



**Abstracts of the Emerging Scholars Program Research Projects**

**Spring 2011**

**Supported by New York City College of Technology**

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2. Aisha Nafasat Yumina Bashir	BIO	Rachele Arrigoni- Restrepo	Brownfields in NJ: Where They Are, and How They May Harm Us
3. Anna Soyfer Pablo Mota	BIO	Rachele Arrigoni- Restrepo	Environmental Impact of Brownfields in the NY Metro Area
4. Margarita Malayeva	BIO	Majeedul Chowdhury/Walied Samarrai	Evaluation of Medicinal Plants for In Vitro Antimicrobial
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14. Christina Valore	CHEM	Diana Samaroo	Chlorins for Diagnosis, Imaging and Targeted Therapeutic Delivery
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19.Ryan Moore	HU	Michael Justin Davis	Analyzing the EPA Greenversations Blog
20.Steven Lora	MAT	Andrew Douglas	The Linear Algebra behind Web Search Engines
21.Enmanuel Almanzar	MAT	Andrew Douglas	Origami Geometric Construction
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35.Karl Garcia	PHYS/ ENG/ MAT	Reginald Blake/Reneta Lansiquot/Janet Liou- Mark	Database Development for the Tracking of Intervention Activities of the Black Male Initiative Program
36.Hend Bayoumi	Social Science	Edward Kaplan	Open Market Operations at the Federal Reserve
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**1.Title:** Designing for Disaster

**Student Researchers:** Erik Jester, Hiba Nafe, Long Raun

**Faculty Mentor:** Prof. Illya Azaroff

The current global ecological crisis is at the forefront of architecture. The intensity and frequency of natural disasters are an unfortunate commonality that all of humanity must face. Hurricane Katrina (2005), the earthquake in Haiti (2010), and most recently, the earthquake/tsunami in Japan (2011), are certain evidence of this.

As future design professionals, we consider it our charge to maintain a humanitarian conscious throughout present and subsequent endeavors. The focus of our architectural design studio, directed by Illya Azaroff, is to examine deployable first response emergency shelters with the built in cradle-to-cradle features required for disaster relief. Maintaining the essential needs of human life must be met, and the post use strategy is just as important as the present use. Additional emphasis is placed on the exploration of different deployment types and their inherent efficiencies. The most compact and light weight package must turn into a durable, space capturing structure that has a post stage 1 plan for its materials.

Our first constructed prototype, the **HIBA-tat**, is a flat-packed and pre-hinged unit with a Terrapin system in kit form. All materials are off-the-shelf and readily available keeping within the DIY (do-it-yourself) framework. It is lightweight, and can be easily deployed by two people in about 5 minutes. The expansion ratio is 1000%, meaning 10 compacted units occupy the space of 1 deployed unit, which is essential for effective transportation/distribution.

The Emerging Scholars Program has provided us with a unique opportunity to become more capable humanitarians with the design profession, and bring awareness to our surrounding community.

**2.Title:** Brownfields in NJ: Where They Are, and How They May Harm Us.

**Student Researchers:** Aisha Nafasat, Yumina Bashir

**Faculty Mentor:** Prof. Rachele Arrigoni-Restrepo

Despite its designation as the “Garden State”, the State of New Jersey, particularly in its Northern and Central parts, is characterized by the presence of highly industrialized areas, that are known to release high levels of contaminants into water bodies (including the Passaic and Hackensack Rivers), soil and air. The state also contains a high number of so-called Superfund sites, which are highly contaminated areas that are currently undergoing remediation through funding from the superfund EPA program. Some of these sites are brownfields, which are areas where past contaminations occurred and are in need of cleanup before they can undergo further development. Our research project focuses on the identification and characterization of contaminated sites in the Northern NJ area, particularly along the Hudson River, since these sites are more likely to affect contamination levels in neighboring Manhattan and Staten Island. Sites’ location and contaminants’ identification will be provided, and health effects of common contaminants will also be described. We hope to bring the topic of environmental contamination by human activities to the attention of the public, with the broader purpose to promote the

implementation and development of green technologies that may cause less pollution and, as a consequence, less environmental degradation.

**3.Title:** Environmental Impact of Brownfields in the NY Metro Area

**Student Researchers:** Anna Soyfer, Pablo Mota

**Faculty Mentor:** Prof. Rachele Arrigoni-Restrepo

Technological progress in industrialized countries has allowed mankind to reach extremely high levels of “post-nature evolution”. However, this progress has not come without consequences for the environment surrounding us, and for our own health. For each step forward we have taken, we have contributed to the release into various environmental media (water, soil, air) of extremely toxic substances, including petroleum byproducts and additives, organic solvents and various kinds of heavy metals. Brownfields are sites where known, past contamination events have occurred, and that are therefore prevented from further development (for both commercial and residential purposes) until all contaminants have been removed from the affected media. This research project focuses on the identification, mapping and gross characterization of brownfield sites within the NY Metro area. Most common contaminants in those sites will be presented, along with their effects to human health, should exposure occur. Public awareness of the existence and location of these contaminated sites will hopefully help our community realize the impact of modern technology to our and our environment’s health, and, possibly, may help us promote the development of cleaner, more environmentally friendly technologies with time.

**4.Title:** Evaluation of Medicinal Plants for In Vitro Antimicrobial Activity.

**Student Researcher:** Margarita Malayeva

**Faculty Mentors:** Profs. Walied Samarra and Majeedul H Chowdhury

In ethnobotany plants have always been the common source of medicaments. *Acacia nilotica* (family: Leguminosae) bark is used in ethnomedicine for treatment of diarrhea and dysentery. Many microbial diseases, such as Shigellosis, remain a major public health problem in developing countries, and microbial resistance to antibiotics has complicated their empirical treatment. To address this problem, the effect of the extracts of powdered pods of medicinal plant *Acacia nilotica* on the growth of *S aureus*, *B subtilis* and *E coli* was studied. The extracts of the pods showed antimicrobial effect against most of the bacteria incubated at 37°C for 24 h. The maximum inhibitory effect was noticed on *S aureus* and *B subtilis*. The results suggest that *Acacia nilotica* plant could be a potential source of antimicrobial phytochemicals for treatment of bacterial pathogens in general and *perhaps* antibiotic resistant bacteria in particular.

