Baccalaureate Research Scholars Program (BRSP)

Book of Abstracts – Spring 2016

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1. Computer Simulation and Design of Bridges
   Amanda Abrew
   Prof. Navid Allahverdi

   Bridges serve as a vital part of our transportation network, along with serving as signature icons in our cities. As the geometry of bridges gets more complicated, it poses a challenging task for the bridge engineers. Using computer simulations combined with optimization methods provides a powerful tool for designing bridges with higher performance and lower costs. Structural optimization aids in the process of choosing material, sizing material and expanding on innovative structural forms. In this study, I surveyed different types of bridge structures including short and medium span truss bridges, as well as long span bridges such as suspension bridges and cable stayed bridges with emphasis on New York City iconic bridges such as Brooklyn Bridge, Verrazano Bridge and George Washington. As the next step, I performed structural simulations of each systems. Focusing on the structural form and function of bridge systems and members, with emphasis on strength limits will help increase understanding of the expected behaviors, capabilities and limitations of these various systems. In performing the computer simulations, I used STAADPRO modeling software, which is capable of performing structural analysis using finite element method (FEM). This analyzes the system's reliability in order to evaluate the failure possibilities of bridges accounting for each member's uncertainties. I verified and validated my computer simulations with a lab scale bridge fabricated in the CMCE department. As an integral part of my research, I adopted structural optimization techniques to design bridges for goal functions such as providing maximum stiffness while reducing material's weight. I used this methodology to perform geometry and topology optimization for different types of bridge structures.

2. Examining the Effect of Oxidative Stress on *Tetrahymena thermophila* Sirtuins.
   Victor Adedara
   Prof. Ralph Alcendor

   Sirtuins are proteins found in almost all organisms. These proteins have many functions including, regulating of cell survival, deacetylation, transcription and translation regulation and mitochondrial biogenesis. Sirtuins have also been shown to be important for longevity. Mice overexpressing sirt6, one of the seven mammalian sirtuins, live 15.8% longer than normal mice. Oxidative stress, OS, is the imbalance between the production of reactive oxygen species, and antioxidants. A higher level of ROS can have dire consequences on proteins and DNA and other molecules. High amount of OS, for example, can disrupt mitochondrial function and can lead to cell death. OS has been connected to many diseases including cancer, diabetes and chronic disorders such as rheumatoid arthritis. Although numerous studies have been conducted on OS,

the mechanisms involved are still not well understood. This project aimed at examining the effect of OS on sirtuins using *Tetrahymena thermophila* as a model. *T. thermophila* is a fresh water protist found around the world. These organisms are very similar to mammalian cells and, as a result, they have been used extensively for cellular and molecular research. *T. thermophila* are very resistant to conditions that are lethal to mammalian cells. These characteristics make them ideal for studying the effects of high OS. Therefore, we hypothesized that sirtuins are involved in OS regulation in *T. thermophila*. Cells were exposed to varying concentration of H2O2, an inducer of OS, for 24 hrs. followed by cell death analysis and gene expression. Cell death as a result of H_2O_2 was concentration dependent with 0.5 mM of H_2O_2 resulting in only 69% of cell surviving, while 1.0 mM resulted in about 50% of cells surviving. The mRNA levels of several T. thermophila sirtuins upregulated in the presence of up to 1.0mM H2O2. However, 2.0 mM resulted in significant reduction of sirtuin mRNA levels. These results suggest that sirtuins may be involved in OS in *Tetrahymena thermophila*.

3. Design of a Stand-Up Power Wheelchair
   Joshua Afrifa, Justen Garner, Damir Kasumovic
   Prof. Angran Xiao
   The title of our project is “Design of a stand-up Power Wheelchair”. In this project, one professor and three students in Department of Mechanical Engineering Technology designed and prototyped a stand-up power wheelchair which enables a patient to switch between seating and standing positions with a click of button. This was done by several tests including; stress analysis, and motion analysis. Also research was done in order to meet ethical, health needs and requirements. The stand-up functionality offers many physical and psychological benefits previously unavailable in traditional wheelchairs. By supporting the patient’s body into a standing position, this chair improves circulation, muscle tone and helps prevent bone decalcification. The goal was to enable the patient to speak eye-level with others. As a result the patient will greatly improve their self- esteem and confidence.

4. The Challenge Module of the iPractice challenge: A mobile app for practicing computer programming
   Brayan Almonte
   Prof. Benito Mendoza

   This project aimed to develop an application that will help students to practice some computer programming concepts. The goal is to develop a multi-platform app (running in iOS, Android, FireOs, and Windows) that can be used both online and off-line. This application would be used by students to practice their computer programming knowledge and skills while commuting. This poster presents the advances in one of the options in the mobile app, the challenge module. This module is a game where the students are challenged about the computer programming skills. The challenge will present in twenty questions covering the computer programming curriculum. Points will be awarded based on the time taken to solve each

question. The challenge will end when either the student chooses the wrong answer or completes all the twenty questions.

