Abstracts of the Emerging Scholars Program Research Projects

Supported by CUNY Compact funds
Fall 2008

Student Name	Mentor	Dept	Title
Nadia Frank	Shelley Smith	ARCH	Ground Penetrating Radar
Juan Perez	David Kubik	ARCH	Experimental Prototypes for High-Rise Residential Architecture – VERTICAL TRAJECTORIES_VERTICAL WORLD
Bartosz Tarnawa	Mary-Jo Schlachter	ARCH	Experimental Prototypes for High-Rise Residential Architecture – VERTICAL TRAJECTORIES_VERTICAL WORLD
Matthew Murtha	Anne Leonhardt	ARCH	Evolution of Form in Architecture through Computer-based Collaborations between Architects and Engineers
Belsasar Herrera	Gregory Marinic	ARCH	Experimental Prototypes for High-Rise Residential Architecture – SUPER_ ORGANISM City
Bhupinder Singh	Gregory Marinic	ARCH	Experimental Prototypes for High-Rise Residential Architecture – SUPER_ ORGANISM City
Gersain Calderon	MaryJo Schlachter	ARCH	Experimental Prototypes for High-Rise Residential Architecture
Amanda Watson	Zongmin Li/Rena Dabydeen/ Liana Tsenova	BIO	The Effect of Long-Term Exposure to Antibacterial Soaps on the Development of Microbial Resistance
Adley Alezy	Zongmin Li/Rena Dabydeen/ Liana Tsenova	BIO	The Effect of Long-Term Exposure to Antibacterial Soaps on the Development of Microbial Resistance
Marie Lynch	Zongmin Li/Rena Dabydeen/ Liana Tsenova	BIO	The Effect of Long-Term Exposure to Antibacterial Soaps on the Development of Microbial Resistance
Anna Zieziula	Vasily Kolchenko	BIO	Viral Genome Analysis
Stanislav Veytsman	Vasily Kolchenko	BIO	Viral Genome Analysis
Merlina Music	Majeedul Chowdhury	BIO	Effect Of Gram-Negative Bacteria Derived Lipopolysaccharide on Osteoclast Activity
Zahura Akter	Isaac Barjis	BIO	Modeling of Signaling Pathways
Elio Archer-Clarke	Farrukh Zia/Carmen Trudell	CET/ARCH	Electronic Circuitry
Eddy Chin	Farrukh Zia/Carmen Trudell	CET/ARCH	Electronic Circuitry
Meleny Perez	Reneta Lansiquot	ENG	A Student's Guide to Virtual Worlds
Kayon Pryce	Matthew Gold	ENG	Microblogging
Carly Nadler	Shauna Vey	HU	Excavating Brooklyn's Theatrical Past
Raymond Li	Delaram Kharobaei	MAT	Authentication Protocols

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Sherard Harewood	Holly Carley	MAT	Investigations Concerning Numerical Quadrature
Jian Hong Li	Andrew Douglas	MAT	Nonassociative Algebra Structures on Representations of Simple Lie Algebras
Hong Jun Li	Victoria Gitman	MAT	Exploring Dynamical Systems: Theory and Experiment
Jonathan Daley	Victoria Gitman	MAT	Exploring Dynamical Systems: Theory and Experiment
Gilbert Center	Urmi Ghosh-Dastidar	MAT	Study of the transmission of Rotavirus
Ya Ping Zhang	Urmi Ghosh-Dastidar	MAT	Bio-Surveillance and Detection of BVD virus
Lori Younge	Janet Liou-Mark	MAT	Assessing the Outcomes of the Bridge to College Mathematics Summer Academy
Ledio Mustaqi	Andy Zhang	MT	Concurrent Approach to Machine Design Using Robots as Prototypes
Jed Ferreras	Andy Zhang	MT	Concurrent Approach to Machine Design Using Robots as Prototypes
Thinh Le	Lufeng Leng	PHYS	Fiber Optics
Frenny Ruiz	Justin Vazquez-Poritz	PHYS	Modeling Energy Transfer with Strings on Wormholes
Carlos Saint Victor	Justin Vazquez-Poritz	PHYS	Modeling Energy Transfer with Strings on Wormholes
Mir Ali	Justin Vazquez-Poritz	PHYS	Modeling Energy Transfer with Strings on Wormholes
Anna O'Brien	Daniel Capruso	SS	Development of a Russian/Cyrillic Version of a Multilingual Computerized Legal Competency Evaluation
Tamelia Spence	Daniel Capruso	SS	Collection of Normative Data for a Multilingual Computerized legal Competency Evaluation
Jhonatan Echavarria	Jean Kubeck	SS	A Reexamination of the Age Declines in Job Related Training Performance: New Data and Moderators
Sherma Soodeen	Eric Rodriguez	SS	Identity Conflict and Identity Integration: Applying Psychological Theory to the Lives of City Tech Students

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Student Name	Mentor	Dept	Title
Jamal Stovall	Eric Rodriguez	SS	Identity Conflict and Identity Integration: Applying Psychological Theory to the Lives of City Tech Students
Moumin Ghanem	Howard Sisco	SS	Exploring the role of cultural learning styles in success rates of minority students
Jorge Reinozo	Howard Sisco	SS	Exploring the role of cultural learning styles in success rates of minority students
Nancy Delcid	Peter Catapano	SS	From Ellis Island to Angels Island: A Cinematic History of Immigration
Zaw Zaw Lat	Djafar Mynbaev	TC	Electronic circuitry for improving performance of an optical communications link
NSF Funded Stipends			**Grant # 0622493**
Rajvinder Kaur	Niloufar Haque	BIO	Research in Biological Sciences
Javier Joya	Satyanand Singh	MAT	Testing the Extremes and Extrema
Adam Atia	Sidi Berri	MT	Development of simulations and models for General Biology classes
Muktar Adeyinka	Sidi Berri	MT	Development of simulations and models for General Biology classes
Michael Gibilero	Sidi Berri	MT	Development of simulations and models for General Biology classes

Title: Ground Penetrating Radar (GPR) in the Investigation of Historic Masonry Buildings
Undergraduate researcher: Nadia Frank
Faculty Mentor: Prof. Shelley E. Smith

Ground Penetrating Radar (GPR) has been used by archeologists and geologists to discover treasures beneath the earth's surface. GPR is an imaging technology used for subsurface earth exploration. It is an advanced and specialized underground mapping procedure. GPR can provide necessary information on hidden underground elements like buried utilities, buried rebar, and buried concrete foundations. GPR can also map underground concrete deterioration, and is capable of creating two and three-dimensional underground imaging.

The research that I was engaged in with Professor Smith, involved the use of GPR to locate small voids the size of mortar joints in walls. Having such a method would be very instrumental in the preservation of historic masonry buildings and therefore the preservation of a very integral part of our past.