**5.Title:** Social Sound Production in Gerbils  
**Undergraduate Researcher:** MD Rakhibuzzaman  
**Faculty Mentor:** Prof. Maria Ter-Mikaelian

The Mongolian gerbil is a social desert rodent which is widely used for behavioral and physiological studies. The goal of this experiment was observing their communicative behavior to study the auditory part of the brain. Gerbils were placed in a sound-proof room for sound recording, and the environment was made as natural as possible for them. During four months of observation, four types of vocalization were found associated with their behaviors, which were alarm behavior, aggressive behavior, sexual behavior, and feeding behavior. Gerbils vocalize differently for each kind of behavior.

The acoustic properties of the vocalizations can be visualized using a spectrogram, a graph in which sound frequency is plotted as a function of time. Additionally, the power spectrum can be used to show the intensity of each frequency in the sound. Using these graphs, the acoustic properties of three types of vocalizations were compared. It was found that aggression calls, food calls, and mating calls differ in peak frequency as well as the frequency sweep range at 15 dB below the peak frequency. This suggests that gerbils may distinguish the calls on the basis of their sound properties.

**6.Title:** Information Optimization in Protein Structure Prediction  
**Student Researchers:** Sereta Scott, Tanja Zivkovic-Culjak  
**Faculty Mentor:** Prof. Armando Solis

The bioinformatics of protein structure prediction relies on using a comprehensive database of protein structures to formulate equations, called potential functions, that assist in identifying the correct molecular structure of any given amino acid sequence. Such a protein structure database is usually organized from high resolution molecular structures deposited in the Protein Data Bank (PDB). Tanja Zivkovic-Culjak's preliminary work centers on how to organize the database of structures from the large PDB set (made up of more than 60,000 macromolecular structures) so that computer programs constructed to formulate potential functions will be able to access and manipulate the data in an efficient manner. She intends to continue the work, began this semester, into the summer and fall semesters, by completing an organized and working structural database, and then subsequently testing it in a computation-intensive application. In particular, the database will be used to implement a comprehensive search for the best local backbone potential, out of the many existing backbone potentials in the literature, using information-theoretic strategies. These information-theoretic strategies are the subject of Sereta Scott's work. Specifically, her preliminary work involves the study of how entropy and mutual information, two fundamental information-theoretic quantities, can be used to formulate potential functions from large structural databases. These information-theoretic quantities are of interest because they have been shown to be fundamental to the action of potential functions.

**7.Title:** Microbial Diversity in the Gowanus Canal

**Student Researcher:** Kenneth Paneto

**Faculty Mentor:** Prof. Nasreen Haque

Every living organism has a specific role in maintaining the balance of the ecosystem. As a result of this balance, all organism including bacteria can contribute to a healthy and balanced ecosystem. When this balanced is disturbed, the ecosystem can suffer. Gowanus Canal, an estuary in New York City is infamous for its level of pollution. We are studying the microbial populations colonizing in the water body. In spite of measures being taken, various microbes survive in this environment. The metabolic activity of these organisms plays a significant role in their survival. Understanding these factors will aid in the identification of new therapeutics. Our hypothesis is that the microorganisms in the canal may yield molecules that may be of value in modulating diseased conditions. Our aims are to identify and characterize bacteria that may show an antibiotic effect on *Eshcerica coli* and *Staphlococcus aureus*.

**8.Title:** Chemokines in Atherosclerosis

**Student Researcher:** Erika Green

**Faculty Mentor:** Prof. Nasreen Haque

The response of the arterial vascular wall to injury is characterized by vascular smooth muscle cell migration. This migration is induced by cytokines, however the agonists involved are not fully defined. Chemokines are chemotactic cytokines that are known to attract leukocytes to the sites of infection and inflammation. The CC chemokine receptor 8 (CCR8) is expressed on monocytes and T-lymphocytes and is the sole receptor for the human CC chemokine CCL1 (I-309) and for the viral chemokine, vCCL1 (vMIP-1). The induction of CCR8 and CCL1 under conditions associated with vascular smooth muscle cell proliferation and migration raises the possibility that CCR8 may play an important role in vessel wall pathology. We aim to define: 1) how chemokines enhance cell survival, motility and proliferation and 2) the mechanisms by which chemokines influence cell remodeling. We will be using protein gel electrophoresis to identify protein that influence these parameters

**9.Title:** The Search for Novel Antibiotics: A Metagenomic Approach

**Student Researchers:** Erika J. Green, Jakub Domanowski,

**Faculty Mentors:** Profs.Niloufar Haque and Nasreen S.Haque

Widespread overuse and inappropriate use of antibiotics are fueling an increase in bacterial resistance and warrants an urgent search for new antibiotics to be re-energized. It has been demonstrated previously that potential antibiotics may be isolated from diverse underwater environments. Microbial populations in response to environmental conditions evolve novel strategies of defense by harboring novel molecules to develop resistance. Targeting these niches may allow for the isolation of new molecules that may combat antibiotic resistance. Our aims were to (1) Identify potential antibiotics from different environments and (2) test its effects on

pathogens from different organ systems. In this regard, we have used the traditional microbiology tools and in addition, functional metagenomics.

Metagenomics is the study genetic material recovered directly from environmental samples. Moreover, functional metagenomics allows the identification of specific targets of interest based on function.