5. Visualization of *Toxoplasma gondii* infected cells using high throughput fluorescent screens and microscopy techniques
   William Bennett
   Prof. Jeremy Seto

   The intracellular parasite, *Toxoplasma gondii* efficiently infects its host by forming intracellular vacuoles within the cells. These vacuoles eventually burst, releasing the parasites throughout the cell which leads to cell lysis and death. We use insertionally mutagenized *T. gondii* strains in high throughput fluorescent screens to display organelle capture by parasite and abrogation of the cell fate during the different phases of *T. gondii* infection using human foreskin fibroblasts. We utilize a combination of a fluorescent cell dyes to produce optimal visualizations of these cells using high throughput microscopy. We use these images to better understand how *T. gondii* infects cells.

6. Computational approach to drug design of VEGF-D
   Najma Bibi, David Carvajal, Binita Giri
   Prof. Mai Zahran

   Brain functions like memory formation are performed by intracellular calcium signaling by synaptic inputs. These nuclear calcium signaling modulates the neurons structure especially dendrites. In recent studies, Vascular Endothelial Growth Factor-D (VEGF-D), a protein whose initial functions are angiogenesis and vasculogenesis has been found to play a profound role in dendrite growth and cognitive functioning. Through calcium-calmodulin-dependent protein kinase IV (CaMKIV) signaling the protein has the ability to control the complexity of dendrites in the adult mouse hippocampus as well as cultured hippocampal neurons. This knowledge can lead to finding a cure to many neurodegenerative diseases including Alzheimer. However, VEGF-D is too large to bypass the human blood barrier to experiment in vivo. The purpose of this research is to use computational methods to study the structural and functional details of this protein at residue level and design small peptides that will bypass the blood brain barrier and replicate the function of VEGF-D bound with its receptor VEGF-3. A total of 9 peptides were designed to determine which one would be the best candidate that functions similar to VEGF-D. High performing computing servers were used to test their interaction and stability.

7. From Cave Paintings to Infograms: Graphic Symbols for STEM Education
   Tristan Charran
   Prof. Vasily Kolchenko

   Graphic symbols are extensively integrated into visual media – in print, online, etc., becoming a vital part of everyday communication. They are also ubiquitous in STEM learning materials due

to the cognitive advantages provided by the graphic symbolic representation. These advantages are utilized in the Infogram learning materials developed for BIO2311, Anatomy and Physiology I, by Dr. Vasily Kolchenko at New York City College of Technology. The Infograms employ graphic symbols, key terminology, abbreviations, simple charts and diagrams to condense information into an informative visual narrative. Symbols are rich in semantics, and the interpretation of these graphics may present a challenge for underprepared students. In this project, we address the need for creating an inventory of symbols used in STEM learning materials and their possible symbolic meanings. We start by constructing a timeline of the significant historic milestones in the use of graphical symbols in order to put into perspective symbolic meaning and the importance of visual communication over time. We also catalogue graphic symbols based on their structural and functional meaning. This inventory draft may serve as a useful step for introducing students to abstracting information in STEM learning materials.

8. Global Drought and Land-Cover/ Land-Use Change Studies Using Satellite Microwave Observations
   Yanna Chen
   Prof. Hamidreza Norouzi, Prof. Satya Prakash

   Land-cover/Land-use change considerably affects the global climate system. The anomalous changes in land cover and droughts are currently among the major concerns affecting the world. Therefore recognizing the ever increasing environmental changes and their impacts on sustainable development issues is crucial. The Earth-observation satellites provide a unique opportunity to monitor these changes at global scale. The purpose of this research is to investigate the potential of using passive microwave brightness temperature and emissivity data sets from satellite observations to monitor recent land cover changes and droughts. The passive microwave observations at various frequencies from the Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) and the Special Sensor Microwave Imager (SSM/I) have been formulated to calculate the global land surface emissivity for the last two decades. In this study, the lower frequencies are used because at such frequencies, the signals are more sensitive to surface properties such as soil moisture and vegetation. The Emissivity Microwave Polarization Difference Index (EMPDI) and Brightness Temperature Microwave Polarization Difference Index (BTMPDI) are computed for both vertical and horizontal polarization values. Both EMPDI and BTMPDI estimates for two decades are then compared against the independent drought indicators from the Global Integrated Drought Monitoring and Prediction System (GIDMaPS) based on precipitation and soil moisture data records. Moreover, a drought severity test is performed using suitable statistical techniques that previously was deployed on precipitation and soil moisture data sets. A preliminary analysis has been performed to investigate the potential application of passive microwave land emissivity estimates in drought monitoring.