There are various methods of detecting wall deterioration which are used today, some of which include destructive testing like core drillings and borings, which are very precise in their findings, but are undesirable for use because of their destructive nature. There are a few non-destructive tests that exist, but they are not as precise. These include visual inspections, x-ray testing and ultrasound testing.

Of the testing that exists today, none has proven as exacting as we anticipated. When interviewing a representative of Sensors and Software, a GPR manufacturer in Canada, I was told that "for a GPR scan to be successful you have to ensure the attenuation or absorption of the signal, when searching for voids rebar's and wire mesh can interfere with the signal and give an incorrect reading, if the wall is less than two feet thick it becomes extremely difficult to get a reading since the radar currently uses 1000 megahertz transformers and this can only be used on walls more than two feet thick." Most companies are still trying to figure out the correct megahertz to use.

Professor Smith and her partner, James Mellett have figured out the right size of antenna to use and have used it successfully in recent projects, including Christ Church in Bronxville, NY. Based on the information I have collected to date, it seems like they have found a ground-breaking method for the investigation of deterioration in historic masonry construction.

My responsibilities on this project included helping with in-depth research on the following:
. The current state of GPR technology and its uses
. Current research on the deterioration of historic masonry
. Methods currently used to identify deterioration in historic masonry

Title: Experimental Prototypes for High-Rise Residential Architecture –
VERTICAL TRAJECTORIES_VERTICAL WORLD
Undergraduate Researchers: Juan Perez and Bartosz Tarnawa
Faculty Mentors: Profs. Gregory Marinic, David Kubik, Mary-Jo Schlachter

The world's current population is estimated at approximately 6.72 billion, and is expected to reach nearly 9 billion by the year 2040. This stark reality calls for new ideas and approaches for super tall high-rise residential towers that would address dramatic

future growth in urban populations. In Dubai, one of the seven United Arab Emirates, we are exploring new design trajectories based on the unlikely marriage of geometries related to hydrology and cultural derivatives based on Islamic mosaic patterning.

The study of hydrology, and more specifically the structure and development of snow crystals, launched the initial stages of our research. As a result, each crystal has been categorized as an architectural 'module' based on a temperature and saturation matrix related to the atmosphere in which it is formed. During this process, it is not uncommon for snow crystals to exhibit a thin liquid film at temperatures below the freezing point. Molecules on the surface are not held in place as tightly as those in the main bulk of the crystal. This 'roughening transition' is a function of temperature--below this state, crystals will remain smooth. An infinite number of non-repetitive, yet co-related shapes, emerge depending on the precise temperature at the time of crystal generation. Their perfect forms may be studied, refined, and deployed at infinite scales.

Through focused research, we shall attempt to introduce an innovative sustainable design solution based on functional, programmatic, and crystalline morphologies in relation to site-specific programmatic, climatic, and cultural influences.

Title: Evolution of Form in Architecture through Computer-based Collaborations between Architects and Engineers
Undergraduate Researcher: Matthew Murtha
Faculty Mentor: Prof. Anne Leonhardt

As the industrial revolution worked to insulate humans from their natural surroundings in the name of progress, some thinkers began to appreciate the intricacies inherent in natural structures. The naturalist and mathematician D'Arcy Thompson undertook a major reappraisal of why natural forms exist the way they do. In his seminal text, On Growth and Form, he explores the shape of the simple and the complex, the aquatic, airborne, and terrestrial, plant and animal, the living and the inorganic. From his observations he carefully postulates (largely mathematical) reasonings on form configurations throughout the natural world. For decades, designers and engineers were content to be inspired by nature as showcased by Thompson, yet limited by their tools, often with rather crude reproductions. In recent years computers have opened the door to the modeling of unimaginably complex objects. Today, structural engineers are expert form manipulators, using computers to generate virtual objects, often in a way analogous to nature's tried and true methods.

Title: Experimental Prototypes for High-Rise Residential Architecture – SUPER_ ORGANISM City
Undergraduate Researchers: Belsasar Herrera, Bhupinder Singh
Faculty Mentors: Profs. Gregory Marinic, David Kubik, Mary-Jo Schlachter

As the world evolves into a more cohesive community, the transfer of information and technology has increased tremendously. During recent years, human activity has

been affecting the earth in detrimental ways, resulting in dangerous levels of greenhouse gases and increasing pollution in our own cities. As a whole, we are destroying the earth and increasing the threat of global warming exponentially. The global community must act now to decrease the amount of carbon dioxide being emitted into the upper atmosphere.

The beehive is a very complex social structure where different casts of bees occupy specific roles. Since it acts as a self-contained entity, the beehive is known as a *super-organism*. The honeycomb itself is comprised of tens of thousands of individuals working together as one. This unique situation depends on the individual engaging toward the survival of the larger group, instead of its own livelihood. In essence, the community grows, regenerates, and dies as one.

Our concept for a super-tall residential tower for Dubai suggests that the beehive system can inform architectonic principles. Our proposal will incorporate a cohesive community, much like the naturally occurring beehive, in which each individual lives as a social unit and interacts for the better good of the tower community.

Title: Experimental Prototypes for High-Rise Residential Architecture
Undergraduate Researchers: Gersain Calderon, Carlos Honorio Jr., Michelle Roberts
Faculty Mentor: Prof. Mary-Jo Schlachter

By 2055, China has assumed its role as metaphorical spine of a new world economy where urban residential environments reach higher and higher.

Our research focuses on the spine--emerging from human origins, considered architecturally as the core of any high-rise building, and more symbolically as inherent stability. The spine's structure consists of 24 vertebras, which correspond to different regions on the column--cervical, thoracic, lumbar, and pelvic regions.
Thankfully, most humans begin their lives with healthy spines. The passage of time changes the position of our spine due to everyday activities that result in a certain amount of degradation and natural deformation.   Degenerative changes in the spinal column associated with osteoporosis in particular can cause differential spine positions. This change is due to the slow evolution of the spine toward fragility—a state that reduces it to more minimum dimensions.

Title: The Effect of Long-term Exposure to Antibacterial Soaps on the Development of Microbial Resistance
Undergraduate Researchers: Adley Alezy, Amanda Watson, Marie Lynch
Faculty Mentors: Profs. Rena Dabydeen, Zongmin Li and Liana Tsenova

It has been clinically proven that overuse of antibiotics can cause sensitive bacteria to develop resistance to their antibacterial action. It is not well defined whether overuse of antibacterial soap has similar effect. Some studies have found that soaps containing antimicrobial active ingredients remove more bacteria than simply washing

with plain soap and water. It was recently shown that long-term exposure to residual antibacterial soap on the skin may result in selection of antibiotic-resistant strains of pathogens.