The effect of microbial cultures from different environments for their antibiotic potential was studied. The Gowanus Canal in New York City (site1) is heavily polluted by industrial activity and considered highly toxic, whereas Dutch Spring, PA (site2) is highly populated by divers and serves as a high traffic recreational quarry. Our previous results have shown that samples (#1,#4) from these sites inhibited the growth of *Escherichia coli* and *Staphylococcus aureus*. We have extended these studies to human pathogens of the oral cavity, respiratory system, gastrointestinal system and genitourinary system. Sample #1 was highly effective against streptococcus genus affecting the oral cavity but showed limited inhibition against the skin pathogens. Sample#4 appeared to be largely ineffective against skin pathogens, with marginal inhibition present in only 25% of the species. Interestingly, the inhibition was observed in  $\beta$ -Streptococcus group A which demonstrated resistance against sample#1. These findings demonstrate the efficacy of underwater samples impacted by humans as a potential source of new drugs. Future studies will include screening the metagenomic library for antibiotic activity in order to augment current efforts.

**10.Title:** Recent Advances in Alzheimer’s Disease Research

**Student Researcher:** Ximena Morocho

**Faculty Mentors:** Profs. Nasreen S Haque and Niloufar Haque

This project is a continuation from last year’s poster presentation of, “What are your risks of developing Alzheimer disease?” The research is focused on Alzheimer Disease research and how it has change in just one year. Many new statistics show that Alzheimer Disease has not declined and most importantly that we need to be aware and take care of the way we treat our minds and bodies as early as we can. My project last year focused on the relationship between Alzheimer Disease and type-2 diabetes. Type-2 diabetes leads to neuronal cell loss that results in short term memory deficit. This means that diabetes is one of the many risk factors, this potential association between Alzheimer’s disease is known as hypercholesterolemia (high level of cholesterol in the blood). Cholesterol can be obtained from dairy products and an unbalanced diet that can lead to an accumulation of this molecule in the body. Hypercholesterolemia causes metabolic syndrome and loss of glucose regulation, which commonly leads to diabetes. It is important for people with diabetes or hypercholesterolemia to consider an appropriate diet in which the nutrients they intake will help them regulate and maintain a healthy diet. We are going to review and update the recent studies in Alzheimer Disease during the past one year and report the findings.

**11.Title:** Arterial Blood Supply and Oxygen Deprivation in Progression of Alzheimer's Disease  
**Student Researchers:** Emily Kheluram, Tenzin Doma  
**Faculty Mentors:** Profs. Nasreen and Niloufar Haque

As many as 5.3 million Americans are living with Alzheimer's disease. Alzheimer's destroys brain cells, causing memory loss and problems with thinking and behavior severe enough to affect work, lifelong hobbies or social life. Alzheimer's gets worse over time, and it is fatal. Just like your heart, your brain depends on a nourishing blood supply to function properly and survive. How does our cardiovascular system play major role in Alzheimer's disease? Alzheimer's disease can result from narrowing and blockage of the arteries that supply blood to the brain and depriving cells of food and oxygen. Food and oxygen are carried to the brain by many blood vessels. Although the brain is only about 2% of the total body weight in humans, it receives 15-20% of the body's blood supply. Because brain cells will die if the supply of blood which carries oxygen is stopped, the brain has top priority for the blood. Even if other organs need blood, the body attempts to supply the brain with a constant flow of blood. The blood brings many materials necessary for the brain to function properly and also removes materials from the brain. Thus, the prevention of brain blood flow will lead to the deterioration of the brain itself.

Cardiovascular system seems to play a role in progression of Alzheimer's disease. Researchers have found that two proteins which work in tandem in the brain's blood vessels and present a double problem in Alzheimer's disease. Not only do the proteins lessen blood flow in the brain, but they also reduce the rate at which the brain is able to remove beta amyloid, the protein that builds up in toxic quantities in the brains of patients with the disease. Beta amyloid, or A beta is one of many proteins found to be associated with Alzheimer's disease. It is released when a larger protein, amyloid precursor protein (APP), is cut by several enzymes, resulting in amyloid plaques, a contributing factor in Alzheimer's disease. Research suggests this occurs when APP is abnormally processed, possibly due to trauma, cholesterol levels or oxidative stress (cardiovascular system). Thus, beta amyloid and APP are involved in the early process of Alzheimer's disease development. Providing hard evidence directly linking two processes thought to be at play in Alzheimer's disease: reduction in blood flow and the buildup of toxic beta amyloid. Normally, amyloid is picked up efficiently by blood vessels that then whisked the toxic trash away. But in Alzheimer's disease, the system no longer is able to keep up with the body's production of the substance. The molecular trash accumulates, and is believed the buildup kills brain cells. The findings came primarily from studies of brain taken from people who have Alzheimer's disease and comparing them to cells from healthy elderly people. Studies show that the two proteins are much more active in the blood vessels of brains of people Alzheimer's disease than in people who do not have the disease. They showed that when they reduced the activity of the proteins, blood flow in the brain increased, and when the proteins were more active, blood flow decreased.

Research studies show that Alzheimer's disease is indeed linked to the cardiovascular system. It's not simply that reduced blood supply hurts brain cells by causing a shortage of oxygen and other nutrients. Rather, deterioration of blood flow seems to clog up the brain's ability to remove toxic waste products. One of the best ways to take care of the human brain is to make sure that the heart supplying blood to that brain is performing optimally. Alzheimer's disease has no current

cure, but treatments for symptoms are available and research continues. Although current Alzheimer treatments cannot stop Alzheimer's from progressing, they can temporarily slow the worsening of symptoms and improve quality of life.