9. The Effect of Oxidative Stress on Sirtuins In Tetrahymena thermophlia
   Edrouine Gabriel

Prof. Ralph Alcendor

Tetrahymena thermophila, a ciliated protozoan, has been a reliable research model for many years. They have made significant contributions to biology such as the discovery of ribozymes and telomere function. They are ideal research models because of the minimum facility required for growth, maintenance and manipulations. Additionally, the complete *T. thermophila* genome has been sequenced, making it an appropriate model for bioinformatics studies. Overall, the volume of research conducted with these organisms is extensive. However, in the area of stress resistance and aging, *T. thermophila*'s biology has not been exploited. These cells have proficient anti-stress mechanisms. They can survive in sublethal temperature, in extremely low oxygen environment, and starved or poor nutrient conditions. If the condition is conducive, *T. thermophila* can divide indefinitely without showing classic signs of aging such as senescence. The aim of this project is to investigate the role of sirtuins in *T. thermophila* ability to survive high oxidative stress conditions induced by copper. Cells were exposed to varying amount of copper and incubated for 24 h – 48 h. Cell death analysis showed increase cell death with increasing amount of copper. Only 40% of cells survived after 24 hours in the presence of 1.0 mM of copper. mRNA expression of sirtuins decreased in the presence of 0.1 – 0.5 mM of copper but increased in the presence of 0.8 – 1.0 mM of copper. Similar pattern was seen in the mRNA expression levels of antioxidant genes. These results suggest that sirtuins may be involved in OS induced by high rather than low amount of copper.

10. Study of multi-target directed ligands: Copper binding selectivity and inhibition of reactive oxygen species formation.
    Miguel Gomez
    Prof. Alberto Martinez

    Alzheimer's disease (AD) is the most prevalent form of dementia, affecting over 5 million Americans and 28 million people worldwide. It is predicted that by 2050, the number of people age 65 and older with AD will increase to 13.8 million Americans. Currently, AD is the only disease among the top 10 causes of deaths in America that does not have a cure or treatments to slow the progression. Under the amyloid cascade hypothesis, a 39-42 residue amyloid-□ (A□) peptide is linked to plaque A□ depositions or partially aggregated soluble A□□that trigger a neurotoxic cascade resulting in AD pathology. Intracellular tangles in the brain, and production of reactive oxygen species (ROS) are hallmarks of AD that result in neuronal death. Due to the mounting evidence supporting the implication of some metal ions like Cu^{2+} and Zn^{2+} in the progression of AD, our study focused on the role of Cu^{2+}. Using a multi-target directed ligand design (MTDL) approach, two compounds (AM29 and AM49) were studied for metal ion selectivity and ROS inhibition. Focus was placed on finding the selective binding to Cu^{2+} over other biologically relevant metal ions, and the correlation between Cu^{2+} binding and the ability of the compounds to inhibit the Cu^{2+}-catalyzed ROS formation. UV-Visible spectroscopy and fluorescence spectroscopy were used to acquire data in our experiments. Results demonstrate a high degree of selectivity for Cu^{2+} versus Ca^{2+}, Mg^{2+}, Zn^{2+}, Mn^{2+} and Fe^{2+}, which could have

important implication in preventing side effects. Additionally, both multi-target compounds were able to inhibit to a 98% extent the Cu^{2+}-catalyzed ROS formation. In conclusion, the compounds herein studied represent a novel and promising alternative for the treatment of AD.

11. GravGen An Interdependent Alternate Energy Generator
    Yevgeniy Babkin, Chris Guzman
    Prof. Yu Wang, Prof. Andy Zhang

    This project involves researching and developing a prototype of an interdependent alternative energy generation system encompassing three technologies, Solar, Wind and Gravity. All three technologies will be integrated together into one system which will be monitored and controlled via low power microcontrollers. The system can greatly benefit the world by providing a clean, low cost, on demand power source capable of significantly limiting our dependency on fossil fuels. The gravity generator is the focus of this project, as well as the main source of energy production within the system.