Previously, we have studied the effect of long-term exposure to low dosage of antibacterial soaps on two common pathogenic bacteria: *Staphyloccocus aurues*, a Gram positive coccal bacterium and *E. coli*, a Gram negative rod-shaped bacterium. Our preliminary data indicated that after treatment with a low dosage antibacterial soap for two weeks, *E. coli* developed significant resistance to the soap while *S. aureus* became more sensitive. Also, we observed that after this treatment, neither *E. coli* nor *S. aureus* developed significant resistance to various antibiotics tested, most likely because the period of treatment was too short. Interestingly, this treatment sensitized *S. aureus* to various antibiotics.

To verify these results in the current experiments we studied four additional bacterial species: *Pseudomonas aeruginosa*, *Staphylococcus epidermidis, Bacillus subtilis, and Proteus vulgaris. P. aeruginosa,* one of the most common causative agents of nosocomial infections, was completely resistant to all tested antibiotics. *S. epidermidis,* considered a normal flora of the skin, was sensitive to all tested concentrations of the soap. Because of these reasons the two bacterial species were excluded from the study.

When we tested the antibiotic sensitivity, *E. coli* showed resistance to all antibiotics except Tetracyclin (sensitive) and Erythromycin (intermediate). *S. aureus* and *B. subtilis* were sensitive to all tested antibiotics. *P. vulgaris* showed sensitivity only to Ampicillin and Tetracyclin.

To test the primary sensitivity of the bacteria to the soap we used the following concentrations of a soap with Triclosan as active ingredient (obtained from CVS pharmacy): 1) 0%, 2) 0.005%, 3) 0.01%, 4) 0.05%, 5) 0.1% and 6) 0.2%. The highest sensitivity of all bacteria was observed with the highest concentration of the soap – 0.2%. Next, bacteria were treated for 4 weeks with 0.01% of the soap. This experiment is in progress and we expect that the longer exposure to the antibacterial soap may lead to more obvious resistance of the bacteria to this soap, and to some antibiotics as well. All tests have been run in triplicate for statistical significance. So far, all results have been consistent.

This study will bring us insights into the relationship between antibiotic resistance and overuse of antibacterial soap.

Title: Viral Genomes, Structures and Sequence Alignment for Optical Biosensing
Undergraduate Researchers: Anna Ziezula, Stanislav Veytsman
Faculty Mentor: Prof. Vasily Kolchenko

Optical biosensing for viral detection is a growing field that was pioneered by the MicroParticle PhotoPhysics Lab at Polytechnic Institute of New York University. Initial research collaboration of New York City Tech and NYU-Poly in this project was first presented at the American Physical Society conference (first prize for the poster presentation, 2004). Currently, the group is working on highly specific and sensitive virus detection that is based on using optical resonances in the silica microsphere. As the viral nanoparticle lands on the microsphere surface, the resonance frequencies will shift producing a signal that can characterize nanoparticle molecular weight, adsorption

process and other features. Specific viral detection is achieved by chemically modifying microsphere surface and using commercially available antibodies.

To better understand viral adsorption rates, we analyzed genomes of the selected viruses, particularly of MS2, Phix174, and Influenza A, that were used in the experiments at NYU-Poly and Harvard University. Genome size and structure, gene content, protein function and viral particle structure were identified. We also studied gene finding methods, gene annotation and viral particle assembly process, among other topics of interest, and used databases of genomic sequences, protein sequences and protein structures. We concentrated on viral capsid protein subunit structures in order to predict and explain the unexpected features of viral adsorption. Protein Data Bank files and visualization software tools were used to generate and manipulate protein structure images. Phylogenetic viral genome analysis can help in selecting appropriate viruses for future experiments.

In the process of analyzing viral genomes, a MatLab software program was developed that simulated Needleman-Wunsch algorithm for global sequence alignment (Jian Li, AFB). This program uses dynamic programming and particular scoring rules to complete a matrix and align DNA sequences of up to 4,000 nucleotides long generating and scoring an optimal alignment. All optimal alignments could be found and presented for shorter DNA sequences of about 300 nucleotides. The program is also able of randomly generating two nucleotide sequences and aligning them. It can be tested using selected viral DNA of related viruses.

Title: Effect of Gram-Negative Bacteria Derived Lipopolysaccharide on Osteoclast Activity
Undergraduate Researcher: Merlina Music
Faculty Mentor: Prof. Majeedul H. Chowdhury

Lipopolysaccharide (LPS), the endotoxin of Gram-negative bacteria, plays an important role in provoking inflammatory periodontal disease and increasing bone resorption *in vivo*. The stimulation of lysosomal enzyme release and collagenase activity plays a part in LPS action on bone. The portion of the LPS molecule responsible for bone resorptive activity is the lipid A portion, which binds directly to the cell membrane receptor. The studies with LPS-activated macrophages have shown that LPS induces the release of various cytokines and prostaglandins (PGs), factors which are able to increase osteoclastic bone resorption. A role of CD14 (a membrane anchored glycoprotein) and Toll-like receptor 4 (TLR4) in mediating LPS effect have been implicated. We examined the effect of LPS, extracted from *Escherichia coli*, on bone resorption. Embryonic (16 d) chick osteoclast (OC) were added to bovine cortical bone slices and cultured for 24 hr in Medium 199 containing Earle's salts with 10% fatal calf serum (FCS) or 0.1% bovine serum albumin (BSA) in 24 well plates. The number of excavated lacunae, as an index of osteoclastic resorption, was quantified under light microscope, after stripping the cells from the bone slices and staining with toluidine blue; data expressed as pits per slice $\pm$ SEM (n=5). In the absence of FCS, bone resorption was significantly increased by LPS at 10 ug/ml from 28 ± 6 (baseline) to 57 ± 6 (LPS); tartarate resistant acid phosphatase positive (TRAP+) cells were increased by 200% from 8 ± 2 (baseline) to 24 ± 7 (LPS). However, 10% FCS masked any effect of LPS on bone resorption (control: 86 ± 9; LPS:

76 ± 7); there was no significant difference in TRAP+ cells (control/LPS: $27 \pm 6/31 \pm 7$). LPS also increased bone resorption in a dose dependent fashion, with significant effects at 1 ug/ml- and 10 ug/ml concentration. These results indicate that LPS increases both bone loss and OC number in cell culture model, possibly through proinflammatory cytokine production and OC recruitment and formation.

Title: Modeling of Signaling Pathways
Undergraduate Researcher: Zahura Akter
Faculty Mentor: Prof. Isaac Barjis

Transcription and translation are central and multi-step process where the information coded within a gene is transformed into a protein. Understanding the process of transcription and translation are very important in medical applications such as interaction of initiation factors with the virus. This process requires diverse sets of proteins, transcription factors and initiation factors such as eIF3. In this paper we made some extensions to the graphical notation of ordinary Petri nets. Than we used the extended Petri net to model, simulate and analyze the mRNA translation and the initiation factor (eIF3) interaction with hepatitis C virus (HCV) IRES. This initiation factor controls the assembly of ribosomal subunit (40S) on mRNA during the process of mRNA translation. Our model shows assembly of eIF3 with mRNA, and its interaction with hepatitis C virus (HCV) IRES RNA. Analysis of mRNA translation model can provide an unprecedented opportunity in understanding the interaction of factors that are contributing to the process of protein production.

