and Analysis of Waterborne Pathogen Transmission
Student Researchers: Thierno Amadou Diallo and Olivia Hylton
Faculty Mentor: Prof. Urmi Ghosh-Dastidar
Department: Mathematics

Using mathematical models to study the progression of infectious diseases is a significant aspect of mathematical research. Mathematical models allow us to use information about a specific disease to show the projected outcome of an epidemic. This information can be used to help control the spread of the disease and reduce disease related costs. Recently in Haiti there has been a major outbreak of Cholera. Cholera is an intestinal infection caused by the bacterium *Vibrio cholerae*, and it has caused a significant amount of deaths. In their research Dr. Urmi Ghosh-Dastidar and Dr. Suzanne Lenhart used a SIWR model with a vaccination parameter to find the best strategy to reduce disease related costs and lower disease related deaths while vaccinating the population of Haiti. In our research we attempted to find the disease-free equilibrium, the unique endemic equilibrium, and the conditions when the disease-free and the endemic equilibria are locally and globally stable.

Title: An Exploration of Urban Undergraduate Students' Beliefs And Their Attitudes Towards Mathematics
Student Researcher: Saloua Daouki
Faculty Mentor: Prof. Nadia S. Kennedy
Department: Mathematics

This study aims at answering the following questions: What belief about Mathematics do students have? How do they understand of what it means "to be good at math"? What are students' attitudes towards mathematics and how do they organize their study efforts? Students from two Pre-Calculus (MAT-1375) classes were interviewed. The collected data was analyzed and conclusions drawn.

Title: An Exploration of Urban Undergraduate Students' Identities as Math Learners
Student Researcher: Rushdha Rafeek (Fathima R Mohamed Rafeek)
Faculty Mentor: Prof. Nadia S. Kennedy
Department: Mathematics

This study aims at answering the following questions: How do students understand themselves as mathematics learners? How may they have been shaped by their previous mathematics classroom experiences? Students from two Pre-Calculus (MAT-1375) classes were interviewed. The collected data was analyzed and conclusions drawn.

Title: Examining Attitudes towards Mathematics in Foundational Courses with Peer-Led Workshops

Student Researcher: Marieme Toure

Faculty Mentor: Profs. Janet Liou-Mark and A.E. Dreyfuss

Department: Mathematics and Peer-Led Team Learning Program

Persistence through fundamental undergraduate mathematics courses may be explained by self-efficacy, that is, a person's belief regarding his or her ability to successfully perform a given task. This study examined mathematics self-efficacy in three foundational mathematics courses with a mandatory peer-led workshop component. Statistically significant differences were found in attitudes particularly in statements regarding mathematics self-efficacy and goal orientation. Discussion will be provided on how an additional one hour of collaborative learning facilitated by a Peer Leader may affect students' attitudes towards mathematics.

Title: A Model of Gas Exchange in the Lung

Student Researchers: Silma Samayeen and Ling Yang

Faculty Mentor: Prof. Ariane Masuda

Department: Mathematics

Discrete-time dynamical systems provide a way to relate a quantity measured at the beginning and the end of an experiment or a time interval. In this work we show how breathing creates a discrete-time dynamical system. Then we use a graphical technique called *cobwebbing* to study a model that investigates the chemical dynamics in the lung.

Title: Fractional Derivative

Student Researcher: Yen Pham

Faculty Mentor: Prof. Satyanand Singh

Department: Mathematics

In this exploration we study a different class of derivatives with fractional powers. This work traces back to Leibnitz. We present an elementary derivation of fractional derivatives. Our techniques employ tools that are present in the first course in Calculus. It is easy to comprehend but it provides powerful results that are widely used in diffusion of liquids, DNA sequencing and the fractional calculus of differential equations. Some of the results are unexpected such as the derivative of constants which are non zero whilst the derivative of the reciprocal of the radical of a variable is zero.