**12.Title:** Social Behavior of Human Beings: Inter-personal Relationships and Brain Function

**Student Researcher:** Lynn D. Jean

**Faculty Mentor:** Nasreen S. Haque and Niloufar Haque

As we go through life, have you ever wondered why do we as adults tend to trust others less, than as kids who would play with another kid (who is a perfect stranger) as if there were best friends forever? Which brings us to another perspective on education.....? Why do some students have a hard time interacting with each other or better yet motivate students to be the best they can be? According to Erik Homburger, Erikson's theory on social development of human begins. One can say he hit the nail right on the head, in answering these questions, based on his theory of social development which he sums up into eight stages that are identified as "conflict involving the individual's relationship with their social environment, which must be resolved satisfactorily for healthy development to occur." (Wood, Wood and Boyd).

Mr. Erikson's eight stages are Trust vs. Mistrust, Autonomy vs. Shame and Doubt, Initiative vs. Role Confusion, Intimacy vs. Isolation, Generativity vs. Stagnation, and Ego Integrity vs. Despair. Throughout these stages one may begin to learn about themselves in many ways. Erikson's first four stages are the basic foundation in discovering adult's personality which is laid out in childhood stages. Stage one talks about Trust vs. Mistrust being at the age of infancy (birth to 1 years old) this stage is the door way into developing a sense of trust or mistrust, depending on the mother, or caregiver's demonstration of love and affection. Stage two talks about Autonomy vs. Shame which starts at the age of 18 months to 3 years old; where fine tuning skills begin when the brain starts to form. In other words it's the start of learning to walk, talk, feed, and toilet train oneself, using motor skills. Stage three talks about Initiative vs. guilt which beings age 3 to 6 years old. This stage goes beyond the Autonomy vs. Shame into a developing initiative, by enjoying the abilities and motor the individual possesses. The fourth stage is about Industry vs. Inferiority - it starts from age 6 years old to puberty, the individuals develops a sense of pride and fulfillment in oneself. Erikson's later stages being with puberty but yet they are not strongly bonded compared to the chronological age as those that take place throughout childhood stage. However, adolescents and adult stages play important roles in adult life, which will be fewer, delve in this present project. The objective of the present project is to study the effects of human beings in their social environment, through the changes of human perspective of life form being a well connected individual to becoming a remote individual. Preliminary results will be presented and discussed.

**13.Title:** The Role of Diet and Nutrition in the Etiology and Prevention of Oral Cancer

**Student Researcher :** Judy Liang

**Faculty Mentor:** Prof. Laina Karthikeyan

Epidemiological studies worldwide have implicated dietary and nutritional factors in the development of oral cancer. Every year, nearly 300,000 people worldwide are diagnosed with oral cancer. This type of cancer has the highest incidence in people who use tobacco, including cigarettes, but the means by which tobacco promotes the development of oral cancer is unknown. Researchers at the Jean Mayer USDA Human Nutrition Research Center on Aging (USDA HNRCA) at Tufts University are investigating whether nutritional factors may be involved.

There are several types of oral cancers, but around 90% are squamous cell carcinomas originating in the tissues that line the mouth and lips. These are malignant and tend to spread rapidly. Oral or mouth cancer most commonly involves the tongue. It may also occur on the floor of the mouth, cheek lining, gingiva (gums), lips, or palate (roof of the mouth).

Scientific literature was researched to investigate whether certain food intake will reduce the risk of oral cancer and whether supplementing with vitamins has a protective role.

Fruits, cereals, dairy products, and olive oil appear to convey protection against oral carcinoma and their effects may be mediated through higher intakes of riboflavin, iron, and magnesium. The low incidence of oral carcinoma reported in Greece may be explained in part by the higher consumption of the food groups and micronutrients that appear to protect against the disease.

A Brazilian case-control study showed that habitual intake of bacon and fried foods was a risk factor for oral cancer (Toporcov *et al*, 2004.) In developing countries, around 60% of cancers of the oral cavity, pharynx and oesophagus are thought to be due to micronutrient deficiencies related to a restricted diet that is low in fruits and vegetables and animal products; it should be noted, however, that the evidence for a protective effect of fruits and vegetables is largely derived from case-control studies and there are few data yet from prospective studies. The relative roles of various micronutrients are not yet clear, but deficiencies of riboflavin, folate, vitamin C and zinc may all be vital. There is also consistent evidence that consuming drinks and foods at a very high temperature increases the risk for oral cancer. Yet another study suggested that a diet with a higher Glycemic Load increases the risk for oral cancer.

**14.Title:** Chlorins for Diagnosis, Imaging and Targeted Therapeutic Delivery

**Student Researcher:** Christina Valore

**Faculty Mentor:** Prof. Diana Samaroo

In the conducted research porphyrinoids were studied in treatments used for cancer, viral, and other biological applications. Porphyrinoids are groups of organic compounds, which include corroles, phthalocyanines, porphyrins, porphyrazines, and chlorins. For the concise purposes of this study only chlorins and porphyrins were used. Photodynamic therapy or PDT is a newly tested procedure to treat vast types of cancer. For PDT to work correctly, the procedure must be

in the presence of oxygen, along with a photosensitizer and a light with sufficient amount of wavelength (energy). When the photosensitizer (chlorin/ porphyrin) is exposed to a light with the proper wavelength, the molecules become excited and begin to decay through a triplet state. By doing so singlet oxygen and reactive oxygen species are produced, which are both toxic to the cancer cell. By use of the PDT procedure it was found that chlorin is effective as an antitumor photosensitizer. This was evident since many cancer cells had suppressed invasiveness, inhibited cell proliferation, and was able to set off apoptosis via the mitochondrial pathway when both light and chlorin/porphyrin is present.