Title: Electronic Circuitry
Undergraduate Researchers: Elio Archer-Clarke, Eddy Chin
Faculty Mentors: Profs. Farrukh Zia and Carmen Trudell

Prof. Carmen Trudell has worked with energy harvesting from human motion (opening a door, turning a hand crank, etc.) for a couple of years. Her energy capturing revolving door project, in collaboration with Jenny Broutin, has been awarded several grants and awards. In this Emerging Scholars research project, we are working with Prof. Trudell and Prof. Zia, to develop the electronic circuits to convert the "dirty" energy harvested kinetically from the revolving door into "clean" usable electricity. A long term goal of this project is to reduce the impact of the consumption of electrical energy on the environment. In order to do that, one starts by reducing the energy consumption by the array of appliances/devices that do not have to be operated continuously; and can otherwise produce electrical energy on an intermittent basis, like the revolving door system.

Currently, we are working on connecting the revolving door prototype to an electro-magnetic generator through a chain-linked gear system; and to a microcontroller board for making electrical power output measurements. We have completed the design of a software block diagram (UML draft) for programming the microcontroller. We are

also working on implementing this software design using the C programming language. Debugging of the software will be done later, during the next few weeks.

Our goal is to demonstrate that by making use of humans' mechanical energy to turn the revolving door, we can generate useful electrical energy; and this energy is capable of powering a microcontroller and the electric circuit around it. We are also going to investigate various means of storing the intermittent electrical energy and to channel it into the desired circuit. We are planning to display a "thank you" message by using the microcontroller together with an LCD display at the exit of the door, to those who contribute to the generation of this energy.

Consequently, during the remaining weeks of the semester we will be mounting the generator and fine tuning its output power; designing a circuit capable of storing and measuring the electrical power output; followed subsequently by the software development; whose function is to instruct the microcontroller to display the measured and derived values to the user. We will also create guidelines for future students to continue this research.

Title: A Student's Guide to Virtual Worlds
Undergraduate Researcher: Meleny Perez
Faculty Mentor: Prof. Reneta D. Lansiquot

As a student in Advanced Technical Writing, I was given the chance to explore how virtual worlds (in this case, Second Life) can facilitate meaningful communication for educational purposes. In doing so, I investigated the creation of manuals written for student users by student users. I met with students from sections of Prof. Lansiquot's Advanced Technical Writing classes and interviewed them, asking general questions about Second Life and what they have learned so far. The information from the interviews along with data from online self-evaluations completed by the students will be used to improve this course in the future and to plan future distance learning courses. Although I did not have much experience in Second Life when I started this project, having background experience with other virtual worlds helped me better understand this 3D virtual world created by its residents.

Although we are not finished with the whole project, many accomplishments can be reported at this point. First of all, the interactive collaborative nature of the virtual environment helped students to identify unique and creative topics. For example, when one student came up with a topic like how to create a concert in Second Life, other students were inspired to pursue such topics as reenacting a scene from a television show and developing a live poetry slam, where people could come and recite their poems in front of an audience in this virtual world, including judges. Once the students had developed their topics, they could begin building their table of contents and dividing up the tasks for development. However, there were a few conflicts at this stage of the project. Some students were not specific enough in outlining particular process or would miss the group deadline, causing problems for the rest of the students in their groups. Fortunately, having group meetings about task assignments, dividing the work equally,

and sharing their work via e-mail solved these problems. As a research assistant, I found it beneficial to observe such group dynamics.

My own accomplishments in this project include learning to take field notes. I began by interviewing students individually and recording their responses in a notebook. The interviews were a little difficult at first because I did not have much experience interviewing people, especially in allowing their responses to shape the next questions I would ask. However, the more students I interviewed, the more experienced I became at allowing my further questions to develop from the interviewees' responses. In addition, my general research skills have improved immensely. At first, I was not able to answer many the students' specific questions, but as I read the Second Life manual, I was able to assist students with their questions and concerns. Further, I have brought the groups together and taken a snapshot to capture their Second Life experience, and I have asked each group to give me three of their best images for the poster presentation of my work on this project. So far, this project is going really well, with the students working together and the first draft of their manual completed. The final accomplishment will be to review the completed group manuals, which will be converted to online versions. I consider it a great accomplishment to have been able to help the students get this far in their research.

Title: Micro-blogging - Web 2.0
Undergraduate Researcher: Kayon Pryce
Faculty Mentor: Prof. Matthew Gold

As a 2008 student participant in the Emerging Scholars program here at New York City College of Technology (City Tech), I have had the pleasure of working alongside Professor Matthew Gold, Ph.D. in compiling research on the topic of micro-blogging. This experience has been one of the highlights of my academic career here at City Tech, as I have had the pleasure of experiencing firsthand the efforts that go in to preparing scholarly research. As I intend to continue my educational pursuit beyond the Undergraduate level, and to attend Graduate school for a degree in Instructional Technology, this research project was well within the scope of my interests, and has provided me with a great deal of insight as to what I can look forward to at the next level of my academic career. I would like to sincerely thank all the sponsors and participants of this program for providing the students of City Tech with such a wonderful opportunity.

The focus of our research was micro-blogging. Micro-blogging is a form of online communication that allows a user/subscriber of a website or service to publish brief text updates of approximately 140 characters. These updates are posted to a restricted group which is selected by the author, or to the entire internet community as a whole. In an effort to fully understand micro-blogging and to experience how it works, I registered and used some of the websites that offer these services. We focused on Twitter, which Dr. Gold was prominent member of. Twitter is one of the most popular free micro-blogging services that allow users to communicate with other users through brief updates, which are usually written in the form of text-based posts of 140 characters. The site is largely used by people who share commonalities like academia, technology and other mutual

interests. In using this service, my primary goal was to examine how it is utilized, and to observe whether the 140 character limit had any effect on the language people used to communicate on these sites.

As we delved deeper into examining the different aspects of micro-blogging and Twitter, many questions arose, some of which required us to go beyond the extent of what we had originally set out to do. This was great, because this was what research was all about. Many of the questions that we had developed would require us to survey random people about certain topics. We decided that we would develop a full length electronic and paper survey that would be given to a random sample of individuals from different groups, including high school students (whom I work with daily), peers, and colleagues. This was a very interesting part of our research, as we brainstormed the questions that should be included, as well as the ways in which we would interpret the data that would be collected. To date, we are in the final stages of this process and I am looking forward to reviewing our findings once the process is complete.