12. A novel technique of designing a C-band SOA-based bidirectional tunable fiber laser with two merged fiber ring cavities
    Ouidir Harikenchikh
    Prof. Muhammad Ummy

    High power lasers with high beam quality are of a great interest in numerous applications including scientific, medical, material processing and military purposes. Different concepts have been used to achieve a very high power radiation from a single laser. However, there are several factors that set limits on maximum power and energy that could be generated from a single laser source with high brightness quality.
    Several laser resonator types have been studied extensively to accommodate the power scaling and to achieve high power from coherently combined laser sources. Rare-earth, erbium or ytterbium doped fiber amplifiers (EDFA, YDFA) are mostly utilized because they offer large gain, high saturation power and low noise. However they have limitations because of the strong line broadening and cross gain saturation that can lead to unstable oscillations and also EDFA's are relatively large in size, expensive and require high pump power consumption .In contrast, semiconductor optical amplifiers (SOA's) offer several advantages over EDFA's such as compactness, lightness, and low power consumption and it used in bidirectional fiber ring resonators do not require extra optical components. SOA's with a broad range of operating wavelengths are available at different regions of the wavelength spectrum from 400nm up to more than 2000nm.This wide range tunable characteristic makes the SOA as a potential candidate for gain media of a fiber laser system.
    In this work, we investigate the performance of a novel technique of beam combining of three C-band low power SOA's based tunable fiber lasers in a ring configuration. The resonator uses mainly low power optical components but has a great potential for achieving a high power laser

source. The uses of SOA's enable us to limit the cost of the system and it doesn't require the optical isolators which mostly limit the maximum power that can be produced.

13. Advanced Design and Fabrication of Custom Total Knee Replacement with Cost Analysis
    Ehab Ahmad, Gabriel Higuera
    Prof. Gaffar Gailani

    Prosthetics are often used to replace, and in some cases enhance, injured or missing limbs. In most cases, implants follow standard sizes that will not be unique to the patient in need. Surgeons use these implants and are sometimes required to force fit – by making other necessary cuts to the bones implants into patients. This process is not only time consuming, but can be detrimental to progress. In order to rectify this, customized prosthesis enables the surgeon to complete the operation with full confidence that the implant will fit correctly. Ideally, the implant will be a perfect fit leading to a natural feeling prosthetic. Analyzing CT scans through mimics, medical imaging software, the goal to make a custom fit prosthetic implant can be obtained. Scanning the files layer-by-layer allows us to isolate the targeting area for further analysis. Creating a threshold that emphasizes bone structure or soft tissue will clearly identify the points of interest. An implant created on 3-matic is 3D printed double checked for accuracy. With software capable of exacting proportions, custom prosthesis is a better alternative to people in need.

14. Mechanical Characterization of PEGDA based scaffolds for Tissue Engineering Applications
    Mian Huang
    Prof. Ozlem Yasar

    Tissue Engineering is an interdisciplinary field which applies the principles of engineering and life science to maintain or improve the tissue or whole organ. In order to achieve success in Tissue Engineering, porous 3D man-made structures known as scaffolds must be fabricated accurately. Scaffolds let the cells grow in 3D when they are seeded with the cells. Ideally, scaffolds must show the same mechanical properties with the tissues. In this research, PEGDA-based scaffolds will be fabricated. Mechanical characterization of PEGDA will be done by using INSTRON Machine. The preliminary research shows that, due to its mechanical properties, PEGDA can be used to make molds or they can be used as scaffolds for bone implant applications.

15. 3-D Printer Modeling and Construction
    David Amegavie, Justin Colon, Eraj Khan
    Prof. Gaffar Gailani

    A 3D printer is a manufacturing object/ device that uses various processes to synthesize a three dimensional object. There are many fields that 3D printers can be used such as in aerospace, automotive, and electronics. In 3D printing, materials are built in layers under computer control to create an object. 3D printers are finding their way into many industries and homes. However,

the majority of 3D printers are very expensive. They also come in a bulky size. The research that is currently being worked on is the construction of a 3-D printer. The 3-D printer was provided by the supervisor. The 3-D printer which is being modeled and constructed is not just a regular 3-D printer. It comes with many challenges. Models and some pieces are going to be created due to the fact that they were missing or broken. The main purpose of this research is to provide the Mechanical Engineering department with a 3-D printer that is more efficient. The printer will be constructed in a more eco-friendly way so that students and faculty can use it and cause the minimal amount of harm to the environment and the closed lab surroundings that they are working in. There were a few challenges encountered due to the missing pieces but were resolved through programs such as Inventors which helped create parts that were missing. Codes and programs like MatLab (and any other program required) will also be used to set up the printer to actually print the parts as needed with minimal flaws in the material/parts. The purpose of the programming is mainly to set up the printer so that it functions in the most effective way. The printer has yet to be completed due to the modifications being made to make it more efficient and more useful to its purpose.