**15.Title:** Phthalocyanines Nanoparticles in Targeted Therapeutic Delivery and Photodynamic Therapy

**Student Researcher:** Jason Johnson

**Faculty Mentor:** Prof. Diana Samaroo

Phthalocyanines are members of a class of organic compounds known as porphyrinoids. Porphyrinoids, such as the iron-containing 'heme' group in the hemoglobin of red blood cells, are cyclic compounds composed of four carbon rings, and are known for their ability to absorb visible light, a property exploited in photodynamic therapy (PDT). PDT has been extensively used in the treatment of cancers, and consists of three components: light, oxygen, and a photosensitizer, such as phthalocyanine. Recent studies have attempted to discern how to increase the efficacy of phthalocyanines as photosensitizers, to hopefully result in a better prognosis following PDT. Phthalocyanines have been effectively utilized in the treatment of early stage breast and cervical cancers, resulting in apoptosis, or programmed cell death, as well as a disruption of the G<sub>0</sub> and G<sub>1</sub> phases of the cell cycle. Modifying phthalocyanine compounds by conjugating the particles with gold nanorods, modifying the surface of the phthalocyanine particle, encapsulating phthalocyanine in polyethylene-glycol-coated polylactic acid nanoparticles, and/or coupling with compounds such as titanium oxide, among other methods, have proven to increase the solubility and specificity of drug targeting of the phthalocyanine compounds in PDT. Modification of phthalocyanines in these regards will be an important field of study as we refine the use of these compounds as the photosensitizer in PDT, bettering patient outcomes.

**16.Title:** Weird Science: What Does It Mean to be Virtually Human?

**Student Researcher:** Sanjiv Latchman

**Faculty Mentor:** Prof. Reneta D. Lansiquot

Being an Academic Counseling Expert (ACE) in an online writing program ([www.citytechpalace.org](http://www.citytechpalace.org)) was again a good experience. Through this experience, I reviewed academic essays, video game background stories as part of a learning community, and annotated bibliographies and literature reviews on what it means to be human, addressed in the new interdisciplinary course, *Weird Science: Interpreting and Redefining Humanity*. The assignment for the latter was to connect and synthesize students' viewpoints and the required course readings.

I used the experience and skills acquired in my first semester to give comments and help writers improve their skills. As I offer peer feedback, I keep “affect” in mind. Being an ACE reviewer has made me a better writer because it has allowed me to see that writers view things differently and convey their thinking using different styles. Most of all, I have learned from the feedback of my peers. When students submitted a document, I reviewed their questions and tried to answer them in the best possible way to clarify the mistakes. This may aid their avoiding or repeating future errors and may teach them to self-correct. I also provided comments and explanations, which I thought would be helpful to the writer. This method aided the writer in focusing on the weaker points of the essay and in creating solutions.

Following reviewing and revision, student papers improved, resulting in better developed pieces. Some students really needed help in writing a college-level essay, while others already wrote well. As a reviewer, I tried to strengthen the good writers and to build a stronger foundation for the writers who were not doing so well. Students not only improved their class performance but also learned to see their mistakes, correct them, and learn from the revision process. This process revealed their strengths and weaknesses in writing. ACE is a good resource for students to improve their writing skills. ACE should be available to all students on campus to submit their papers, have them reviewed, and gain feedback. This could also reduce pressure on students who may have writing anxiety.

**17.Title:** Weird Science: What Does It Mean to be Virtually Human?

**Student Researcher:** Elaine Green

**Faculty Mentor:** Prof. Reneta D. Lansiquot

Academic Counseling Expert (ACE), an online writing program, aids students in improving their writing through reflecting on their work and addressing feedback from two reviewers and a facilitator. Initially, students complete an online submission form, responding to questions on their assessment of each document submitted and in what areas they would like help. My job was to review papers for students that submitted online. To facilitate the process, I reviewed the professor’s criteria for the students and offered helpful comments on whether or not they followed instructions correctly. Last semester, I used the skills I learned in my first semester of training to become a peer reviewer. This semester, I had the help of the facilitator, the professor who taught me.

Throughout this period, I have grown as a reviewer by learning how to tackle papers that are more difficult. Last year, my focus was on revising grammatical errors, but now I am able to correct sentence structure and proper word usage. These are valuable skills for a reviewer because there are many different levels of student writing. Not only must one know how to correct simple mistakes, but also be able to discern the vaguest ones. This is why the ACE online writing program is important. Students may not realize that what they are writing may not be the best choice. As a reviewer, my job was to point out areas for correction, and offer hints on ways to correct the problem, but not to correct it for them. For example, if there was a repetitive error,

I offered the students a helpful link that explained the error and offered clear instructions on ways to correct the error. This method aided students in not repeating the mistake, and taught them to become their own reviewers. Using these methods, ACE is beneficial for both sides of the writing exchange.

Being an ACE reviewer has not only made me more aware of my own mistakes, but also how to prevent future ones. It is nice to know that I am helping students find their strengths and weaknesses in writing. This aids my becoming a stronger peer reviewer and allows me to help more students become better writers. Hopefully, through this process, they are able to learn and reuse this system on their own.

**18.Title:** Are Human Activities Increasing the Frequency of Intense Atlantic Hurricanes?

**Student Researcher:** Dawid Janik

**Faculty Mentor:** Prof. Gerarda M. Shields

Research in the area of climate change suggests that human, or anthropogenic, activity will cause Atlantic Hurricanes to occur more frequently in the future. Main topics covered in this work include relationship between Sea Surface Temperatures (SST) and formation of the Atlantic Hurricanes, studies of few important models used by scientists to predict future of hurricane formation, possible evidence of increasing number of very intense category 4-5 hurricanes.

Most of the research focused on investigation of works done by scientists to analyze past behavior of our climate in relation to formation of hurricanes along the Atlantic Ocean, as well as the possible future models that predict correlation between warming climate and increasing number of Atlantic Hurricanes. In order to be able to get any possible conclusions a lot of work and analysis is required. That includes obtaining data (historical and present), making some important assumptions (missing data estimate), as well as summarizing findings with some confidence level (reliability of estimate).