Title: Numerical Analysis of Waste-to-Energy Combustion Chambers

Student Researchers: Joshua Afrifa, Tiffany Chong, Luca Scarano and Usaama Van

Faculty Mentor: Prof. Masato R. Nakamura

Department: Mechanical Engineering Technology

Numerical analysis, used for implementing algorithms for obtaining numerical solutions to problems, is carried out for a new design of waste-to-energy combustion chambers. The goal of this project is to understand mixing phenomena of Municipal Solid Waste (MSW) particles

enhanced by a mechanical motion of moving grate system in a combustion chamber. In order to analyze solid waste mixing, we used a stochastic particle-based bed model of MSW and built physical models of reverse acting, forward acting and vibration grate systems. These physical models are used in order to quantify the relationship between the particle mixing and motion of moving bars. Experimental data from the physical models with different shaped and sized particles are used for calibrating the stochastic model. Through this numerical analysis, the mixing diffusion coefficient for each condition was quantified.

Title: Polyethylene (glycol) Diacrylate (PEGDA) Characterization for Tissue Engineering Applications

Student Researchers: Andres Delgado and Chris Lopez

Faculty Mentor: Prof. Ozlem Yasar

Department: Mechanical Engineering Technology

Tissue Engineering is an interdisciplinary field that applies the principle of engineering and life sciences to improve the function of tissue or whole organ. In a synthetic environment, cells can only grow in two-dimensional patterns. Therefore, creating an artificial environment for cells to grow and thrive in a three-dimensional matter is the main concern in tissue regeneration. These scaffolds provide shape and direction to the cells that inhabit them. The use of the chemical compound Polyethylene Glycol Diacrylate (or PEGDA) which is a biodegradable and biocompatible polymer is the main ingredient for these scaffolds, therefore, discovering its durability, stress and strain principles becomes a very crucial portion of this experiment. With the creation of "I" shape models about 7mm long, and the use of a Universal Testing Machine (UTM) the polymer PEGDA in mixed with photo-initiators (to harden the substance) is properly tested. Our research showed that highest concentration of PEGDA based scaffolds provide the highest mechanical strength for tissue regeneration.

Title: Channel Characterization of Polyethylene (glycol) Diacrylate (PEGDA) Based Engineered Tissue Scaffolds

Student Researchers: Dmitry Koval and Harold Tanjung

Faculty Mentor: Prof. Ozlem Yasar

Department: Mechanical Engineering Technology

The purpose of tissue engineering is to design and develop spatially patterned, highly porous scaffolds/matrixes to do organ/tissue regeneration. Scaffolds guide overall shape of tissue growth and replacement. In this project, engineered tissue scaffolds are generated with Photolithography. Scaffolds are obtained with inbuilt hollow channels in layer by layer fashion to control the internal architecture. The purpose of having hollow channels is to provide oxygen for the cells located within the engineered scaffolds. It is highly critical to have the highest channel dimension accuracy to have them deliver the desired oxygen amount. In this research, scaffold channel characterization is done to provide the necessary oxygen for cells to survive. Scaffolds with inbuilt channels were created by using 100% PEGDA, 50% PEGDA and 20% PEGDA. Our research showed that scaffolds that are obtained with 100% PEGDA has the highest accuracy whereas the 20% PEGDA based scaffolds have the least channel accuracy.

Title: Bose-Einstein Condensation of Exciton Polaritons in a Microcavity
Student Researchers: Volodymir Komendyak, William Mcguire and Sulav Sharma
Faculty Mentors: Profs. Oleg Berman and Ilya Grigorenko
Department: Physics

We study the formation of Bose-Einstein condensate of exciton polaritons in a semiconductor microcavity at low temperatures. The particles forming the Bose-Einstein condensate are in the same quantum state, and behave like one large particle represented by a single wavefunction. The exciton polaritons are formed by the superposition of the excitons in a semiconductor quantum well embedded in a microcavity and microcavity photons. We assume the polaritons are trapped by the stress-induced external parabolic potential. Another property of polariton condensate is the superfluidity, which means that polaritons can move without friction providing non-dissipative energy transfer. The superfluidity of polaritons can occur at relatively high temperatures (~ 50 K). The non-equilibrium dynamics of superfluid polariton condensate density profile is obtained by solving Gross-Pitaevskii equation for the polariton condensate wave function.