16. On Applying the Bacterial Foraging Optimization Algorithm for the Automated Design of Combinational Logic Circuits
    Volodymyr Komendyak
    Prof. Benito Mendoza

    In digital circuit design, one of the most important goals is minimization. To reduce the circuit cost, the physical size, and weight, circuit designers aim to minimize the number of components utilized in the circuit. Minimization, sometimes, translates into an increase of system reliability and lower power consumption. The Automated Circuit Design Problem (ACDP) can be seen as an optimization problem that aims to reduce the number of components used to create a functional circuit with the minimum number of components. Recently several methods using computational intelligence approaches such as Swarm Intelligence, Fuzzy Logic, and Artificial Neural Network (ANN) have been applied to this problem. The methods based on computational intelligence have a great advantage over human methods since they have the ability being automated through programming. In this poster, we present our findings on applying the Bacterial Foraging Optimization Algorithm (BFOA) for the ACDP. The BFOA is a Swarm Intelligence Algorithm inspired by the group foraging behavior of bacteria such as E.coli and M.xanthus. Specifically, this algorithm is inspired by the chemotaxis behavior of bacteria that will perceive chemical gradients in the environment (such as nutrients) and move toward or away from specific signals to survive.

17. Computational Design of a Drug Against Neurodegenerative Diseases Based on VEGF-D.
    Adam Sadowski, Christopher Mason
    Prof. Mai Zahran

The goal of this work is to computationally design peptides that imitate the role of VEGF-D. VEGF-D is a protein part of the vascular endothelial growth factor family and is commonly known as an angiogenic mitogen. It has recently been discovered to control the total length and complexity of dendrites both in cultured hippocampal neurons and in the adult mouse hippocampus through nuclear calcium-calmodulin-dependent protein kinase IV (CaMKIV) signalling [1,2]. VEGF-D endothelial growth factor is of great interest when it comes to drug design and treatment of neurodegenerative conditions because it has demonstrated to improve memory and cognitive function. The objectives of our study is to understand the interaction between VEGF-D with the receptor VEGFR-3 and to be able to mimic VEGF-D by designing a small drug, that would replicate the interaction of VEGF-D complexed to VEGFR-3. In this study we have set out to analyze the proposed peptides using computational methods to help our collaborators start with the most promising peptides and test them first in vivo on the mice. This research will support diligent efforts in design of medication to treat not only Alzheimer's disease but other neurodegenerative conditions.

18. Perfect Power at Different Heights
    Justin Meyer
    Prof. Satyanand Singh

    We will show how to generate *n* such that $\left(\frac{n}{p_i}\right)^{\frac{1}{p_i}} \in \mathbb{Z}^+$ for a finite set of primes p_i where *i* = 1, 2,…, *k*.

    The poster presentation will demonstrate how to find numbers which are of the form $\left(\frac{n}{p_i}\right)^{\frac{1}{p_i}} \in Z^+$. This will cover cases concerning specific primes, general cases concerning a specific amount of primes, and the general case concerning *m* amount of primes where $m \in \mathbb{Z}$. This is done my defining the powers in terms of the prime divisibility of their exponents. A Diophantine equation is then solved to reduce the number of variables. This results in an algorithm where the number of independent variables is equivalent to the amount of primes. Plugging in different positive integer values for the independent variables will result in the various possible solutions for our initial problem. This research would not have been possible without the generous support of the Baccalaureate Student Research Scholars Program.

19. Molecular characterization of black corals (antipatharians) from the Flower Garden Banks National Marine Sanctuary (NW Gulf of Mexico)
    Nicole Bellaflores-Mejia, Colin Joseph, Juanita Marin, Sheila Moaleman
    Prof. Mercer Brugler, Craig Dawes (LSAMP), Lysna Paul (LSAMP)

    Black corals (Cnidaria: Anthozoa: Hexacorallia: Antipatharia) are cosmopolitan in the world's oceans and live as deep as 8,900 meters. To date, 7 families, 41 genera and 247 species of black corals have been described. During Summer 2015, LSAMP Scholar Craig Dawes participated in a research cruise aboard the *R/V Manta* to the Flower Garden Banks National Marine Sanctuary

(Gulf of Mexico) to collect mesophotic black corals using the remotely operated vehicle *Mohawk*. The primary purpose of the cruise was to conduct video and collection-based surveys immediately outside of the sanctuary in hopes of expanding the current boundaries and protecting any newly-discovered communities from further impacts due to oil and gas exploration and drilling. The cruise also 1) surveyed the banks for new, as of yet undescribed species of black corals, and 2) collected additional representatives of the black corals *Acanthopathes thyoides* and *Elatopathes abietina*. While both species are currently classified in the same family based on morphology, they do not group together in a molecular phylogeny; they are considered *wandering taxa* as they change positions depending on the gene (mtDNA vs. nuclear) or algorithm (parsimony, likelihood or Bayesian) used to build the phylogeny. To stabilize their position, additional representatives are needed; the cruise successfully collected two additional *Acanthopathes* and six *Elatopathes*. We are amplifying and sequencing three mitochondrial regions (*igrN*, *igrW*, *igrC*) and three nuclear genes (18S, 28S and ITS2) for these two taxa as well as all other black corals collected on the cruise. Based on a rough morphological examination of the black corals collected at sea, we anticipate elucidating several new species based on DNA analysis.