Many articles and publications from governmental agencies such as National Oceanic and Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA), were reviewed along the way. A lot of interesting journals were also found on the web site of Academic Journal of Science, AAAS. In addition, there were significant numbers of works done by professors and scientists from fields related to meteorology, oceanology.

**19.Title:** Analyzing the EPA Greenversations Blog

**Student Researcher:** Ryan Moore

**Faculty Mentor:** Prof. Michael J. Davis

This pilot study focuses on the EPA Greenversations Blog (<http://blog.epa.gov/blog/>) to better understand the content, ideas, and usership of the blog. As the EPA Greenversations Blog identifies itself: the "blog is written by EPA employees (and occasional guests) about the things they bring to their jobs every day" (EPA, 2010). The EPA Greenversations Blog was founded in

January of 2008, and is available to both EPA employees as well as the general public via technologies including the World Wide Web as well as email. This project is a multi-semester study. Last semester Professor Davis and I analyzed blog posts from 2008. The tasks for this semester involved: (1) analyzing and categorizing posts occurring in years 2009 and 2010, (2) writing the method of data collection section, and (3) writing the method of data analysis section.

**20.Title:** The Linear Algebra behind Web Search Engines

**Student Researcher:** Steven Lora

**Faculty Mentor:** Prof. Andrew Douglas

Internet search engines typically employ a link analysis algorithm to refine search results. Perhaps the best known such algorithm is Google's PageRank algorithm; an algorithm that ranks the importance of web pages according to an eigenvector of a "link matrix." In this project, we describe the PageRank algorithm and the linear algebra behind it. We used the computer algebra system MAPLE in our analysis.

**21.Title:** Origami Geometric Construction

**Student Researcher:** Enmanuel Almanzar

**Faculty Mentor:** Prof. Andrew Douglas

Straightedge-and-compass constructions have been used in geometry since antiquity. However, such constructions have their limits. One cannot trisect an angle, square the circle, or double a unit cube, for instance, with the use of straightedge-and-compass. Can an angle be trisected, or a unit cube doubled using origami? How can we find a root of a cubic polynomial using origami? We answer these questions and more as we explore the use of origami in mathematics!

**22.Title:** Group Actions on a Soccer Ball and its Illumination of the Spectral Properties of Certain Carbon Molecules or Fullerenes.

**Student Researchers:** Elizabeth Mills, Yi Ming Yu

**Faculty Mentor:** Prof. Satyanand Singh

A study will be made of Group theoretic actions in connection with the rotational symmetry and order of the truncated icosahedrons (Soccer balls). We will also investigate the discovery of the carbon-60 molecules or Buckyballs and how group theoretic studies illuminate the spectral properties of molecules and their classification in different molecular states.

**23.Title:** Predicting Seemingly Esoteric Probabilistic Distributions by Simulations and Confirming Their Validity by Theoretical Methods.

**Student Researchers:** Thomas Cheung, Think Le

**Faculty Mentor:** Prof. Satyanand Singh

Computer simulations will be used to predict certain probabilistic distributions. Simulations will be done with the Matlab and Maple softwares. Extensive use will then be made of convolution techniques, contour integration over a Bromwich path and properties of characteristic functions to theoretically confirm the predicted results.

**24.Title:** Talking to Groups and Rings: The language of Abstract Algebra

**Student Researcher:** Joshua Jansen

**Faculty Mentor:** Prof. Samar El Hitti

To further one's studies in advanced mathematical theories, one must first become acquainted with the language and methodology of abstract algebra. The aim of this project is to instruct the layperson in the basics of abstract algebra to form the foundation with which he/she may be able to collaborate as a research assistant in that field. We present the basic objects of abstract algebra such as maps, groups and rings and take a deeper look at their interesting properties and functionalities. We also expose some of the history component of these objects and the field of algebra.

**25.Title:** Computational and Analytical Aspects of Diffusion and Its Applications to Biology

**Student Researcher:** Elizabeth Mills

**Faculty Mentor:** Prof. Boyan Kostadinov

The goal of this project is to understand a number of tools, both computational and analytical, and their applications to problems in biology. We will use Monte Carlo simulations of random processes applied to a birth and death problem of a bacteria population. We'll learn how to simulate random walks and Brownian motion on the computer using the freely available software R for statistical computing. We shall also program in MATLAB the solution of the diffusion equation with different boundary conditions using finite difference schemes and investigate questions of numerical stability and convergence. In addition to the computational component, we will have an analytical investigation into convection, diffusion and attraction with an eye towards applications to biology. Diffusion models form a good basis for studying insect and animal dispersal and invasion. More specifically, we shall investigate transit times for diffusion, which is very important in many processes on the cellular level.

**26.Title:** Insurance Risk Projections with Monte Carlo Simulations

**Student Researcher:** Shelford Mitchell

**Faculty Mentor:** Prof. Boyan Kostadinov

We will focus on two common problems faced by insurance companies: calculating the probability that they go bust and estimating how much money they will make. We will use a

realistic model for the size of the random claims based on the heavy-tail Pareto distribution and we will learn how to sample from this distribution using the inverse transform method. This will allow us to do Monte Carlo simulations on the computer. Then, we will be able to simulate the fortunes of the insurance company for a given time period, given a fixed number of customers and fixed annual premiums. Using simulations of many scenarios for the assets of the company, we will be able to estimate the probability the company goes bust as well as the company's expected assets at the end of the given time period. We will also simulate and investigate the case when the company takes profits at the end of each year. Using this new scheme, we will estimate again the probability of going bust, the expected assets at the end of the given time period and the expected total profits taken over the specified time period.