Title: Fundamentals of Communication
Student Researcher: Eddie Dang
Faculty Mentor: Prof. Lufeng Leng
Department: Physics

In communication systems, signals are functions that communicate information. Signals may be generated and conveyed by a transmitter, then captured and processed by a receiver. There are two types of signals: analog and digital. Analog waves are continuous, and have continuously variable features, while digital waves are discrete, and use a sequence of distinct values. There are several ways to modify a signal so that the transfer of information can be facilitated.

A carrier wave is a wave, usually of high frequency, that is modulated with an information signal, or modulating signal. The information signal usually has a much lower frequency. This process is called modulation, and is used to transfer an information signal across long distances because low frequency signals often cannot travel long distances. The modulating signal can be either digital or analog, but both kinds of signals use different types of modulation techniques.

Title: Benefits of Expressive Writing: Improvements in Vagal Tone over Time
Student Researcher: Taylor Brown
Faculty Mentor: Profs. Pa Her and Jean Hillstrom
Department: Social Sciences

An extensive body of literature shows that writing about traumatic or emotional experiences results in improved emotional and physical health and well-being (Pennebaker, 1997). This study extends pilot work we did in our lab on the effects of cognitive restructuring (subjects were asked to reframe an emotional experience in positive terms i.e., meaning-making), vagal tone improved. A second major difference in our study versus previous published work is that our study assessed the effects of expressive writing on the parasympathetic (e.g., vagal tone) and sympathetic nervous system responses over time. Forty-four subjects (18 males, 24

females), ranging in age from 18 to 54 years of age, with a mean age of 26.18 years (sd = 7.84) served as participants. Subjects were randomly assigned to one of the three experimental conditions: standard writing (n=19), meaning-making (n=17), control (n=8). Subjects wrote for at least two sessions and most wrote for three sessions. Before the first session, subjects completed a demographic questionnaire. During each of the sessions, baseline physiological measures were taken while the participant viewed a neutral video (ocean) for three minutes. Next, participants were instructed to write continuously for 15 minutes after which participants again viewed the neutral video while post-writing physiological measures were recorded. Lastly, participants were asked a series of questions about the experience they elected to write about (e.g., "how traumatic was the experience you just wrote about?"). Similar to our previous work, a repeated-measures ANOVA comparing the first to the last writing sessions within-subjects showed a trend in improvement in vagal tone over time, $F(1) = 2.971$, $p = .0392$. Trend data show that vagal tone improved for both expressive writing conditions compared to the control group but the interaction was not significant. We also compared the first to the last writing sessions with a repeated-measures ANOVA for heart rate. Results show improvement in heart rate over time, $F(1) = 4.597$, $p = .038$. A significant interaction between time and writing condition was also found, $F(2) = 3.425$, $p = .042$. Post hoc analyses suggest that heart rate improved for both expressive writing conditions compared to the control group with a slightly greater improvement for subjects in the meaning condition across variables.

Title: The Benefits of Organic Foods vs GMO Foods

Student Researcher: Sidra Zafar

Faculty Mentor: Prof. Sean P. MacDonald

Department: Social Sciences

When discussing the benefits of Organic food, the first question that comes to mind is "what does organic really mean"? Organic or NON-GMO means consumable foods or products including dairy products, meat, and eggs which do not contain antibiotics. It also includes fruits, vegetables, and juice which are cultivated through natural resources without pesticides, synthetic fertilizers, sewage sludge, genetically modified organisms, or ionizing radiation. All organic foods have to be approved by USDA, (U.S Department of Agriculture). Any food in the market which is marked as NON-GMO or Organic also must be labeled as USDA approved.

Organic and NON-GMO are healthy and safe for consumption, but is it safe to consume GMO products? Many developed countries do not consider GMOs safe to consume. More than 60 countries around the world including Japan, Australia and all of the countries in the European Union have significant restrictions or outright bans on the production and sale of GMOs, while in the U.S., the government has approved GMOs.

Increasingly, Americans are taking matters into their own hands and choosing to opt out of the GMO experiment. However, because GMO foods are easily available and cheap compared to organics, most Americans choose these either because of income limitations or lack of awareness of the negative impacts on young children's health. At the same time, awareness of the health benefits of organic is increasing among students. One example is Kingsborough Community College's campus urban farm, which is an effort to set an example and to encourage students in urban farming career in future.