20. The Role of sirtuins in T.thermophila
    Kabiru Omolaja
    Prof. Ralph Alcendor

    Tetrahymena thermophila are free-living ciliate protozoa that can be found in fresh water around the world. These organs are model organisms for biomedical and toxicology studies. Studying these cells has led to important findings such as mechanisms controlling cell cycle, identification of cytoskeleton and discovery of the structure of telomeres and telomerase. These cells are known to be very resistant to temperature and other environmental conditions. Therefore they are ideal for examining the effect of oxidative stress, OS. Oxidative stress is the imbalance between levels of free radicals and the ability of the body to neutralize these free radicals. High levels of OS can prevent proteins, DNA and other important molecules from functioning. To combat these free radicals organisms have antioxidants that can neutralize or eliminate these free radicals. Sirtuins are a family of proteins found in almost all living organisms. The name sirtuins comes from yeast silent mating type information regulation 2 or sir2 family of proteins. These genes and proteins have been implicated in in a wide variety of cellular functions such as control of circadian clocks, mitochondrial biogenesis, cell death and survival, and longevity. Cells with mutated form or overexpressing sirtuins live longer than normal cells. Mammalian cells have several sirtuins. In other organisms these enzymes have been shown to function in regulation of OS. In *Tetrahymena thermophila*, the role of sirtuins in regulation of OS has not really been examined. This project aims to examine the effect of OS on *Tetrahymena thermophila* sirtuins. Cells were exposed to normal and starved conditions for 24-48 h. followed by cell death and mRNA analysis. Starvation led to a significant reduction in cell number and metabolic activity. Compared to control, after 24 h there was more than 75% reduction in metabolic activities. Furthermore, the expression levels of most sirtuins were

significantly reduced after 24 to 48 h in starved conditions. Interestingly, compared to 24hrs in normal conditions, 48 h in normal conditions resulted in higher sirtuins expression levels. These results suggest that *T. thermophila* sirtuins may play a very different role in normal and starved conditions.

21. Crash Free Aerial Vehicle for Assistive Navigation System for Blind People
    Tenzing Rabgyal
    Prof. Xiaohai Li

    According to World Health Organization, 285 million people are estimated to be visually impaired worldwide. Of these 285 million people, 39 million are blind and 246 million have low vision. Their handicap places severe limitations on many aspects of their life, the most important being personal mobility. With this project, we aim to develop an Assistive Navigation System (ANS) based on the proposed crash-free aerial platform, which will be used to aid visually disable or challenged people to navigate in an indoor environment. In the literature, a few ANSs have been developed to assist blind and handicapped people in indoor or outdoor environments, but aerial ANS has never been proposed. Compared to existing ANSs, an aerial ANS will be easier to deploy, offer wider vision view and have better response capability in emergence. To achieve this target, a unique crash-free spherical design has been proposed for the aerial vehicle by Dr. Li.
    Thus far, we have successfully managed to design and make the customized spherical frame by using 3D Design/3D Printing and advanced dynamics analysis techniques. We have also tested the aerial vehicle to confirm that the propellers are powerful enough to lift the vehicle. The next phase of this student research project is to finalize the circuitry design for the main and steering rotors specially selected for our vehicle, and complete the programming code for a stable PID flight controller. We will also reposition the tail propellers so that the vehicle can execute three axis of movements (pitch, roll, yaw). Then we will integrate sensing components (cameras, lasers, etc.) to the aerial vehicle, getting us closer to our final goal of developing an aerial assistive navigation system.

22. Coarse-Graining and Simulating a Predicted Model of Protein Kinase A
    Elizabeth Rosenzweig
    Prof. Mai Zahran

    Phosphorylation is the most common and well-characterized signalling method that eukaryotic cells use to regulate biological processes. Cyclic-AMP-dependent protein kinase (PKA) is a model enzyme for studying the phosphorylation process. The enzyme is very large and contains flexible regions without secondary structure, making it challenging to study using many laboratory techniques. In the previous project, an all-atom structure prediction for the entire enzyme was built using a combination of homology and ab initio modeling. In order to make molecular dynamics simulations of the model more computationally efficient, the all-atom model was converted to a coarse-grained structure using the MARTINI force field. During simulations, the

coarse-grained model changed conformation, with the linker region becoming more compact. This corresponds to data collected by small-angle X-ray scattering. The experiment is being repeated to confirm this result.