Title: Excavating Brooklyn's Theatrical Past
Undergraduate Researcher: Carly Nadler
Faculty Mentor: Prof. Shauna Vey

Downtown Brooklyn is constantly evolving. The neighborhood now occupied by City Tech and Metro Tech was once a theatrical district. Our project is to discover what went on in the theatres that were here and what happened to them. We will trace the connections between architecture, economics, entertainment, and shifting populations. Stage One was to study historical maps held by the Brooklyn Historical Society library. Working from these maps, that were drawn between 1865 and 1987, we have identified 23 theatre structures. In Stage Two we will use the BROOKLYN EAGLE and other archival sources to research these theatres, the audiences who attended, and the actors who performed there. Our findings will be the foundation for a Spring 2009 joint lecture with Prof. Robert Zagaroli as part of the Architecture Technology Departments WAM Series: WHERE ARCHITECTURE MEETS.

Title: Authentication Protocols
Undergraduate Researcher: Raymond Li
Faculty Mentor: Prof. Delaram Kharobaei

This purpose of this project is to introduce the various mathematical concepts behind cryptography and the algorithms of various cryptosystems that are commonly used. It will discuss the various weaknesses of chosen cryptosystems and discuss how the Cramer-Shoup cryptosystem covers up all these weaknesses.

Title: Investigations Concerning Numerical Quadrature
Undergraduate Researcher: Sherard Harewood
Faculty Mentor: Prof. Holly Carley

The aim of this project is to understand and to explain the general framework of numerical quadrature. We begin our investigation by considering the problem of round-off error. To demonstrate this issue, we experiment with an identity for Bernoulli polynomials which involves writing a Bernoulli polynomial at a point in terms of a sum of Bernoulli polynomials at other points. We then investigate the general framework of numerical quadrature and consider difficulties dealing with round-off error as well as theoretical errors in approximation. We see familiar examples as special cases of the general numerical quadrature problem. We also investigate how commercial programs deal with these issues.

Title: Nonassociative Algebra Structures on Representations of Simple Lie Algebras
Undergraduate Researcher: Jian Hong Li
Faculty Mentor: Prof. Andrew Douglas

Lie algebras are algebraic structures that arise naturally in such fields *as* quantum mechanics, particle physics, and robotics. The primary applications of Lie algebras to these fields come from their *representation theory*. Representation theory is a way of writing a Lie algebra as a set of matrices. In this project, we study Lie algebras and their representations. After reviewing the basic theory we examine several classical examples including the special linear algebra and the Euclidean algebra. We created a computer program to assist in this study. Guided by this computer program, we produced a new proof of a known result pertaining to a class of Euclidean algebra representations. We hope to apply the computer program to the examination of a larger class of Euclidean algebra representations for which little is known.

Title: Exploring Dynamical Systems: Theory and Experiment
Undergraduate Researchers: Hongjun Li and Jonathan Daley
Faculty Mentor: Prof. Victoria Gitman

Dynamical systems is an area of applied mathematics that studies and tries to describes the behavior of complex systems that evolve over time according to a fixed set of rules. Examples of dynamical systems include the weather, financial markets, firing of neurons in the brain, the motion of planets and stars, etc. Typical mathematical examples of dynamical systems involve taking a function and applying it repeatedly to an initial input in a process called *iteration*. The behavior of the initial input under the iteration corresponds to the change in the system over time. Naturally occurring dynamical systems have been classically described by differential equations so complex that even numerical methods often cannot provide a solution. The main contribution of dynamical

systems has been the understanding that very different complex systems exhibit essentially the same general patterns of behavior. Systems having completely different components and described by completely unrelated sets of rules develop the same behavioral characteristics over time. This means that to understand the various systems mentioned above, it suffices to study the mathematical model consisting of iterating a function. In this project, we studied the various techniques required to understand and predict the behavior of these mathematical models. In particular, we studied the concepts of *attracting* and *repelling* orbits. We analyzed how self-similar behavior exhibited by fractals (such as the *Cantor set*) arises in dynamical processes. We began to explore the through theoretical analysis and computer approximations the behavior of the family of quadratic functions $f(x) = x^2 + c$. This family is of great interest to dynamical theorists because it exhibits nearly all prototypical behaviors of dynamical systems.

Title: Study of transmission of Rotavirus
Undergraduate Researcher: Gilbert Center
Faculty Mentor: Prof. Urmi Ghosh-Dastidar

Rotavirus, one of the most common causes of severe diarrhea among children, results in approximately 55,000 hospitalization each year and globally deaths of over 600,000 children per year. Once exposed, the children show symptoms on average within 2 days. Symptoms include fever, frequent abdominal pain, watery diarrhea and vomiting for 3-8 days. In this project we studied the transmission process of this virus sequentially as follows:

For all cases we assume that the event GE means that the patient has reported GE complication, RV is the event that the patient has rotavirus, and the event Ai means that the patient belongs in the ith age group where the 1st age group consists of 1-3 months, 2nd age group contains children of ages 4-6 months and so on.

First we calculated the probability that a child has rotavirus if s/he is chosen randomly out of all children who are admitted in the hospital with gastroenteritis (GE) complications. Next, we estimated the probability of a child of having rotavirus and who also belongs to group Ai if s/he is chosen randomly out of all children who are admitted in the hospital with gastroenteritis (GE) complications. As a follow-up we also calculated the probability that the child has rotavirus provided that s/he reports GE complications and s/he is in age group Ai. Lastly we used Bayesian analysis to calculate the probability of having gastroenteritis (GE) complications given that the child has rotavirus and in a specific age group Ai. We also used statistical data smoothing techniques moving average on simulated data on rotavirus transmission.

Title: Bio-Surveillance and Detection of BVD virus
Undergraduate Researcher: Ya Ping Zhang
Faculty Mentor: Prof. Urmi Ghosh-Dastidar

Bio-surveillance is the process of monitoring new outbreaks of infectious diseases. In this project we explored how Bayesian approach can be used to detect BVD outbreak in a firm. We studied how statistics can be used to detect presence of Bovine

virus diarrhea (BVD) in a cattle population. This is one of the potentially dangerous viruses that are hardest to prevent once it has set its first onset among the cattle population. BVD is an RNA virus that is classified into two different genotypes known as Type I and Type II. Within each genotype there are several different strains of BVD virus that can differ significantly in their ability to cause disease. This virus transmits through cattle faces and secretions from nose and mouth. It can also spread through aerosol droplets and direct contacts. In this research project we addressed the following issue:

Given a cow shows symptom Si, i = 1,…,6 (There are seven different symptoms that we looked at: Symi, i = 1,…,7. We assumed symptoms 1, 2, 3, 4, 5, 6, and 7 imply respectively, infertility or decreased pregnancy rate, abortion or still birth, birth defects, pneumonia, diarrhea, lameness and high fever (more than or equal to 105 deg.). We found through literature search that these symptoms are some of the common symptoms associated with BVD virus. We used Bayesian statistics to analyze different situations when we should test the cow for BVD virus. Mathematically, the values of $P(H_j | Sym_i)$ for i = 1,…,7, and j=1,2 are calculated. H1 is the hypothesis that the cow does not have the virus and H2 is the hypothesis that the cow has the virus (it does not matter whether it is type I or type II virus).