**27. Title:** Computer Algebra Systems for Particle Physics: FORM  
**Student Researchers:** Vladimir Monpremier and Etiosa Obasuyi  
**Faculty Advisor:** Andrea Ferroglia

At present, calculations in high energy physics involve the manipulation of formulas with a very large number of terms. These calculations cannot be carried out by hand, and several computer algebra systems (CAS) have been developed with the aim of making algebraic manipulation possible in a reasonably short amount of time. During the semester, we learned how to use the freeware CAS Form to implement matrices operations which arise in the context of Quantum Chromodynamics (QCD). In particular, we developed a program which allows one to calculate products of Gell-Mann matrices. These products are an essential part of the calculation of scattering processes mediated by the strong interaction. We checked our code by making sure that it correctly reproduces the algebraic properties of the commutators and anticommutators of these matrices.

**28. Title:** Recent progress at the LHC: the search for the Higgs boson  
**Student Researcher:** Jose Jimenez  
**Faculty Advisor:** Prof. Giovanni Ossola

We monitored the events happening at CERN within the experiments at the Large Hadron collider. In particular we focused on the direct and indirect constraints on the mass of the last missing particle of the Standard Model, the Higgs boson. By comparing the theoretical prediction with the experimental value of the mass of the W-boson, we obtained some prediction of the most likely values for the mass of the Higgs boson.

**29. Title:** Photon Emission in Bhabha scattering  
**Student Researcher:** Andrey Galper  
**Faculty Mentor:** Prof. Giovanni Ossola

We reviewed the relevance of electron-positron scattering for the physics of particle colliders. This was accompanied by some direct calculation of scattering amplitudes using a new code called SAMURAI that allows for the computation of one-loop corrections to various physical processes.

**30.Title:** Exciton-exciton Interaction in the Bose-Einstein Condensate of Excitons

**Student Researcher:** Daysha McNair

**Faculty Mentor:** Prof. Oleg Berman

We study the pair exciton-exciton interaction in the Bose-Einstein condensate of excitons formed by electron-hole pairs in a semiconductor. The superfluidity of excitons is possible because the excitons interact. Two excitons repel due to van der Waals interaction. Solving time-dependent Gross-Pitaevskii equation, we study how the density of exciton condensate depends on the constant of pair exciton-exciton repulsion.

**31.Title:** Exciton Condensate Density in the Trapped Condensate

**Student Researcher:** Luis Pineda

**Faculty Mentor:** Prof. Oleg Berman

We consider the semiconductor quantum well in the presence of the external parabolic potential. This parabolic potential is induced by the mechanical stress. Bose-Einstein condensate of excitons is formed by electron-hole pairs in the semiconductor quantum well. Solving time-dependent Gross-Pitaevskii equation, we study how the density of exciton condensate depends on the strength of the external trapping potential.

**32.Title:** Threshold Laser Pumping Rate for the Exciton Condensate

**Student Researcher:** Jamal Stoval

**Faculty Mentor:** Prof. Oleg Berman

We consider Bose-Einstein condensate of excitons formed by electron-hole pairs induced by the laser pumping in a semiconductor quantum well in the presence of the external parabolic potential. Solving time-dependent Gross-Pitaevskii equation, we found that the excitons form Bose-Einstein condensate at the laser pumping above the threshold rate. We study how this threshold rate of the laser pumping depends on the external parabolic potential of the trap.

**33.Title:** Time Evolution of Bose-Einstein Condensation of Excitons

**Student Researcher:** Seyedhamidreza Sadatian

**Faculty Mentor:** Prof. Oleg Berman

We study Bose-Einstein condensate of excitons formed by electron-hole pairs in a semiconductor quantum well in the presence of laser pumping. We assume the finite rate of the growth of excitons due to the laser pumping and decay of excitons due to electron-hole recombination. We have solved numerically time-dependent Gross-Pitaevskii equation for the exciton condensate, when the number of excitons is not conserved. We studied the time-dependence of the density of the excitons condensate.

**34.Title:** Bose-Einstein Condensation of Excitons in a Parabolic Trap

**Student Researcher:** Michal Faryniarz  
**Faculty Mentor:** Prof. Oleg Berman

We consider Bose-Einstein condensate of excitons formed by electron-hole pairs in a semiconductor quantum well with a parabolic trap. We have solved numerically Gross-Pitaevskii equation for the exciton condensate in the presence of the parabolic trap caused by the stress. We studied the influence of the localization on the kinetics of the exciton superfluid.

**35.Title:** Following the Black Male Initiative Programmatic Activities: Analysis of Intervention Assessment

**Student Researcher:** Karl Garcia

**Faculty Advisors:** Profs. Reginald A. Blake, Dr. Reneta D. Lansiquot, and Dr. Janet Liou-Mark

The progress of a student's college experience not only tells a tale of that student's evolution and development throughout college, but also serves as a beneficial source of knowledge that can be used to improve the overall college experience for all students. Furthermore, it helps us reinforce existing initiatives to aid students, and allows us to achieve a better understanding of what is effective.

Last year, I created a database in Microsoft Access for members of the Black Male Initiative for the purpose of analyzing current activities with the intention of discovering ways to improve them. This year, the goal of my research is to fine tune the database by including a variety of relevant fields and removing fields that simply weren't effective. One of the main improvements that were made was the inclusion of activity before and after undergraduate college. This includes various programs they participated in while they were still high school students, and current plans and status of students who have graduated. Finally, a detailed list of resources used in the Black Male Initiative was added so that research data can be more precise, thus yielding more comprehensive results.

During my research, I learned that as a researcher, it is important to truly apply critical thinking when it came to discerning correlation versus causation. It most often isn't as simple as putting two and two together when it comes to applying results as a means. One must consider a variety of factors, and carefully measure the relationship between one factor and another. I believe that this precise filtering has vastly improved the efficiency of the database, and will ultimately assist in providing vital student information capable of improving students' college experience.