23. Combatting Horizontal Violence in Nursing Using Peer-led Workshops
    Monica Heredia, Peggy Saint-vil, Esther Saint-vil, Tatiana Toussaint, Christine Quashie
    Prof. Aida Egues, Prof. Elaine Leinung

    Horizontal violence (HV) in nursing has a negative effect on the victim, the organization, and patient care. The goal is to raise awareness of the harmful effects of HV through the implementation of peer-led workshops. The research conducted is intended to fill in the gap of interventions to combat HV among BSN students who are near graduation period. Analyzing previous articles, concerning interventions to decrease the incidence of HV, we have concluded that the single best way to decrease the incidence of HV is through the implementation of interactive workshops among students. As a result of our findings, we plan to implement these workshops in the upcoming months.

24. Walking Assist Device with Fall Prevention and Bodyweight Support
    Luca Scarano, Dylan Wolf
    Prof. Andy Zhang

    According to the U.S. Center for Disease Control and Prevention (CDC), 12.5% (40 million) of Americans suffer from walking disabilities. Assistive devices have been developed and shown to reduce energy expenditure and stress on muscles and joints. However, the high costs associated with said devices prevent wide adoption. Provided is a low-cost electromechanical walking assist device (eWAD) including leg links, wheels driven by brushless DC motors, and 6-axis digital gyroscope+accelerometer chips. The WAD provides fall prevention and gait support in the sagittal plane to keep the user upright when large angular displacements occur between the user's center of gravity and the ground. To study the efficiency of the WAD, analysis of biomechanic operations and mathematic simulation was used to determine the appropriate supporting angular forces from the leg links and output torques from the DC motors.

25. Hydrogel Fabrication Using Maskless Photolithography
    Joyce Tam
    Prof. Ozlem Yasar

    In the field of Tissue Engineering, fabrication of engineered scaffolds is vital to guide the tissue growth and replacement. Scaffolds can be fabricated by using light, heat, adhesives and molds. However, fabrication of 3-D thick scaffolds is always a challenge due to desired design characteristics. Failure of precise scaffold fabrication cause improper tissue regeneration. Recent study show that, light based scaffold fabrication techniques has more advantages than other techniques as it generates the minimum toxicity. In this study, scaffolds are generated by

a light-based fabrication technique that is known as “maskless photolithography”. In this technique, Polyethylene (glycol) Diacrylate (PEGDA), which is biodegradable and biocompatible polymer, is used as a fabrication material. UV-light is shined on a “Digital Micro-mirror Device (DMD)” and it is selectively reflected to PEGDA solution. Illuminated area gets solidified and generate the hydrogels whereas non-illuminated area remains in the liquid form. Our fabrication results show that scaffolds can be fabricated layer-by-layer fashion by “Maskless Pholotolithography”. This technology can be easily applied to engineered living systems

26. Structural Health Monitoring of Bridges
    Daniel Telemaque
    Prof. Navid Allahverdi

    Existing steel and concrete bridges in the US are in critical need of repair and upgrade. The collapse of the St. Anthony Falls Bridge, also known as the I-35W bridge, over the Mississippi River in Minneapolis, MN – killing 13 people in August 2007 in the middle of rush hour – is a reminder of imminent possibilities of such catastrophic events in future. Active monitoring of structural health of bridges enables engineer to identify and prevent potential bridge collapses. In this research, primary focus will be made on identifying and comparing methods to monitor existing structural health condition of bridges; Reviewing different instrumentation methods to measure strain, deflections, accelerations, and crack growth as parameters for assessing the state of the health of bridges.
    In the design process of structures, particularly bridges, the goal is to design for the safe, reliable and cost effective structure. During the design process, assumptions are made for the conditions for which that structure will undergo. These conditions may be worst case scenarios for natural disasters within a given time span based on occurrences in history, but often the full strength structures aren’t fully verified, but theoretically, the structures’ responses to extreme loads or disasters remain hypothetical. In rare cases, structures fail to meet these criteria, and fails locally, it is in the engineer’s best interest to do structural health checks on bridges. With the help of technological breakthroughs in wireless microwave and satellite communications in applications to science pertaining to the civil engineering field, remote monitoring has become a part of the everyday way to do structural health monitoring (SHM). The most basic remote monitoring system provides users with a way to collect data from an event such as a foundation capacity test or ongoing thermal recording, and then transmit the collected data to another location, such as a database or spreadsheet file on a computer. Remote monitoring is used in many different civil engineering applications from basic deflection calculations and production of a structure, to quality assurance in construction to ongoing health verification. This provides assurance to engineers as well as society that structures are sound and safe and will be suffice in strength from its design capacities. The benefits of SHM have proven to increase with the increase of technology, but even with failures like the St. Anthony Falls Bridge, also known as the I-35W bridge, collapse over the Mississippi River in 2007, the need to further push for technological advances in such SHM becomes imperative to monitor structures.
    Monitoring systems range in their functionality, cost, applied technology, and monitoring

approach. A system generally contains three components: a measuring device, a method of reading that device, and a method of storing the measurements. Some measuring devices are capable of the reading and storing data measurements at the same time, for example, a pressure or dial gauge. Wireless instrumentation, Fiber Optic Sensors and Void Shaft Thermal monitoring are some other instruments used to collect data on structures built.