Title: Assessing the Outcomes of the Bridge to College Mathematics Summer Academy
Undergraduate Researcher: Lori Younge
**Faculty Mentor:** Prof. Janet Liou-Mark

The Bridge to College Mathematics Summer Academy is an intensive review course in intermediate algebra offered at New York City College of Technology for incoming freshmen planning to major in a Science, Technology, Engineering, and Technology (STEM) discipline. Sessions on study and time management skills, learning and study strategies, motivational assessments, and careers and opportunities in engineering technology, chemistry, and physics were also included in the program. The one-week program is designed to bridge the gap between high school and college by providing student the necessary tools needed to succeed and persist in the STEM fields. A student survey measuring the impact of the Academy will be analyzed and summarized.

Title: Concurrent Engineering Approach to Machine Design Using Robots as Prototypes
Undergraduate Researcher: Ledio Mustaqi
Faculty Mentor: Prof. Andy Zhang

The goal of the project is to build a robot used the concurrent engineering design method learned in the machine design class. The robot will have an extendable arm that
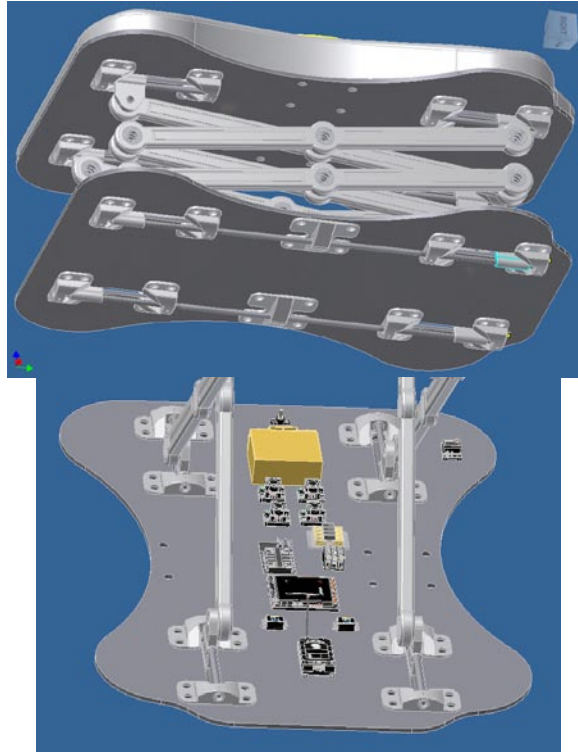
will be able to grab an object. The robot's arm will be able to raise and lower using a scissor lift mechanism. It will move like a car, with two station wheels connected to the shaft and motor. The front of the robot will be steered by one step motor. It will also have one CIM motor that will be driving the robot. The arm of the robot will contain two actuators to extend it..

This semester the following has been accomplished. 3D prototype of the robot has been created as shown above. This includes three different mechanisms. First the steering mechanism, this will steer both wheels, which will steer the direction the robot is driving, at the same time by only one source. Second is a scissor lift mechanism, which will be powered by a motor and a gear box. On the very top of robot there is a small circular platform that will be pivoting the arm at a required angle.

Title: Concurrent Engineering Approach to Machine Design Using Robots as Prototypes
Undergraduate Researcher: Jed A. Ferreras
Faculty Mentor: Prof. Andy Zhang

This project tried to simulate some of the functions of an actual Mars Rover designed by NASA using available materials at hand. This provides an opportunity to apply concurrent design and engineering concepts learned in the machine design class to design and construct a mechatronic product such as this Mars Exploring Rover. The project includes the following activities: 1) design of various mechanical subsystems, 2) design and selection of electric/electronic systems, 3) construction of a physical rover, 4) programming of the rover, 5) and testing and analyzing the functions of the design.

The following has been accomplished this semester: A computer model of the Mars Exploring Rover as shown above has been created using Autodesk Inventor. This
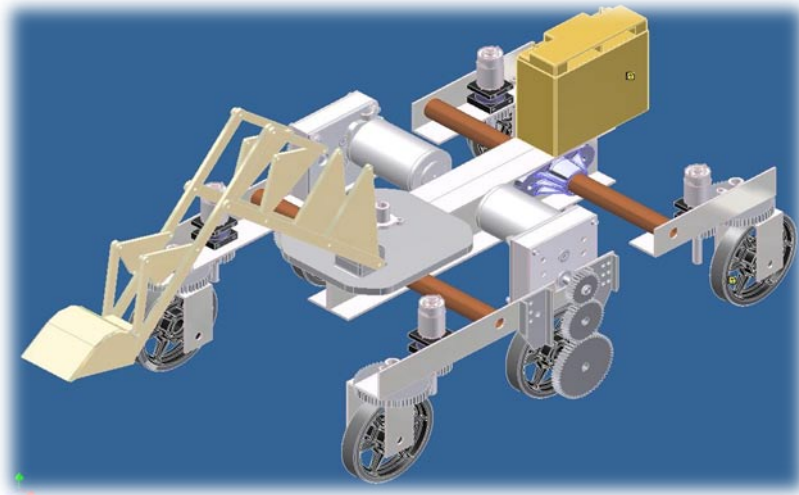
included the rover chassis support system, the shovel mechanism, and the transmission system. The rover is supported by a chassis support system with six wheels. This will allow rover to move around tough terrains. The shovel mechanism was included in the design to perform excavation. The motion of the shovel has been analyzed and animated to check if it satisfies the design objective. The transmission system provides the power for the rover.

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

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

Title: Modeling Energy Transfer with Strings on Wormholes
Undergraduate Researchers: Mir Ali, Frenny Ruiz, Carlos Saint-Victor
Faculty Mentor: Justin Vazquez-Poritz

The Holographic Principle enables us to investigate aspects of strongly-coupled quantum field theories which would otherwise remain hidden when applying

conventional methods. According to this novel approach, particles correspond to the endpoints of strings moving within a five-dimensional gravitational background. The fifth dimension corresponds to the energy scale of the field theory. Various dynamical processes of the particles can be understood in terms of the differential equations which govern the motion of the strings.

We consider strings moving on various wormhole backgrounds which arise as solutions to Einstein-Gauss-Bonnet theory. The string endpoints are located on opposite ends of the wormhole. This corresponds to a pair of different types of charges-- such as electric charge and quark color charge. We find that there is no interaction between a pair of slowly moving charges. However, upon passing a critical speed, one of them begins to lag behind the other. This marks a dynamical phase transition, after which energy is transferred from the leading charge to the lagging one. We analyze how the rate of energy transfer depends on the properties of the quantum field theory.