**36.Title:** Open Market Operations at the Federal Reserve

**Student Researcher:** Hend Bayoumi

**Faculty Advisor:** Prof. Edward Kaplan

The Federal Reserve System (Fed) is a central banking system that consists of twelve banks chartered by the United States government to control the money supply and maintain a growing economy. This system consists of the Board of Governors and the twelve Federal Reserve Banks, which controls the lending activity of the nation's banks and thrift institutions. The Feds

most important function is monetary policy, which is the availability and cost of money and credit which promotes the nation's economic goals. It consists of three tools; the raising and lowering of the discount rate, the reserve requirements and Open Market operations.

The Fed seeks to promote maximum employment, stable prices and moderate long term interest rates, which is required by the Federal Reserve Act. In order to do this the Fed has to maintain an elastic money supply by implementing monetary policy. For the past three years the economy has been in a recession which caused the Fed to maintain low interests rates. In my opinion, within six months to a year interest rates will rise due to the threat of inflation, especially the rapid rise of food and energy prices. When this happens we can expect the Fed to implement a tight money policy, which will cause a drop in lending activity; but would counter inflation in order to maintain a healthy economy.

**37.Title:** Hermann Field and the “Fieldist Conspiracy” in Poland

**Student Researchers:** Katarzyna Woldyla, Ewelina Kosmaczewska

**Faculty Mentor:** Prof. Kyle Cuordileone

This historical research investigates the experience of Hermann Field, an American architect who was held prisoner in Poland from 1949-1954 during the peak of the cold war. He was arrested because the Polish government and the Soviet government accused him of being a US/British spy who was trying to overturn Communism in eastern Europe (along with his brother Noel Field who was imprisoned in Hungary). Hermann Field, like his brother, was innocent. We have translated from Polish to English the transcriptions of wiretapped telephone conversations between Hermann and his wife (and others). These were phone calls Hermann Field was allowed to make right before he was released from prison in 1954. These records show that Hermann, following five years of prison and torture, was obviously traumatized and very distant from everything around him. On the other hand, he was optimistic about being freed and seeing his family again. No doubt Hermann knew his conversations were being monitored and he was careful not to say anything negative about the Polish government. After being absent from the “real world” for so long, he was in need of much sympathy and understanding from his family as well as the US diplomats he spoke to. Amazingly, these conversations show that even while Hermann was a prisoner, he helped the Polish government create the architectural design of the Main Station in Warsaw. Thus we can also see that the Communist government of Poland used the skills of its political prisoners for the benefit of Polish society.

**38.Title:** Pupillary motility and content of visual stimulus

**Student Researchers:** Lisa Fong, Dmytro Yanush, Shaun Palmer

**Faculty Mentor:** Prof. Daniel Capruso

Objective: The aim of the study was to determine pupillary reactivity to various types of visual stimuli.

Background: Changes in pupillary diameter occur not only in response to light, but also in response to the qualities of visual events. Interesting visual stimuli, whether pleasant or aversive, produce pupillary dilation, whereas neutral stimuli produce negligible pupillary motility. Disinterest can result in pupillary constriction.

Method: Male (n=15) and female (n=7) college students were exposed for a 10s duration to a visual image on a computer monitor. Pupillometry was performed for different types of visual materials including a facial stimulus, a morbid stimulus, and a threat/aggression stimulus. Pupillary diameters of the left and right eyes were measured separately to within .01mm, at the beginning and at the end of viewing the visual material. The data from both eyes was then averaged. A difference score was computed to measure pupillary motility occurring from onset to termination of viewing the visual stimulus. Data were then subjected to a within-subjects analysis of variance with gender as a between subjects factor and time as the repeated measure.

Results: For viewing the facial stimulus, there was a borderline time x gender interaction ( $F(1,19) = 4.30, p = .05$ ) in that males showed pupillary constriction over time, but females maintained constant pupillary diameter. For the morbid stimulus, there was an effect of pupillary dilation over time ( $F(1, 17) = 6.50, p < .05$ ), but no interaction with or effect of gender. For the threat/aggression stimulus there was also an effect of pupillary dilation over time ( $F(1, 12) = 5.92, p < .05$ ), but no interaction with or effect of gender.

Conclusions: The apparent pupillary constriction over time of males while viewing a facial stimulus suggests a lack of sustained interest when compared to females. In contrast, both males and females showed pupillary dilation over time when viewing morbid and threat/aggression stimuli which suggests sustained visual interest or emotional reaction to these images. Overall, the results confirm that pupillary motility varies with the emotional and interest content of the visual stimulus, and that interactions with gender may also occur.

**39.Title:** Using the Mediation Methodology to Analyze the Northern Ireland communal conflict

**Student Researcher:** Renisa Ribeiro

**Faculty Mentor:** Prof. Lauren Park

Mediation is part of the conflict resolution family and falls in the Alternate Dispute Resolution category. Mediation is basically when two or more parties voluntarily come together with an impartial third party to resolve a conflict. The purpose of this paper is to explain the six steps to the mediation methodology presented in "Peacemakers Toolkit: Managing a Mediation Process" which is authored by Amy L. Smith and David R. Smock. I will be using the Northern Ireland Communal Conflict as a case study. The six steps to the mediation process include: a) assessing the conflict, b) ensuring mediator readiness, c) ensuring conflict ripeness d) conducting track I mediation e) conducting track II- dialogue and f) constructing a peace agreement. The Northern Ireland Communal conflict deals with the tension between the Protestants who have held the majority of the population whereas the Catholics who have been the minority in Northern Ireland- a case of ethno-nationalism. The Protestants desired to be part of the UK as they identified themselves as British. On the other hand, the Catholics identified themselves as Irish and desired a separate governing structure from the United Kingdom. John W. Burton (1915-2010) is considered by many to be one the founders of the conflict resolution scholarship. Throughout this paper I will be mainly referencing to the works of John W. Burton. He derived the concept of "provention"- which involved eliminating the sources of conflict, removing the causes of conflict and promoting an atmosphere where conflict does not exist. "