27. The limitations in increasing spectral efficiency of optical communications
    Ina Tsikhanava
    Prof. Djafar Mynbaev

    The exponential growth of volume of the telecommunications traffic calls for increasing transmission capacity of global optical networks at the same pace. This increase, however, faces fundamental and technological limitations, which is reflected in constraining the spectral efficiency (SE), the integral metric of network performance. Due to tradeoff between spectral efficiency and power (energy) efficiency, a further research in the relation between spectral efficiency and M signal states for different modulation techniques is needed. This research will be the key to investigating the best approach to developing energy efficient communication systems. Concentrating on the spectral analysis of the transmitted signals of existing optical communications networks enables us to separate the fundamental limitations in increasing SE from technological ones. This, in turn, permits us for focusing on solving the practical problems. In order to improve spectral efficiency, researchers have investigated different modulation techniques. However, there is still lack of knowledge of how spectral efficiency can be mathematically defined for various M. In this work, we'll mathematically and graphically describe the relationship between spectral efficiency and digital signal-tp-noise ratio (SNR), Here, this SNR is presented by the ratio of energy per bit, E_b, to noise spectral density, N_0, denoted E_b/N_0. We need to obtain this ratio for several M-ary modulation techniques. To achieve this goal, we'll use two methods: Analytical approach to derive the equations determining the relationship between M and SE (and then SE and E_b/N_o), and MATLAB to build all the variations of signal states for different schemes.
    Our results would demonstrate that the relationship among SE, Eb/N0 and M must be taken into account to define the technological limitations in increasing spectral efficiency of optical communications. The expected result of our research would be the proposals for practical solutions to the problems intended to overcome the spectral limitations that optical communications industry meets today.

28. Effect of High Glucose on Sirtuins In Tetrahymena thermophlia
    Masood Usman
    Prof. Ralph Alcendor

    Sirtuins are a family of proteins that exist in almost all life forms. They are involved in important processes and functions such as lifespan expansion, protection from cell death and regulation of important cellular processes. Although sirtuins have been studied extensively, little is known on

their role in oxidative stress in *Tetrahymena thermophila. Tetrahymena thermophila*, a ciliate protozoan, has been used as a model for studying the effects of a wide range of factors and stresses. These cells are very easy to work with and they are great models for eukaryotic cells, especially human cells. One of the most popular uses of *Tetrahymena* is to examine the toxicity of drugs and heavy metals. Oxidative stress is the imbalance between toxic form of oxygen or reactive oxygen species, and antioxidants. High levels of oxidative stress results in cell death, and damage to proteins and nucleic acids. Oxidative stress has also been shown to be involved in diseases such as cancer and Alzheimer's disease. Although oxidative stress has been studied extensively, very little is known on *Tetrahymena thermophila*'s response to oxidative stress. Therefore, the goal of this project was to examine the effect of oxidative stress on sirtuins in *T. thermophila*. We hypothesis that sirtuins are involved in oxidative stress activities. Cells were incubated in glucose free and high glucose media for 24 – 48 h. high glucose has been shown to increase the levels of OS in cells. Following incubation, cell death and mRNA levels for selected sirtuins were assessed. Cell activity and cell number were both higher in media with glucose, 0.25, 0.5, 0.75 and 1.0%, compared to glucose free media. Sirtuin mRNA expression were consistently higher in glucose media. mRNA of antioxidant genes, were also higher in media with glucose compared to glucose free media. These results suggest that sirtuins may be involved in oxidative stress induced by high glucose

29. Advanced Design of bionic Hand with Cost Analysis
    Muhammad Ameen, Harold Barreto, Rachid Moumni, Kayla Natal, Jiamian Zhao
    Prof. Gaffar Gailani

    In this project we are working on design and fabrication of prosthetic bionic hand for amputees. The challenge of bionic hands is the cost and the complexity of the model where design, fabrication, and mechatronics have to be optimized and integrated. The open source Hackberry model developed by EXIII Corporation (Japan) will be utilized as a design platform. This open source model consists of more than 90 parts. A computer aided design software, Autodesk Inventor, has been utilized to create the design, fingers motion has been simulated. Additive manufacturing is used to make prototypes of all components. The challenge now is to integrate mechatronics components (motors, controllers, etc) into the design and allow the mechanism to function. The final stage of the work will be cost analysis for the design and drafting easier approaches to make this design to allow for integration of high end technology such as voice recognition.