Title: A Russian Version of a Computerized Forensic Evaluation in a Cyrillic Character Set
Undergraduate Researcher: Anna O'Brien
Faculty Mentor: Prof. Daniel Capruso

Aim: New York has a rapidly increasing Russian immigrant population for whom it is difficult to provide forensic psychiatric services due to a language barrier. The aim of the project was to produce a Russian version of an existing computerized legal competency evaluation in a Cyrillic character set.
Method and Results: The 105 question item pool of an existing computerized forensic evaluation produced by the second author was translated into a Cyrillic character set and created as a digital file. These questions focus on the first prong of legal competency as defined by NYS Criminal Procedure Law § 730: the ability of a person to comprehend the legal proceedings against them. When a forensic patient selects the Russian language option, the computerized forensic evaluation is presented in Russian/Cyrillic with English subtitles.
Conclusion: The production of a Russian version of a computerized fitness evaluation will allow provision of expanded forensic services to immigrant forensic patients. The multilingual English/Spanish/Chinese (simplified character set) version of the forensic program already exists, and the inclusion of a Russian language option will allow cross-cultural research into differences in fitness to proceed among these immigrant groups. Because many immigrants from Eastern Europe and the former states of the Soviet Union are able to speak and comprehend Russian in addition to their native languages, the expanded multilingual forensic program may have applications outside the Russian immigrant population.

Title: The Effect of Immigration on Legal Competence in Normal Subjects
Undergraduate Researcher: Tamelia Spence
Faculty Mentor: Prof. Daniel Capruso

Aim: The aim of the project was to determine if immigrant status has an effect on legal knowledge and judgment.

Method: Subjects were 43 students recruited from classes at the New York City College of Technology. The sample was almost equally divided between American born (n = 22) and immigrant (n=21) subjects. The recency of immigration ranged 3 to 17 years (M = 9.90; SD = 4.49). Legal knowledge was tested using 12 computerized multiple choice questions that measured understanding of various plea options and the roles of judge, jury, district attorney and defense attorney. These questions were designed to be compatible with the second prong of legal competency as outlined in Dusky v. US (1960). A series of 12 computerized true/false questions was used to further measure legal knowledge and judgment. Response latency for each question was measured by the computer.

Results: On the legal competency task, immigrants slightly outperformed American born subjects, but the results did not reach statistical significance. Multiple choice response latencies were significantly shorter $(F = 1, 41) = 7.11, p < .05$) for American born subjects (M = 90s; SD = 29) than for immigrant subjects (M = 118s; SD = 38). True/false response latencies did not differ between American born and immigrant subjects. For immigrants, correlational analysis indicated that there was no relationship between speed, accuracy, and years residing in the United States.

Conclusions: In normal subjects, immigrant status does not have an effect on legal competence as measured by knowledge of courtroom personnel and procedure, plea options, and ability to exercise good legal judgment. Immigrants do take significantly longer than American born citizens to respond to legal questions, but that does not reflect knowledge deficiency. Americans are faster at responding to legal questions, but they are not more accurate. Recency of immigration is unrelated to the speed and accuracy of performance.

Title: A Reexamination of the Age Declines in Job-Related Training Performance: New Data and Moderators"
Undergraduate Researcher: Jhonatan Echavarria
Faculty Mentor: Prof. Jean Kubeck

The goal of this study is to extend previous work (i.e., Kubeck et al., 1996) and assess the degree of relationship between age and training outcomes by cumulating the existing literature, with a focus on current and recent research. Specifically, the present study aims to assess the age and training performance relationship by summarizing studies that trained adults on skills necessary for successful job performance. Moderator analyses will be conducted for type of training, type of training outcome measure, type of sample, crystallized and fluid abilities (e.g., Ackerman & Beier, 2006; Kanfer & Ackerman, 2004) cohort, gender, and others as the obtained data allow. This will provide an update, as well as, a better view of age and its effects on job-related training

performance for older workers. First, we searched electronic databases for works that cited the original Kubeck et al (1996) article. Thirty-one articles in were identified, of which we have currently obtained thirteen. Based on a qualitative review, eleven of these articles cited the Kubeck et al. (1996) study to support statements of age-related deficits. The remaining two articles were neutral.

Title: Integration of Two Separate Identities: Single Mother and College Student
Undergraduate Researcher: Sherma Soodeen
Faculty Mentor: Prof. Eric M. Rodriguez

Within our social interaction and our environment we develop several different identities, such as Mother, Student, Sister, Intern, and Emerging Scholar. Do we therefore have on and off switches as we move from one identity to another? The roles we play in our daily lives do not function in exclusivity, but at times become intertwined with each other. As per Rodriguez (In Press), I focused on a few key psychological theories in use in the field today. Festinger's (1957) cognitive dissonance theory, where we experience tension between two inconsistent thoughts and beliefs, Baumeister, Shapiro, and Tice's (1985) theory of identity conflict, this is when we experience conflicting feelings and commitment to two equally important identities, and Shallenberger's (1998) notion of identity integration as a process, where we try to achieve a balance between these two identities. I then applied these theories to two conflicting aspects of my own life: Being a *Mother* verses being a *College Student*. For example, my identity as a mother of four children comes into conflict with my identity as a college student when my children are ill. The tension between these two roles forces me to value one over the other. On one hand I am their mother and must care for my children, on the other I have papers due and an exam to prepare for. So far I have managed to integrate these identities through my ability to categorize and find available resources, and by relying heavily on my family for assistance, which has thus enabled me to successfully fulfill both roles.

Title: Applying Theories of Identity Conflict and Identity Integration to My Own Life: Being a College Student Verses Being a Young Adult
Undergraduate Researcher: Jamal Stovall
Faculty Mentor: Prof. Eric M. Rodriguez

Dr. Rodriguez has conducted several studies on identity conflict. His focus is on the gay and lesbian community and their Christian identities. The underlying concept of his research is personality integration. Through this review of Dr. Rodriguez's research, I looked to explore the concept of identity integration as it affects my life. A conflict that many students face, including me, is the conflict between being a student and a young adult. As young adults, we want to experience this "new" world that we have been exposed to (i.e. going to parties, bars, clubs etc). However as students, we must be diligent in our studies, no matter how time consuming, in order for us to graduate and maintain an acceptable GPA. Putting too much emphasis on one has caused unhappiness in my case. Studying all the time is extremely exhausting and causes mental stress. At the

same time, going out consistently doesn't give you the adequate time you need to study and this cause guilt and poor grades. In both cases, neither outcome is wanted. I've learned that in order to be successful in school and preserve happiness outside of school, these two identities must combine. Through this academic exercise, I've learned attaining this integration is, at times, difficult for many students. The examples used are from my experiences as a student who has dealt with identity conflict being a student and young adult. In this academic exercise, I looked at myself as a student and analyzed how problems between these identities arose and how they were addressed. Both identities are extremely important to me because when both are in balance, I am jovial. I feel a sense of accomplishment knowing I am doing well in school while keeping a social life. I took particular interest in this academic exercise in order to take a closer look at the reasons for integration and the aspects that cause conflict.

Title: Validation of a Teaching Style Inventory
Undergraduate Researchers: Jorge Reinozo, Moumin Ghanem
Faculty Mentor: Prof. Howard Sisco

Purpose: The faculty sponsor is the creator of a Teaching Style Inventory, a 48 item paper and pencil scale developed to identify students' perceptions of their professor's teaching style behaviors. The ratings do not depend on whether the teacher is liked, but rather to what degree different style behaviors are demonstrated. The inventory uses a 7 point rating scale ranging from never to always. Respondents rate the degree to which each behavior is displayed by their professor. Until now a validated measurement instrument has not existed to allow social scientists to systematically investigate how teaching styles interact with learning styles in a culturally diverse classroom. The purpose of this professor/student collaborative effort was to take data already collected in this IRB approved study, and validate the scale using statistical software.

Method: Collected data from 240 students participating from the New York City College of Technology was coded and transcribed into data files for analyses using Statistical Package for Social Sciences (SPSS). Construct Validity (analyzed via Principle Component Analysis, PCA) and Reliability (analyzed via Reliability Analysis) was assessed using the newly coded data. The student assisted with data coding and entry, analyses, and the writing up of results for this project.

Title: From Ellis Island to Angels Island: A Cinematic History of Immigration
Undergraduate Researcher: Nancy Delcid
Faculty Mentor: Professor Peter Catapano

The immigrant experience has been a staple of the American cinema since the silent era. Through the use of such films in the classroom, students may be introduced into the discipline of immigration history. This presentation will provide three examples of U.S. immigrant history teaching modules that incorporate film sources. Each example will be representative of the diversity of the immigrant experience during the 19th and

20th centuries. The cinematic representations of immigrant lives from Europe, Asia, and Latin America are included. Along with each film are viewing question and classroom activities. Also included is a list of recommended films for classroom use divided by time period and country of origin.

Title: Electronic Circuitry for Improving Performance of an Optical Communications Link
Undergraduater Researcher: Zaw Zaw Latt
Faculty Mentor: Prof. Djafar K. Mynbaev

We investigated the electronic filters designed for communications circuits. In this work we have concentrated on a second-order filter. We have used a series R-L-C circuit as an example of such a filter. Our choice has been motivated by the fact that this circuit exhibits all typical features of a second-order system.

Our work included the mathematical description of the circuit. We have derived the differential equation of this circuit and found its homogeneous and nonhomogeneous solutions by classical method. In addition, we have found the solution of the circuit's equation by using the Laplace-transform method. In this quest, we have explicitly resolved the Laplace transform of the circuit's equation into partial fractions. Eventually, through the inverse Laplace transform, we have found the general solution of the circuit's differential equation. Quite clearly, both solutions—obtained by the classical method and through the Laplace transform—coincide; this fact is the proof of the correctness of our solution.

We have found that our solution might have three forms: under damped, over damped and critically damped. In the under damped case, the circuit exhibits the damped oscillations. The decay rate and the frequency of these depend on the circuit's parameters, whereas their amplitude and phase shift are determined by the initial conditions. In the over damped and critically damped cases, the circuit exhibit aperiodic damped behavior. Again, the decay rate depends on the circuit's parameters, but the course of the output-voltage graph depends on the initial conditions. We investigated all possible combinations of these conditions and found all possible courses.

We have considered the series R-L-C circuit with specific parameters and found the free and forced responses of this circuit, which are the homogeneous and nonhomogeneous solutions of the circuit's differential equation. We have also built the graphs of these solutions for all three possible cases. In addition, we have investigated the affect of the circuit's parameters—R, L and C—on the output waveform in the under damped case.

Title: Effect of garlic extract on human neuroblastoma SY5Y cells: SDS-PAGE Analysis
Undergraduate Researcher: Rajvinder Kaur

Faculty Mentors: Profs. Niloufar Haque, Nasreen Haque and Mazhar Malik[1], George Merz[2]

1. *Department of Neurochemistry, Institute for Basic Research in Developmental Disabilities, Staten Island, New York 10314, USA*
2. *Institute for Basic Research in Developmental Disabilities, Staten Island, New York 10314, USA*

Alzheimer's disease is a progressive neurodegenerative disease that attacks the brain and results in dementia-impaired memory, thinking and behavior. The disease progresses slowly from mild forgetfulness to confusion to dementia. Age is known to be a single major risk factor for AD. The fluidity of membrane decreases with age thus making it susceptible to and less resistant to a wide variety of insults. Oxidative modification of DNA, proteins and lipids by reactive oxygen species plays a role in aging, cancer, cardiovascular, neurodegenerative and inflammatory diseases. Oxidative stress can be promoted by a number of factors and conditions including free radical formation. Antioxidants scavenge the free radicals and maintain the membrane fluidity. Excessive oxidative stress can impair cellular processes and lead to neuronal death. Neural plasticity on the other hand, is the ability of brain to adapt to changes, which provides the foundation for learning and memory and for repair after injury. It has been reported that garlic, which belongs to the Liliaceae family has diverse biological properties. Long-time Aged Garlic Extract (AGE) results in modifying unstable molecules with antioxidant activities which include unique water-soluble organosulfur compounds. In the present study, SY5Y human neuroblastoma cells were treated with either fresh or aged garlic extract for seven days. Cell growth was arrested following treatment in a dose dependent manner. Cells not treated with the extract continued to proliferate in a linear fashion and by seven days had increased by 200 fold. LDH assay confirmed cell death in garlic extracted SY5Y cells. Altered protein levels and profiles were observed between the control and experimental groups. Unique protein bands were detected by silver stain and Coommassie blue staining. Details will be discussed at the Conference.

Title: Using Hessian and Quadratic Forms to Study Extremes of Multivariate Functions
Undergraduate Researcher: Javier Joya
Faculty Mentor: Prof. Satyanand Singh

In this analysis, quadratic forms were used to investigate maximum and minimum values of multivariate functions. Some practical examples were considered in this study, and both theoretical and practical considerations were made. Extensive use was made of the Maple software to illustrate the predicted results. This study is very important in economic models. Our results showed that the theoretical calculations and the practical results agree. This means that we can predict extrema reliably using Hessian and Quadratic forms under certain restrictions on the parameters.

Title: Human Heart Modeling and Animation
Undergraduate Researchers: Michael Gibilarlo, Mukhtar Adeyinka, Adam Atia
Faculty Mentor: Prof. Sidi Berri

The objective of this project is to create a model and animation of the human heart in order to further enhance educational resources for undergraduate students in the Biology Department. The animated model will also be used as a teaching tool in the Biology freshman classes at the College. To make such a model and animation, the students had to research and analyze the human heart. By creating a graphical model using the state-of-the art three-dimensional software package MAYA, an animation of the heart in its functioning state was developed. The next phase of this project would be to make plastic three-dimensional models of the heart using a rapid prototyping machine. Other human organs such as the brain could also be studied, modeled and animated using the same process.